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Explanatory Note

Illustrated articles are denoted by an asterisk (*), book notices by a dagger (†).

This index is made comprehensive but concise. Pains are taken to bring together matter belonging to the same subject, so that when a reader looks up an article he will be cited to related data. Under these conditions some further explanation of the method will be useful in finding leading articles quickly. Series of simple page numbers following names of mines or companies usually refer to news notes and other lesser matters. Descriptive articles are appended under titles (often abbreviated) beginning with dashes. When the minor references are numerous, as in the case of "Anaconda," they are sometimes separately designated as "notes." The unspecified entries may, however, be important; for instance, an editorial or other article may be entitled simply by a proper name. With a major entry or series of entries may be placed several minor ones relating to the same subject in order that its history may be followed. The asterisks denoting illustrated articles assist in finding them and if the author's name be known, it is the simplest means of reference. Productions are indexed under names of metals and countries or states, in important cases under both. The mere juxtaposition of a mineral and geographical name usually signifies an output but may cover other statistical or news matter. Not all news notes are indexed, but a liberal selection of them is made.

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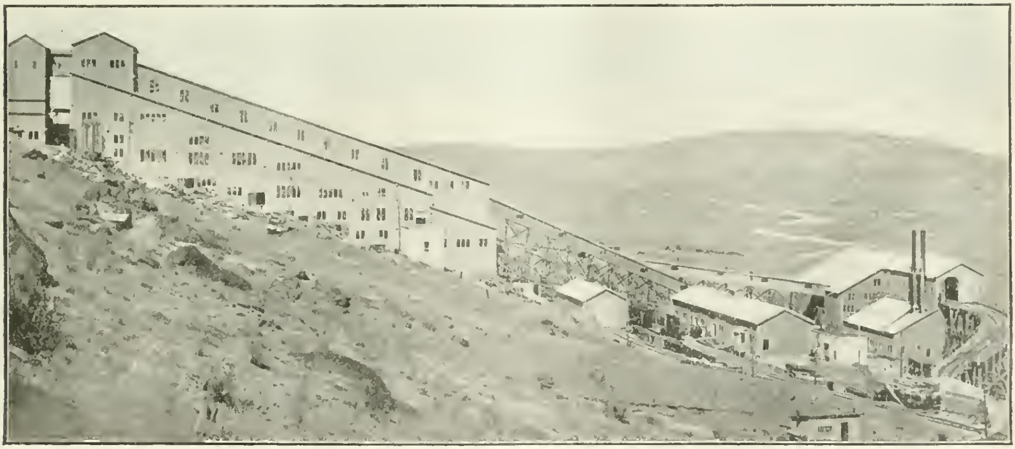
Choosing the Mill Site

By Edward S. Wiard*

SYNOPSIS—The selection of a mill site is usually governed by local considerations that do not leave much room for choice. The facility for securing water, mill supplies and power near the mine have to be considered, and after these the character of the site itself may be discussed.

This problem of the mill site is usually in the form of flat versus sloping site, but before determining the exact spot for the mill, a small area in which it must be placed is the principal factor, and of the others some local one will often be determining. The question of a proper water supply is usually of paramount importance and becomes increasingly so as the upper limit of size to which the ore is crushed increases. If jigs are employed, a large consumption of water is indicated, particularly if the jigging be of the kind making tailings as well as concentrates and middlings, for with the usual way of disposal of tailings by sluicing a large volume of water will be necessary. It is of course feasible to dewater the jig tailings, using the water so obtained for washing purposes and removing the dewatered tailings by means of conveyors, but a metallurgical engineer would consider such a procedure only in the event that the other factors far outweighed the water factor and water was extremely costly to obtain.

The tendency of concentration schemes is toward finer preliminary reduction in size, and this tendency is making for simpler mill plans with fewer machinery platforms or terraces. In times past in lead-zinc jig mills any lead concentrate carrying less than 8 to 10% zinc, depending upon the point at which penalizing began, was acceptable, even in camps where it was possible to make a salable zinc concentrate. At the present day, with the better means of saving the concentrates in slimes provided by the flotation processes, the use of the Harz jig, the Hancock jig and the concentrating table as roughing devices is becoming more common. When these machines are used for roughing, as much of the heavy product is removed by them as is possible, the balance of the material fed to them being reground for treatment in a fine state of division. It means fewer screens or no screens, wider floors and a lower superstructure, and hence a foundation plan adapted to gently sloping or flat sites.



TIMBER BUTTE MILL, AT BUTTE. AN EXAMPLE OF AN INCLINED MILL SITE

The procedure of rigidly limiting the escape of water from a mill by repeated dewaterings originated in arid regions where water is a scarce and precious commodity. Where it is carried to the extreme, only such water escapes as is sufficient to carry away sand and slime tailings. If the sand and slime be routed to a settling pond, the overflow of this pond being used over again for wash water, the loss is confined to leakage from the pond dam and the small amount lost through evaporation.

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*Mining and metallurgical engineer, Denver, Colo.

Unless economy in the use of water is imperative, dewatering and settling should be carried only to the degree necessary for proper preparation for the treatment of products. The deliberate use of tank sludges as wash water is very bad practice if clean water is available. A common expedient in half-baked improvements, originated after the mill is completed, is to use slimy waters as wash water, these being deemed too good to throw away and yet not good enough to warrant special treatment other than by settling and use in the way mentioned. The disadvantages in the use of slimy water as wash water are many. It settles with difficulty, and the chance of any concentrate being saved from it is small. A relatively small amount of the slime adheres to the decks of sand and slime concentrators and alters the cling of the washing-up surface. To some extent the fouling of the washing surface can be overcome by brooming at regular intervals. Stoppages of the apertures of the wash-water boxes will occur where slimy water is used for washing and more particularly where the water box is not shaken with the table. Slimy wash water obscures the vision in controlling the separation of the high-grade products. This difficulty and the further one of the contamination of the concentrates by the slimy water can be somewhat overcome by the use of clean water sprays at the point where the concentrates discharge.

Where water is used over and over again, there will often arise further difficulties. If there is present free acid or an acid radical capable of attacking iron or steel, as there is in sulphide copper ores, there will be an upbuilding of the acid content of the wash water. If there be salts present in the wash water which precipitate on being oxidized by long contact with the air, a nasty muck will form, which in the case of iron salts yields a deleterious and strongly adhering coat on linoleum surfaces.

There is a vast difference in the settling power of clean wash waters, and my experience has been that such differences are largely inherent in the water, though the ore itself often affects the rate of settlement. As a rule the purer the water the better it is for concentrating purposes. In our northern camps the purest water is nearest to the snow line, but anywhere in the mountains proper, uncontaminated water suitable for concentrating purposes will readily be found.

If it is proposed to have the mill near the mine and the mine is in the upper part of the mountains and at an early stage in its development, the following difficulties will be encountered: The ground will probably be too precipitous to provide a good natural site, and such excavations as have to be made will largely be in solid rock. The supply of water will scarcely be adequate for proper washing and entirely inadequate for power purposes. In most cases it will not be possible to avoid a conflict with prior rights unless the property was located before the accumulation of such rights by others. These rights may consist in preëmptions of water, claim and mill sites on the ground favored for the mill. Towns and the owners of dwellings and agricultural lands have a right to damages if injured by débris or if the domestic water supply is made impotable by mill wastes. The progress of development in the particular mine under consideration located at high altitudes may, by lowering the ground water, cause the water supply to fail entirely. At high altitudes there will be seasons and years when the supply of water is insufficient to carry away the tailings, and their accumulation at the points of little slope during such times will be the forerunner of serious difficulties later on. Other objections to high-altitude sites lie in the liability to snowslides, the shortage of labor and costly means for obtaining supplies and transporting concentrates. The only advantage that the high-altitude site offers is in cheapness of transportation of ore to the mill. Small mills may deem this point of great weight, owing to the initial cost of a transportation system, but it should not be allowed to weigh against the factors that have been mentioned. The cost of a ton of concentrate by wagon road will usually figure out greater than the cost of transportating a ton of original ore to a mill site some distance from the mine—the first cost mentioned, like the second, being based on a ton of original ore.

A DISADVANTAGE OF A FLAT MILL SITE. STACKING TAILINGS IN THE FLAT RIVER, MO., DISTRICT

Unless other factors greatly outweigh, the mill site will be located in the lower part of the mountains and at some point accessible to a railroad by a spur on an easy grade. In such an area it will usually be easy to find steeply sloping sites, gently sloping sites (from 15° to 28°) and flat sites. For concentrating mills the steeply sloping site should ordinarily be rejected. Such sites do very well for stamp mills where the departmental operations are few and the movement of the ore, owing to its fine state of division, can readily be had by gravity flow.

Where steep mill sites are employed for concentrating mills, there is no attempt made, as a rule, to have all the steps connected by gravity flow. The concentrating and crushing machinery is usually assembled under the same roof, preliminary crushing machinery being placed on the hillside with gravity flow from one machine to the other and the hillside forming one end of the inclosure occupied by the plant. The remainder of the mill in this sort of a plan rises from the flat ground at the foot of the hill, the machinery being placed on various floors supported by a superstructure rising from the flat ground. I believe that there is now no doubt in the minds of thoughtful designers that the preliminary crushing machinery should be housed in a building separate from the concentrating mill proper. The reasons for this have been discussed at length in my treatise[1] on ore dressing, and the problem of the proper slope of the mill site resolves itself into two parts—the degree of slope for the crushing plant and the concentrating mill proper. An axiom of mill designing is to place as much of the machinery and floor weights on the ground as it is possible to do, or in lieu of this, as near the ground as is possible. It is evident that with the steeply sloping mill site it will be possible to rest all the machinery for crushing on the ground and at the same time avoid the use of elevators or conveyor belts by stringing the equipment down the hill. Further, only a light structure will be necessary for covering the equipment. On the other hand, such an arrangement will entail expensive foundations and will require much labor to operate and will be fatiguing to superintend. If, in addition, the mill proper be strung out below the crushing plant, these disadvantages will be accentuated. The terrain then for the crushing plant boils down to a gently sloping or flat site. On either of these a satisfactory crushing plant can be erected, but since the mill proper should rest on a gently sloping terrain, the crushing plant will have to be on ground of like character unless there is a natural bench on the hillside breaking its general slope. The long axis of the crushing plant, corresponding to the foundation line of the crushing machines, will be laid down along the slope of the hill and at right angles to the long axis of the concentrating mill proper, which will be laid down the hill slope. I believe this arrangement is almost ideal for flat or gently sloping sites, but some exigency of the site might render a different arrangement or more or less modification preferable. The design of a crushing plant arranged in the way indicated will require the use of conveyors and elevators, but conveyors are not the bugbears they used to be since they can now be installed so as to require the minimum of attention in operating and if some sort of adequate sampling equipment is to be provided, elevators will have to be installed for all degrees of mill-site slope.

The Advantages of Sloping Sites

The only advantage of the gently sloping site over a flat one for the location of the crushing plant is that very little excavating will have to be done for foundations and openings for conveyors and elevators.

In the case of the mill proper, the principal considerations affecting the degree of the mill-site slope are the necessity for resting the weight, as far as possible, on the ground and the flow of water in the launders. The slope need be no greater than to allow of the economical transportation of material from one department to another by water flowing in launders. It will scarcely be believed that any advocate of the flat site proposes to gain the advantage of having the machinery weights on the ground by moving material from one group of machines to another by mechanical means. What is usually done on the flat site is to erect artificial terraces to support the machinery entirely off the ground to enable the rejects from one department to flow to another by the aid of water in launders. For simple flow sheets where the bulk of the material treated is in a fine state of division, this mode of construction would not be open to any great objection, but the floors so carried off the ground should not be too numerous or to far off the ground, and floors should not be placed over one another.

In some cases the machinery-platform type of construction may be cheaper than the breast walls and other details of construction necessary to a mill built on a gently sloping site and with all the heavy machinery resting on the ground.

The flat site, pure and simple, is one built flour-mill style with a succession of floors built one above the other supporting machinery, all being supported from the same frame resting on the ground. The disadvantages of such an arrangement have been frequently stated, and it will be idle to repeat them in full here. There is a general impression that this type of mill is cheaper than other kinds. If this is admitted, the advocates of it argue that since for the same flow sheets this sort of plan, and any other that may be used for comparison, has the same machinery it will do equally as good work. Will this not be a sufficient answer to that sort of argument? If the same machines arranged to the same end are put into two factories, one dark, unsanitary, crowded and inaccessible and the other with plenty of light and with the machines arranged for the greatest freedom from interruption from repairs, other things being equal, which will return the greatest profit to the owners? But the first cost of a mill with superimposed floors is actually greater than a properly designed mill resting on a gently sloping terrain, for if equal floor space be provided in both types, the flow sheet being the same, the cost of the heavier structure required in the first case will more than offset the greater cost for lighter building material required in the second. Where stereotyped designing used to save over special designing preceded by careful test work was by resorting to closed circuits, to which expedient the superimposed floor plans lend themselves readily, but with the better means for slime treatment we have today, light crushing and return of middlings to the upper end of the mill is no longer necessary or desirable. In most ore-dressing problems it is today possible to keep all the middlings moving ahead or down the mill. If a flat site were ever compulsory with me, I would gain the advantages of a gently sloping site by using suspended floors, and the difference in cost between doing this and building on *terra firma* on the slope would not be much one way or the other and the advantageous arrangement would compensate.

⁂

Operating Costs at the Liberty Bell Mill

The mill of the Liberty Bell Gold Mining Co., at Telluride, Colo., has a maximum capacity of 175,000 tons annually and during 1915 milled 174,000 tons. The metallurgical process, well-known to operators, is cyaniding with concentration as an auxiliary. The mill has cost, from 1897 to 1913, $345,000. Since 1913 no charge has been made to construction. Of course, part of the cost went into canvas plants which were scrapped, and part represents replacements partly destructive of old work. About 700 hp. is required for the mill operation.

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[1] "Theory and Practice of Ore Dressing," by Edward S. Wiard.

The recovery in the mill is, in stamp bullion, 1% of gold and no silver; in concentrates, 5% of the gold and 9% of the silver. In miscellaneous cyanide products, including bullion, slag, etc., the recovery is 82% of the gold and 67% of the silver, making a total recovery of 88% of the gold and 76% of the silver. About 600 gal. of water per minute is used, almost solely to dispose of tailings. The crusher in use is a T. L. Smith gyratory No. 6. The ratio of concentration is 58:1. The assay of mill heads from 1899 to 1915 inclusive was $7.89; the tailings, $1.44; the percentage of extraction, 82%. In 1915 the total combined extraction was 85%. The mill and shop employ about 47 men, the shop crew doing some mine and tramway work.

Some of the principal materials used in milling and their costs during 1915 are shown in the accompanying table:

MILL COSTS AT THE LIBERTY BELL PLANT (174,100 TONS)

Crushers	$969
Shoes and dies	4,130
Screens	242
Coal for heating	9,069
Cyanide	37,393
Zinc	13,425
Lime	9,015
Acid	1,464
Lead acetate and litharge	4,569
Tube mills	2,068
Pebbles	5,125
Linings	600
Batteries	5,726
Agitators	389
Pumps and compressors	2,231
Filtering	6,715
Zinc boxes	1,124
Buildings and heating plants	5,225
Electric plant	1,802
Concentration	5,672
Concentrate treatment plant	3,566
Settlers	1,181
Pipe lines	3,339
Classifiers and sizes	1,350
Power	37,847
Total	$164,236

TOTAL MILL OPERATING COSTS (174,100 TONS)

Superintendence	$2,534.80
Crushing	5,313.55
Concentrating	9,164.50
Stamping	31,620.62
Regrinding	16,562.55
Settling and agitating	10,071.27
Filtering	9,922.11
Precipitating	17,391.28
Pumping	7,832.35
Cyanide	37,847.86
Lime	9,605.26
Tools	649.49
Sundries	278.17
Assaying and melting	7,758.47
Heating	12,422.87
Lighting	2,435.46
Depreciation (5%)	17,760.89
Maintenance and repairs	36,749.02
Lubricating	1,937.59
Tests	1,086.76
Watchmen	1,477.80
Cleaning	2,399.89
Total	$242,822.56
Per ton	$1.394

⁂

Specifications for Purchase of Leather Belting

The following specifications for leather belting, based on requirements of service rather than methods of manufacture, were given in *American Machinist*, Apr. 20, 1916.

Strength—Ultimate tensile strength should be as high as possible without sacrificing other desirable qualities, in order to protect the belt from unusually severe strains to which most belts are occasionally subjected. Tensile strength should be specified in pounds per inch of width.

Stretch—A belt that stretches unduly in service is a source of considerable trouble and expense, yet it must yield instead of breaking when subjected to severe strains. Even when operated far below its capacity, however, leather will permanently elongate in service for some time after installation. Existing specifications allow 8 to 12½% elongation of the test specimen, but actual tests of the best brands show double this amount.

Pliability—The value of the power consumed in friction between the fibers during the life of a belt is probably many times the cost of the belt. Even a small gain in pliability would therefore be quite worth while. Greater pliability also means better pulley contact and less slip. An accurate method of testing for pliability should be worked out and belt makers given every inducement to develop this quality.

Thickness—As a general rule, the thinner the belt the less power required to bend it around the pulleys, the less wrinkling on the inside and the less stretching on the outside. Whatever the thickness, it is of prime importance that it be uniform, especially on light, high-speed machines where vibration is serious. It is obvious that some tolerance must be allowed, and $\frac{1}{32}$ in. is entirely feasible, although this degree of uniformity is seldom attained unless careful inspection is enforced.

Weight—The self-interest of the maker leads to the lightest weight consistent with the required strength. With strength specified in pounds per inch of width, thickness and weight need not be mentioned.

Piping—When a belt passes over a pulley, the inner surface is compressed and forms corrugations. A certain amount of wrinkling is inevitable; but when it becomes very pronounced, the area in contact with the pulley is materially lessened. This condition is known in the trade as "piping."

Cemented Joints—With reasonable care a cemented joint should be as strong as the remainder of the belt and should be so specified.

Injurious Blemishes—Such a thing as a perfect hide is unknown in the trade, but proper selection of the strips from which the belting is made should eliminate most of the injurious blemishes. Such selection should be insisted upon in first-quality belting.

In a symposium in a later issue of the same publication covering this matter, the following additional features were brought out:

Louis W. Arny, president of the National Association of Leather Belting Manufacturers, agrees with the foregoing specifications except in regard to tensile strength, which he considers as inseparable with stretch. He says that the belt would jump the pulley long before the ultimate tensile strength was reached. He says that a specification of weight does not secure for the buyer any better quality, but only more quantity.

C. B. Auel, of the Westinghouse Electric and Manufacturing Co., also states that tensile strength is not a prime specification and that it has been the experience of his company that a stretch of 16 to 25% is excessive in the best brands.

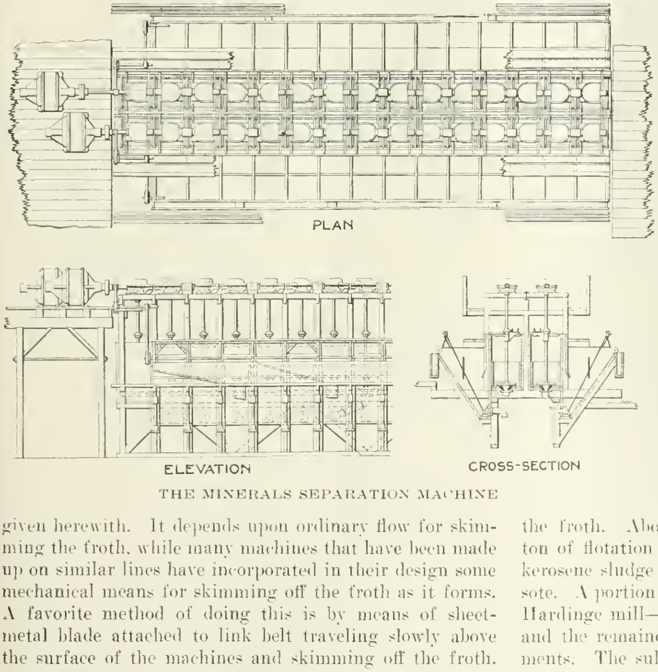
N. G. Near suggests the following good rough-and-ready specification for pliability: "The belt must be so pliable that it will run — — inches slack on — — foot centers and transmit — — horsepower while running at a speed of — — feet per minute. It is well, of course, to give the pulley sizes and speeds and state which is the driving and which the driven pulley. Where the drive is a small one and the belt a narrow one, it would hardly pay to give all details of this kind; but where there are many drives of this type in a given plant, pliability could easily be tested in this way on one representative drive.

Apparatus Used in Flotation

By Herbert A. Megraw

SYNOPSIS—Machines actually in use at flotation plants are limited to three classes. These are typified by the Minerals Separation, Callow and Wood machines. Each is described, together with some of the more prominent modifications.

Since the beginning of operation of the flotation process a large number of machines of different designs have been devised, manufactured and applied to flotation concentration. These have been included in three types. The first is the agitation machine, of the class that is included in the designs used by Everson, most of the preceding inventors, and a great many succeeding ones. This type of machine depends upon violent mechanical agitation to mix oil and air into a pulp. It embraces such well-known machines as the Minerals Separation device, now widely used. A large number of similar machines, having different minor details, have been built to meet the requirements of particular companies working with particular ores. A description of the Minerals Separation apparatus is given herewith. It depends upon ordinary flow for skimming the froth, while many machines that have been made up on similar lines have incorporated in their design some mechanical means for skimming off the froth as it forms. A favorite method of doing this is by means of sheet-metal blade attached to link belt traveling slowly above the surface of the machines and skimming off the froth.



THE MINERALS SEPARATION MACHINE

The Minerals Separation machine as used at Anaconda, and mentioned by Laist and Wiggin in their paper,[1] is shown in the accompanying drawing. The feed is introduced in the first agitator box at the motor end of the machine. From this box it passes to a second box through an opening in the partition—shown in the elevation drawing. From this second agitation compartment the pulp passes into the first spitzkasten, where the first concentrate froth is removed, and the remaining pulp passes through a pipe the inlet to which is controlled by a valve to the third agitating box. From this agitating box the pulp passes to the second spitzkasten and so on down through the machine until it is introduced into the fourteenth spitzkasten. The discharge from the fourteenth, or last, spitzkasten leaves the machine as tailings. The first four to seven spitzkastens make concentrates, and the remaining ones make middlings that are returned to the system. The drawing shows a double machine, each one, however, being run as a separate unit.

The lineshaft is driven by a 150-hp. motor at a speed of 385 r.p.m. The machine under load requires about 100 hp. The vertical shaft carrying the impeller revolves at a speed of 243 r.p.m. These impellers are of the usual Minerals Separation type, having four blades placed at 45° to the vertical. They are 2 ft. in diameter. Each pair of impellers is arranged so that one revolves in one direction and the other in the opposite direction, thus tending to balance the side thrust on the lineshaft. The bevel gears that drive the impeller shaft are cut steel and run in grease. The impeller shaft is supported both vertically and horizontally by ball bearings. In some cases it has been found of advantage to place the motor on the other end of the machine from that shown in the drawing, especially if it is necessary to heat the pulp to over 100° F. There is more or less steam rising from the pulp, especially at the feed end, which condenses on the motors, and by placing the motor at the discharge end this trouble is practically eliminated.

Each machine makes three products: Concentrates, which go to the dewatering division; middlings, returned to the head of the machine; and tailings, going to waste. Concentrates are taken from the first 3 to 5 spitzkastens and middlings from the last 9 to 11. Some of the pulp is overflowed from the last three spitzkastens together with the froth. About 6 to 8 lb. of 60° sulphuric acid per ton of flotation feed is used, together with 2 or 3 lb. of kerosene sludge acid and ½ to 1 lb. of crude wood creosote. A portion of the wood creosote is added ahead of the Hardinge mill—about 0.03 to 0.05 lb. per ton of feed—and the remainder is added in the six agitator compartments. The sulphuric acid and sludge acid are added at the head of the machine. The pulp is heated at from 60° to 70° F. by passing live steam into it at the head of the machine. Three machines are used for treating sand and the fourth for treating current slimes from the upper portion of the mill. Each has a capacity of about 400 tons per day on sand and 175 tons per day on slimes.

The second machine in popularity is the Callow, using a system that dispenses with mechanical agitation for air incorporation into the pulp. In the Callow apparatus the air for bubble formation—serving also for agitation—is compressed air forced through the bottom of the flotation cell. The air passes through a false bottom that may consist of canvas, silica brick or some other similar material, but usually canvas is used. Passing compressed air under low pressure through the canvas subdivides the air into small bubbles, thus supplying the necessary agitation and also the froth-forming constituents. The Callow unit consists of a tank with a bottom inclined at from 3 to 4 in. to the foot. It is 20 in. deep at the shallow end and 45 in. deep at the other end and may be built either of steel or of wood, the latter being considered preferable. The bottom of the tank consists of a porous medium made of about four thicknesses of loosely woven canvas twill, properly supported by a backing of perforated metal to prevent its exploding when under air pressure. Through the porous medium compressed air is forced by a blower. The space underneath this porous bottom is divided into eight compartments, each connected by an individual pipe and valve with the main air pipe. By this means the air pressure to each compartment may be regulated to correspond to the varying hydraulic heads in the tank. A pressure of from 4 to 5 lb. per sq.in. is commonly used, each square foot of porous medium requiring from 8 to 10 cu.ft. of free air per minute.

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[1] "Bulletin," A. I. M. E., March, 1916.

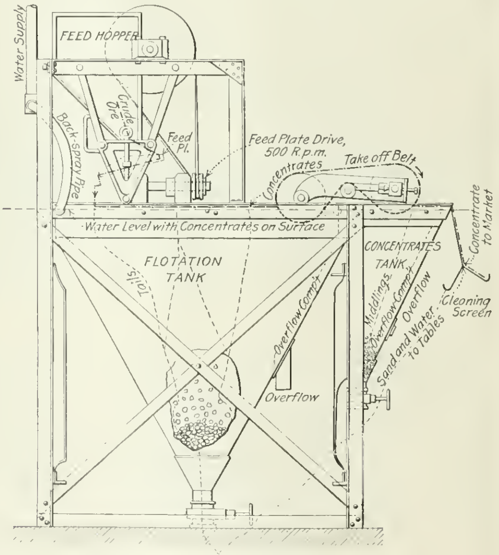
The longitudinal edge of the tank is provided with an overflow gutter for the reception and discharge of froth. The lower end of the tank has a spigot discharge fitted with a plug valve to maintain a uniform water level within the tank and thus, in turn, maintain a constant discharge of froth under all varying conditions of feed supply incident to practical milling operations. The water level may be varied, but is usually maintained at about 10 to 12 in. below the level of the overflow lift. The tailings are discharged through the spigot, and concentrated froth is conveyed to the cleaner separating cell. The cleaner is simply an additional unit intended to treat again the low-grade concentrate obtained from the initial, or roughing, device that performs the first operation. The Callow apparatus does not employ any violent mixing means, but preliminary mixture in a Pachuca tank is usually relied upon. Recent experiments, however, at operating plants have shown that this tank may be dispensed with without in any way interfering with the good results obtained.

MACQUISTEN SURFACE-TENSION MACHINE

The third type of flotation machine depends entirely upon the surface tension of water in contact with air and places no dependence upon oil or agitation by mechanical means or air bubbles. This type does not make a froth, but simply floats the sulphide upon the surface of still or gently flowing water. The earliest commercial machine of this type is the Macquisten tube, which has already been described at length in the *Journal*.[2]

The Macquisten tubes are made of cast iron. As ordinarily used they are about 6 ft. long, 1 ft. in diameter inside and weigh about 450 lb. They have two tires, much like the tire-type tube mill, which rest upon rollers. The discharge end of the tube is entirely open, while the feed end is closed except for a hole in the center large enough to admit the pipe that feeds the pulp. Inside the tube is a helical groove, intended to move the pulp granules forward in the tube. The pitch of the interior helix may be anything from 1 to 3 in., depending upon the ore under consideration. The discharge end of the tube fits into a separating box, the joints between the two being water-tight, while the tube is freely revolved. Means are provided for overflowing from the box a thin layer of water that contains the floating sulphides. The whole operation of this machine, which is well known at this time, is simply feeding the pulp at the head end of the machine, the sulphides having a large number of opportunities to float on the surface of the water, since they are raised to the surface by the revolution of the tube and their opportunities for floating are limited only by the mineral grains being forced out of the discharge end of the tube by the helix of the interior. The Macquisten tube has been successfully used in several cases, although its application at the present time is not wide. It is now in use at the Morning mill of the Federal Mining and Smelting Co., at Mullan, Idaho, and at the Iron Mountain mill of the same company, in Montana.

The Wood flotation machine utilizes the same principle that is employed in the Macquisten, but in a somewhat different way. It consists of a rectangular structural-steel frame about 5½ ft. high at the back, 5 ft. wide and 5 ft. long. Supported in and on this frame are a series of feed hoppers and tanks, feed mechanism, etc. At the back is supported a rectangular feed hopper, the front, ends and part of the back of which are vertical. About two-thirds of the back slopes to the front at an angle of 45°. The bottom of the feed hopper is about 4 in. wide and about 1 ft. long and is made of a removable steel sheet which is used as one of the feed-opening adjustments. On the front of the hopper is a vertical movable gate which, in combination with the bottom, gives a wider range of adjustment of the feed openings. Inside the hopper is a longitudinal shaft studded with short pins, and this is



THE WOOD FLOTATION MACHINE

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[2] "Concentration Upside Down," Eng. and Min. Journ., Oct. 26, 1907.

revolved at the rate of 90 to 100 r.p.m. and serves to keep the ore in the hopper loose and free from channels. Suspended from the upper frame is a triangular truss with cast-iron ends. This truss carries the feed bar, which is made of angle-iron and wood, carrying a number of 3½x¼-in. screws which project into the feed openings of the hopper. Below the feed bar in the trough is supported an adjustable feed pan 8 in. wide and 4 ft. long, which receives ore from the feed hopper as it is delivered to the feed bar. The truss carrying the feed bar and feed pan is vibrated on a horizontal plane by means of a small eccentric attached to the main frame of the machine and connects with the truss by means of a flexible hickory drive rod. The eccentric shaft is driven about 500 r.p.m.

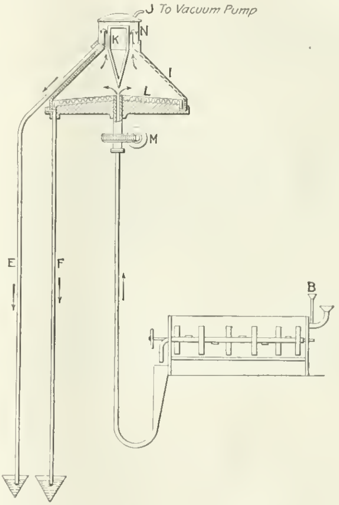
The ore dropping at the back of the feed plate is spread out into a thin, even sheet by the time it has traveled 8 in. at right angles to the vibrations, and is then dropped on the surface of the water contained in the main tank. This tank has a valve at the point, or bottom, above which is a diaphragm to steady the flow of tailings that collect in the tank. At the front of the tank is a partition that has its top edge ¾ in. below the top of the tank. This edge is an overflow weir and maintains a constant level of water in the tank. At the back of the tank there is a spray pipe from which water discharges in a large number of fine jets parallel to and just below the surface of the water contained in the tank, thereby creating a smooth surface current toward the front of the tank. Halfway between the back spray pipe and the front of the tank is a second spray pipe with a smaller number of holes, which assists the back pipe to maintain the surface current uniform clear across the tank. In front of and bolted to the main tank is a narrow rectangular cone that has a bottom discharge and overflow weir similar to that of the main tank. The joint between the tanks is made water-tight by means of a light iron channel set over the top of the tank.

Supported on the top of the main frame directly over the joint of the tank is a take-off, or concentrate-collecting device, consisting of two 6-in. by 5-ft. rollers and one 2½-in. by 5-ft. roller, supported at the ends by adjustable arms. Around these three rollers is passed a heavy fabric belt which picks up the concentrates from the surface of the water in the main tank and carries them over to the concentrates tank where they are washed off under the surface of the water in that tank and passed on over the weir to a settling or filtering device.

The power required for the operation of the machine is about ¼ hp., and the water required varies from 5 to 10 gal. per min. A partly submerged corrugated rubber cylinder may be submitted for the moving plane of water.

Elmore Vacuum Separators

Among the older apparatus used in flotation is the Elmore vacuum machine. This depends, apart from the usual dependence upon oil in froth flotation, upon the fact that air or gas dissolved in water is liberated partly or entirely by subjecting it to a pressure less than that of the surrounding atmosphere. Liberated gases of this kind may be augmented by the generation of gases in the froth or by the introduction of some external force. The gases attach themselves to the mineral particles and, being largely increased in volume as a result of the partial vacuum applied, cause the mineral particles with their attendant bubbles of air or gas to float to the surface of the liquid. A complete description of this process has already been given in the *Journal*[3] by Alexander Stanley Elmore. The apparatus for carrying out this idea is shown in the accompanying drawing. The preliminary mixture of air, froth and oil is made in the beater, the mixture then going into the pipe which carries it up to the separating machine. In this machine a partial vacuum is maintained, while the weight of the tailings in the tailings pipe supplies the power for elevating the feed into the machine. Vacuum is applied in the machine, the concentrates rising with the froth formed and being discharged through the concentrates pipe. The tailings settling upon the conical floor of the machine are continuously raked off by the revolving arms, falling into the concentrates-discharge tube. The process has been used successfully in concentrating some of the Scandanavian iron ores, but at the present time is not known to be in use in this country.



ELMORE VACUUM FLOTATION APPARATUS

One of the principal devices used in flotation now is the Hebbard machine, but this is well known as the Minerals Separation machine. The Hebbard is essentially similar to the Hoover, the original Minerals Separation apparatus, but there are some differences in details. The Harvey modification of the Minerals Separation, or Hebbard, machine is driven from the bottom.

U. S. Patent No. 1,064,209, June 10, 1913, granted to James Hebbard, of Broken Hill, N. S. W., Australia, sets forth an improvement upon his original machines. In the earlier arrangement the apexes of the spitzkasten were carried down to a considerably lower level than the bottom of the mixing vessels, but in this invention the mixing vessels and the spitzkasten are on the same level; that is, the bottoms of the spitzkastens are substantially level with the bottoms of the mixing vessels.

This form of apparatus embodies a number of mixing vessels substantially on the same level and side by side, and a number of spitzkastens, also on the same level and adjoining the mixing vessels, but staggered in relation to their plan view; that is, the first spitzkasten contacts with half of the first mixing vessel and with half of the second, the second spitzkasten contacts with half of the second vessel and half of the third, and so on. At a convenient point in the height of the first mixing vessel is an outlet leading into the first spitzkasten. At the bottom of the other half of the first spitzkasten is an orifice leading into the bottom of the second mixing vessel and so on. Each spitzkasten is thus provided with two openings, one at the high level by which the agitated pulp is passed from an agitating box to it, and the other at a lower level by which the pulp that sinks passes to the next agitating box in the series. The spitzkastens are supplied also with concentrate launders. Each of the collecting launders is provided with a pipe for removing the froth, and if any of this material needs to be re-treated, it can be sent through this pipe back to a preceding agitating compartment. In the accompanying drawing, which shows the layout and operation of the machine, the pipe is shown leading from the concentrate trough of the last spitzkasten back to the first agitating compartment.

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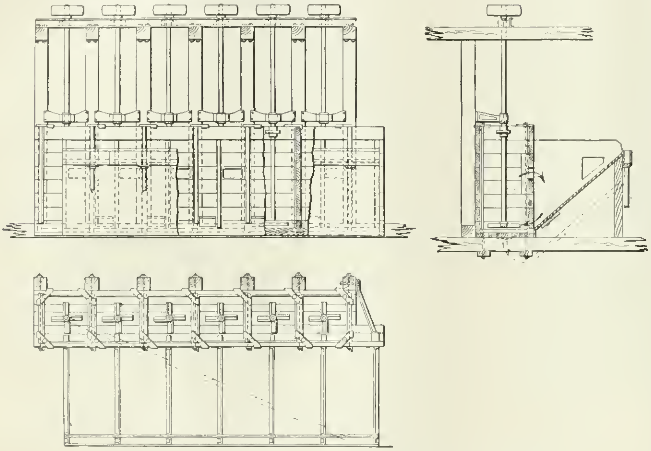
[3] Eng. and Min. Journ., May 11, 1907.



THE IMPROVED HEBBARD FLOTATION MACHINE

The Murex Magnetic System

Mention should be made of the Murex process, which, although not an oil-flotation process at all, does depend upon most of the principles of flotation. In this case the magnetic paint is mixed with oil and then put into the pulp, where it preferentially clings to the sulphide particles that are to be removed. The magnetically painted particles are removed from the mass by a magnetic-concentration machine. The method of applying the magnetic paint is interesting, since it is practically a mixing process such as may be used in flotation. The process is carried out in a small tube mill, in which grinding pebbles are replaced by small metal balls, not heavy enough to provide grinding efficiency. The magnetic paint adheres to these balls, and by them is carried to the mineral particles, the balls in addition providing a gentle agitation by means of which every particle of sulphide comes in contact with sufficient magnetic oil paint. Machinery used in the process is that used in general milling except for the magnetic separators.

Developments at Vindicator

The new concentrating mill of the Vindicator Consolidated Gold Mining Co., Cripple Creek, Colo., was completed in 1914, but it was not until the early part of 1915 that it received its full tonnage. Operations over 15 months have shown that it has fulfilled its purpose, and in fact in nearly every department better results have been obtained than were indicated from experimental work. During the year the mill handled a daily average of 250 tons per 8-hr. shift. An average ratio of concentration of 11 to 1 was maintained. The recovery in handling ores from an average value of $2 per ton was about 55%. Profits from milling operations have been nearly double what was indicated from the experimental work, largely due to the fact that milling costs were cut down to about 20c. per ton. A complete return of the capital expended was shown after 12 months' operations.

About 2,000,000 tons of low-grade ore that is on the dumps of the property averaged $2 a ton or somewhat better, and this, in addition to a large block of low-grade ore in the mine and filled stopes which cannot be worked at a profit with present metallurgical systems, can be expected to yield a handsome profit if a process can be devised whereby milling grades of ore can be treated on the ground with a high percentage of extraction at a low cost of operation.

Metallurgical engineers have been experimenting on this problem for a long time and have tried various methods, including flotation and cyaniding, both in laboratory tests and in actual practice. They are now using a flotation unit of 10 tons' daily capacity. As a result of these experiments, it has been recomended that the old concentrator at the Golden Cycle shaft, which is now obsolete, be remodeled into a flotation unit of 300 tons' daily capacity, sufficient to treat all the reject material from the Golden Cycle orehouse, as well as to experiment on all grades of ores from both shafts. An extraction of 90% or over is expected, at a cost of less than $1 per ton. This plan will enable the operators to determine the best and most economical process to use on the ore, and when this is determined, plans for a larger and thoroughly modern flotation mill of not less than 1,000 tons' daily capacity will be considered. Such a mill would probably cost not over $200,000, while a cyanide mill of the same capacity would cost more than $750,000.

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Cost of Electric Power

The following costs of electric power for mining and milling purposes are given by the St. Joseph Lead Co. in its report for the year 1915:

Plant	Kw.-Hr.	Cost	Cost per Kw.-Hr.
Bonne Terre	9,935,513	$84,020.60	$0.0084
Leadwood (a.c.)	17,560,000	96,989.67	.0055
Leadwood (d.c.)	2,822,626	21,776.65	.0077
River mines	4,041,919	63,324.64	.0156
Totals	34,359,458	$266,111.56	$0.0077

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A Map of Alaska, 10x15 in., no contours, scale 1: 12,000,000, has been published by the United States Geological Survey and is for sale at the price of 1c. per copy or five for 3c.

The Use of Belt Conveyors[*]

SYNOPSIS—Conveyor belts have not been given the technical study they deserve, and they have not given the returns that might have been obtained with more care. The use of balata, cotton and rubber belts is discussed in relation to the kind of material that has to be transported.

All endless conveyor bands may be said to have grown from small hand-operated horizontal types to the present-day conveyors capable of carrying large quantities of material great distances and heights and requiring considerable power for driving purposes. Much skilled attention has been given to the proper design and construction of items which comprise the accessories required for good belt transmission, and also to the construction and manufacture of the belts themselves; as a consequence, many of the faults attached to the running and maintenance of conveyor belts have been overcome. The considerable variations encountered in striving to obtain reliable figures on which to base one's calculations have prompted the authors to compile data on conveyor belts and to add some experience with regard to the design, maintenance and testing of belts, in the hope that the matter submitted may be of interest to the engineer and of some use to those concerned with the design or the running of belts.

TESTING CONVEYOR BELTS

In comparing conveyor belts and adjudicating on their relative commercial values, four points have to be taken into consideration: The build or construction of the belt, its suitability for the work intended, and manufacturing defects; the strength and weight of the cotton duck; the adhesiveness between adjoining plies; and the quality of the rubber. To the engineer must be allotted the duty of determining the first and most important of these qualifications. To the testing and chemical engineer falls the task of ascertaining the strength of the cotton duck, the suitability of the rubber and the quality of the frictioning.

It seems almost unnecessary to place on record the advisability of utilizing the testing engineer, but present-day methods on the Rand so willfully neglect him that little apology is required for pointing out that when it is possible to obtain a fairly accurate forecast of the quality of a belt, surely such should be obtained. The main object of the consumer must be to raise the quality to a maximum, while decreasing the price to the minimum. It is unfortunately the case that the best salesman or the lowest tender often obtains the order. When an agent, acting on behalf of the buyer, executes the order, he rarely includes a quality clause, or if he does, he places this second to the price consideration and has not the means, nor usually the inclination, to determine whether the quality is that demanded.

The effect of such a system of purchase leads to a lowering of quality; to the ousting from this market of reputable makers and merchants; to unfair allocation of blame when an early failure of an untested belt is to be recorded; and to unfair excessive charges on other purchasers when an agent or maker is called upon by the manager or engineer of a mine to replace or make an allowance for a belt that has failed sooner than either had expected, even though this belt failed not from inferior quality, but from unsuitable local conditions or careless handling.

Balata belts are tested by determining the strength of the warp and filler of the canvas and by ascertaining the frictioning or adhesion between adjoining plies or layers. In belting the main strength must lie in the warp, though that of the filler should be but little inferior. This strength is found by breaking in the tension machine a section of the belt one inch in width. Care must be taken in cutting this that no thread in the line of the pull be broken before the test.

STRENGTH OF COTTON DUCK

When for some reason only one ply can be obtained for this test, it is advisable to cut a section just over an inch and detach therefrom single strands until the exact inch is reached. The grips also must bear evenly over a surface, so as to avoid pinching the belt in one place; this may be partly avoided by making the gripped portion larger than an inch—say, one and a half inches, with a taper to one inch. The tested portion should be, over the inch section, at least 3 in. in length.

A specification for the cotton duck used in this belting should note the weight of duck used (oz. per lin.yd.), the number of yards per inch, both for warp and for filler, the tensile strength of the warp and of the filler, the amount of stretch in the belt, and the number of plies in it. To illustrate the variations that exist in this class of belting, the samples being submitted for one particular duty, I may quote the following results:

SAMPLES TESTED LENGTHWAYS OF BELT (WARP)

Tensile Strength of Total Belt 1 In. in Width

2,806 lb	No. of ply 8
3,180 lb	No. of ply 6
3,168 lb	No. of ply 8
3,564 lb	No. of ply 6
3,600 lb	No. of ply 4
3,916 lb	No. of ply 8
3,136 lb	No. of ply 8
1,320 lb	No. of ply 6

If we neglect the last one as being an inferior lot, we still find a variation amounting to over half a ton per inch in the breaking strain of the different duck used. This means an additional load capacity of 15 tons on a 30-in. belt. The tensile strength of the filler in certain belts examined shows even greater differences:

STRENGTH OF BELT FILLER

Samples Tested, 1 In. in Width

0,990 lb	No. of ply 6
1,440 lb	No. of ply 8
2,288 lb	No. of ply 10
1,980 lb	No. of ply 8
1,584 lb	No. of ply 8
1,584 lb	No. of ply 8
1,232 lb	No. of ply 8

The difference of a breaking strain of 750 lb. per 1-in. section in the filler of two 8-ply belts is surely worthy of consideration when placing an order. It is to be noted that the strength of the warp is greater than that of the filler, and agents should note in submitting samples for test that these be at least 10 to 12 in. in length and about 3 to 4 in. in width, except when the strength of both warp and filler is required, in which case the section submitted should be 10 in. square.

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[*] Excerpt from article by A. Robertson and A. McA. Johnston, in the "Journal" of the South African Institution of Engineers, March, 1916.

The adhesion between adjacent plies of duck is determined by maintaining a steady pull in separating them. A section of the belt 1 in. in width is taken, and one, or even two or three, of the plies are separated by hand for a length of 2 in., and the two ends caught in the clamps of the machine shown in Fig. 1. A steady pull is applied by turning the wheel, the rate of turning being regulated so that the jaws may move apart 2 in. per min. The spring balance registers the resistance set up and indicates the effectiveness of the balata frictioning. The adhesiveness depends on the quality and quantity of the balata used and the success of the operation known as frictioning.

The Pennsylvania Railroad Co. requires that the frictioning of its air-brake hose be such as to support a pull of 25 lb. while separating at appromixately the rate given. Much air hose on our market scarcely maintains a 1-lb. pull when separating contiguous plies.

A specification for balata belts might well demand a friction test of at least 20 lb. This figure is not often reached here, but if demanded, it could easily be reached and would form some guarantee that the belt plies would not readily part.

LIFE OF BALATA BELTS

Type of Belt	Put into Use	Taken Off	Actual Life	Tonnage per Week of 6 Days of 9 Hr.	Total Tonnage Carried	Selling Price per Ft.	Cost to Mine per Ton	Cost to Mine per Ft per Month
30-in , 5-ply, 291 ft., with 7 rows of copper stitching. Conveying crushed fines from crusher to main belt. Note. Ply was increased to 6.	May 1, 1911	Mar. 3, 1913	672 days	5,000	397,546	10s. 2d.	0 089d.	5 42d.
30-in., 5-ply, 402 ft., with 7 rows of copper stitching. Horizontal to fines main belt.	May 1, 1911	Sept. 1, 1912	489 days	8,000	416,779	10s. 2d.	0 12d.	9d.
30-in., 5-ply. 270 ft., with 7 rows of copper stitching. Grizzly fines.	May 1, 1911	Dec. 8, 1912	502 days	7,200	602,733	10s. 2d.	0 054d.	7 18d.
32 in., 5-ply, 180 ft., with 8 rows of copper stitching. Shuttle belt. Note. Ply was increased to 7.	May 1, 1911	Nov. 21, 1912	572 days	12,000	799,429	11s.	0 030d.	8 098d.
30 in., 6-ply, 402 ft. Horizontal fines, carrying crushed rock, delivering on to main incline belt.......	.	.	414 days		529,000	14s. 3d.	0 13d.	
20 in., 6-ply, 250 ft., stepped to 4 ply. Conveying uncrushed rock from bins to sorting table. Note. This belt had not worn through, but became too thin to support weight of rock at edges.	Jan. 6, 1913	Oct. 14, 1913		14,000 (average	126,000	10s.	0 24d.	
24-in., 5-ply, 305 ft................	Dec. 7, 1913	....	..	...	.	...	...	.
32-in., 6-ply, 145 ft................	Apr. 15, 1914	..						
24-in., 6-ply, 166 ft., stepped to 4-ply, with 7 rows of copper stitching	June 15, 1912	Sept. 8, 1913		1,200	450,000	11s.	0 048d.	8 8d
Material carried, crushed rock								
30-in., 8-ply, 300 ft. Sorting belt. Uncrushed rock. Severe drive, running in water continuously.	Feb. 20, 1914		.	893 per 10 hr.	320,000	18d.	Cost per 100 tons, 1-8¼	
30-in., 6-ply, 690 ft. Mill incline.	July 1, 1913				Tonnage to May 31, 1914 —367,820	14s. 4d.	0 322d.	7.16d.
32-in., 5-ply, 492 ft Main incline, conveying crushed rock to mill and delivering on to shuttle belt.	..		394 days		467,846	11s.	0.12d.	..

The following results from a series of tests show actual figures on samples of balata belt at present in this market:

FRICTION TEST ON BALATA BELTING

Lb.	Lb.	Lb.	Lb.
24½	18½	15	12
21½	17	14	11
21	16½	13	5

The stretch in the belt is not often determined in the testing laboratory though, given suitable apparatus, this could be easily done. It is always advisable to test the belt as a whole and not over an inch section.

Rubber Conveyor Belts

Similar tests are made on rubber conveyor belts, with, of course, the additional testing and analysis of the rubber. Owing to the greater cost of rubber belting, firms are not keen on supplying test lengths of 9 to 12 in., and as a rule tests of the cotton duck are made on the transverse section. One sample of a very good belt submitted gave the same tensile strength longitudinally as transversely, but this result would not always be found.

In the following table are the records of the total strength of the cotton duck of seven belts recently examined here:

STRENGTH OF COTTON DUCK

	Tensile Strength on 1-In. Transverse Section (6-Ply), Lb.		Tensile Strength on 1-In. Transverse Section (6-Ply), Lb.
A	902	E	1,056
B	858	F	990
C	924	G	1,350
D	825		

The friction tests on these same seven samples showed that none of them was exceptionally good, while one was exceedingly bad and three poor. The tests were made on a 1-in. transverse section.

FRICTION TESTS ON BELTS

	Friction Test Between Cotton-Duck Layers, Lb.		Friction Test Between Cotton-Duck Layers, Lb.
H	10	L	8½
I	14½	M	9½
J	1½	N	6
K	15		

As these results were obtained from belts that are considered the best on our market, it would seem that neither the cotton duck used nor the frictioning is as strong in rubber conveyor belts as in balata belts.

The value of the rubber layer depends entirely on the quality of the rubber used, on the vulcanizing it has received and on its age. One has to handle rubber constantly to realize the depreciation that takes place in this climate, and more especially with the quality of the rubber used for this class of work. It is in my opinion essential in buying a belt to stipulate that it has been but recently imported. Not only does the rubber deteriorate, but the frictioning material used to cement it to the duck loses its adhesive properties.

Two belts that were tested here showed that the rubber layer in each case lost its elasticity to a not inconsiderable extent after a lapse of six months. The thickness of layer was $\frac{3}{16}$ in.; elongation of a section 1 in. wide and measuring 3 in. between the grips, before breaking:

	In.		In
Sept. 14, 1914	13	Mar. 18, 1915	6
Sept. 14, 1914.	8	Mar. 18, 1915	5½

The rubber layer in one sample refused to be detached from the canvas layer. As soon as a grip could be obtained and a moderate pull exerted, the rubber tore, showing both the poorness of the quality and the effect of climatic conditions.

The following results were obtained from seven samples of rubber conveyor belts:

EXAMINATION OF RUBBER BELTS

Incombustible Matter in Rubber, %	Stretch of 3 In. In.	Friction Test Between Rubber Layer and Canvas Layer, Lb.	Incombustible Matter in Rubber, %	Stretch of 3 In., In.	Friction Test Between Rubber Layer and Canvas Layer, Lb.
48 30	13	12	37.07	9½	14
46 05	4¾	3	44 04	8	9
42 00	10	9½	59 34		
63 40	5½	6½	39.00	8½	15

The elasticity, or stretch, in the rubber layer is obtained by gripping a section 1 in. wide in the machine used for the friction test, with a distance of 3 in. between the grips. The total elongation before breaking or tearing is thus obtained, as is also the tensile strength of the rubber. The following may be quoted as characteristic tensile strengths of a 1-in. section of the rubber layer of belts in good or fairly good condition and ready for the market here:

TENSILE STRENGTH OF RUBBER BELTS

Stretch of Rubber (3 In Between Grips), In.	Tensile Strength, Lb.	Stretch of Rubber (3 In. Between Grips), In.	Tensile Strength, Lb.
10	83	8	105
7	67	9½	60
12	120	8½	310
5½	42		

It would be recommended, therefore, that a specification should demand that the incombustible matter in the rubber layer be under 50% by weight; that a section of the rubber layer 1 in. in diameter shall stretch to at least three times its own length before breaking (3 in. to 9 in.); and that the frictioning between any two contiguous layers, rubber and canvas or canvas and canvas, be at least 15 lb. It is probable that these demands could in time be made more stringent.

PARTICULARS OF RUBBER BELTS

Type of Belt	Put into Use	Taken Off	Life, Months	Tonnage per Hr.	Total Tonnage Carried	Selling Price per Ft.	Cost to Mine per Ton	Cost to Mine per Month per Ft.
36-in. belt, 173 ft. long, 5-7-ply, ⅛-in. rubber. Carrying rock to crusher station.	Aug., 1904	May, 1909	57	30	758,777	32s.		6¾d.
36-in. belt, 147 ft. long, 5-7-ply, ⅛-in. rubber. Carrying rock at crusher station.	Aug., 1904	Sept., 1907		76	828,162	32s.	. .	10½d.
36-in. belt, 173 ft. long, 5-7-ply, ⅛-in. rubber. Carrying rock at crusher station.	Aug., 1904	April, 1908	44		522,854	32s.	.	8¾d.
24-in. belt, 182 ft. long, 6-4-ply. Carrying sand.			69	68.6	1,586,764	15s. 6d.	.	2¾d.
20-in. belt, 598 ft. long. Carrying sand.			36	66 5	545,400	16s.		5¾d.
20-in. belt, 930 ft. long, 6-4-ply. Carrying sand.	Jan. 22, 1905	Sept. 1, 1908		80	782,000	10s. 2d.		4d.
24-in. belt, 404 ft. long, 5-ply. Fines to mill.		.	16		205,345	13s. 6d.		10d.
24-in. belt, 864 ft. long, 5-ply. Fines to mill.			11½		293,873	13s. 6d.	. . .	1s. 2d.
36-in. belt, 147 ft. long, 5-7-ply, ⅛-in. rubber. Carrying rock at crusher station.	Aug., 1904	Sept., 1907	36	76	828,162	32s.	.....	10½d.
30-in. belt, 923 ft. long, 7-ply, ⅛-in. rubber. Fines to mill.	Jan., 1911	June, 1912	18	117	854,000	24s 4d.		1s 4¼d.
40-in. belt, 115 ft. long, 7-ply, $\frac{3}{16}$-in. rubber. Sorting belt.			31		390,000	..	$\frac{1}{10}$d.	

The Kind of Material Handled

The material handled on our gold mines is quartz. In the breaking and crushing of ore necessary for reduction operations, the quartz in fracturing acquires very sharp edges, which have a most destructive effect on conveyor belts. The abrasive action of these fine particles is great. It was shown in a recent paper on "The Pumping of Mine Water," by Messrs. Izod and Rouillard,[1] that the very fine grits in suspension in mine water, when caught on a filter paper and examined under a microscope, were found to possess sharp corners which proved most destructive to pump liners and piping. This being so, the action of much coarser material may be understood.

It is owing to the nature of this material that a tripper for delivering from conveyor belts is not a desirable method where such a material as quartz is handled. Owing to the large quantities of water now being used in underground operations, the conditions cited have been accentuated. At some mines the ore is delivered to the head-gear bins in a mushy condition, and where there are no washing trommels adjacent to the bins, the transmission of such material is made difficult, owing to the inconvenience of handling and to the spillage that takes place. Much greater care is then required in loading and in the protection of the belt and its accessories.

Owing to the slight abrasive action of coal, its handling by conveyor belts can be carried out much more efficiently and economically than is the case with quartz or other coarse material. Tripper carriages can be used for most purposes, and the design of the necessary chutes does not present the same difficulties and permits of modifications that are impossible in gold-mining practice.

Other materials are dealt with in a general way in the tables attached to this paper, which give the capacities of belts at different speeds for material of a given weight per cubic foot.

There are two kinds of belts in general use for the conveyance of material—balata belts and rubber belts—and each type has strong advocates in favor of its adoption. We have endeavored to treat the subject as impartially as possible. Both types may be obtained in many qualities and to suit various requirements. Generally speaking, the rubber belts cost from 15% upward more than balata. The high cost and scarcity of rubber at the present time, due to the exigencies of war, must be taken into account in any comparisons of costs between rubber and balata. The detailed construction of any class of belt is the sole property of the makers, but the general essentials should be stated in specifications.

The choice of which type is to be used should have careful consideration, so that the best results may be obtained. For instance, for the transmission of sand even some of the agents for balata belts do not advocate their use, although some of our mines are equipped with no other type; in the same way, some other mines have only rubber belts.

It might be considered advisable on starting a new plant that a comparatively cheap type of belt should be installed in order to lessen the cost of any damage that might occur during the time that trials are run, adjustments made and the plant tuned up generally. Where great care is exercised in the design and manipulation of the loading and unloading devices, such a policy would be unnecessary, but we have always the element of native labor to consider and the bustle attendant on all new works.

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[1] "Journal" of the South African Institution of Engineers, Vol. 13, No. 6.

Balata belts are constructed of various plies of canvas to suit the width and strength of belt required, with pure balata gum well impregnated between the several layers. These belts may be obtained with ordinary or with copper-wire stitching on the wearing edges, and with ordinary or the stepped-ply, as is the case with most belts now on the market. Some who have occasion to use balata belts consider that they are more susceptible than rubber belts to changes of temperature, moisture in the air or on materials carried; to contacts with grit or acid; and that they are more difficult to keep clean and are more given to snaking or swinging, to stretching or creeping. We hold that with a well-made balata belt such disadvantages do not become apparent. In all cases the quality of any belt is the decisive factor.

Rubber belts are constructed of various plies of canvas duck to suit the width and carrying capacity of the belt, with the frictioning medium well impregnated between the plies and a covering of rubber on the upper and under sides and edges. These belts are made with plain or with stepped plies. The best classes of belts are constructed with duck weighing 32 oz. per sq.yd., but less costly qualities may be obtained, which have 26-, 28- or 30-oz. duck as the medium. The frictioning medium in all belts is a matter for close attention; loosely woven canvas and balata are said to show up best when new, but to depreciate in use more than the closely woven and rubber-covered belts. When stretching occurs, the strenth of the frictioning decreases. The ordinary specification for rubber belts was to call for 6- or 7-ply with $\frac{1}{8}$-in. rubber face and $\frac{1}{32}$-in. rubber cover on back.

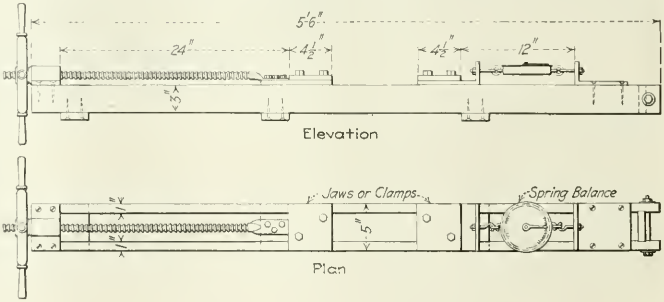


FIG. 1. DEVICE FOR MEASURING BELT TENSIONS

As rubber belts are of high initial cost, it might be well to call for $\frac{3}{16}$-in. rubber face and $\frac{1}{16}$-in. rubber on the pulley side, as with the lesser thickness it has been found that the abrasive action of the material carried caused the rubber covering to be worn out, while at the same time the canvas and frictioning were in good order. A good covering of rubber on the edges of the belt is essential. This point is put forward so that a consistent class of belts may be obtained, with the rubber surface frictioning and canvas as near the correct proportions as possible.

Belts may be obtained with any degree of vulcanization desired to suit the material to be carried. While the makers of belts contend that hard vulcanization gives the best results if large-diameter pulleys are in use, most users like a rubber belt to be easily stretched and elastic. In the running and maintenance of belts where they may have been inadvertently cut or torn, it is possible to repair with rubber and revulcanize if a small vulcanizing set is at hand, as is the case at some mines today.

The systematic painting of belts with P. & B. paint is regarded at some mines as an excellent means of preserving the surface and helping most materially in achieving a good condition of belt and prolonged life. All belts should be housed in, or at least have some form of covering as a protection from the weather, particularly in warm climates.

THE LIFE OF CONVEYOR BELTS

Tables giving the services obtained from various conveying installations on our gold mines are given, but some particulars of special conveyor belts may be of interest.

Particulars of rubber belt conveying coal at a Transvaal colliery:

Started up, October, 1904.
Taken off, February, 1909.
Actual running time, 4 years and 4 months.
Condition when taken off, not bad; was made into shorter lengths and used up.
Belt 30 in. wide, 9-8 ply, $\frac{3}{16}$-in. rubber cover, length between centers 520 ft. approximately.
Speed, 460 ft. per min.
Height elevated, 155 ft.
Troughing idlers, 4-ft. centers.
Return idlers, 10-ft. centers.
No guide idlers used.
Total quantity elevated, 2,000,000 tons approximately.
Approximate cost, 0.45d. per ton carried; this cost including new pieces of belt, grease, repairs, labor and, in fact, everything connected with the running and maintenance of belt during the entire period of working.

Slipping was made known by an automatic electrical signaling arrangement connected to the first return idler pulley. A non-runback ratchet-and-pawl arrangement was provided, but never found necessary because there was no tendency to run back, the whole plant being belt-driven and this drive being driven from the main lineshafts. The maximum output of belt was 3,000 tons in 10 hr.

Belt carrying coal to boiler-room hoppers in power station, Cape Province:

Rubber belt, 16 in. wide.
Length between centers, 178 ft.
Angle of incline, 20°.
Elevation, 30 ft.
Provided with traveling tripper.
Belt carried 150,000 tons of coal.
Life, 7 years; at that time belt had deteriorated through cracking and perishing, due mostly to the changes of temperature between boiler-house roof and outside and to exposure.
Twenty tons per hour could be carried if steadily loaded.

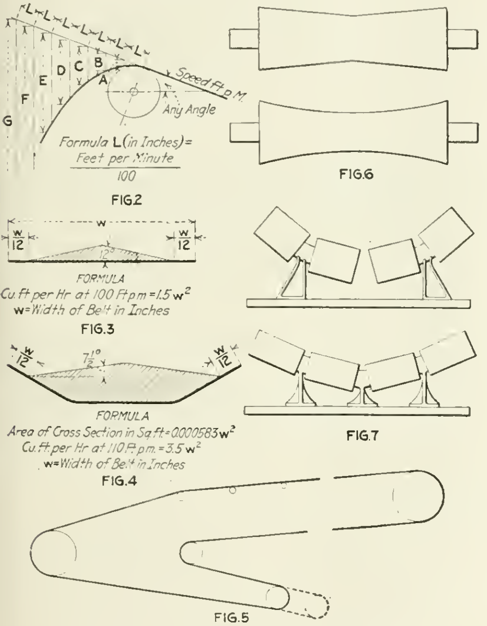
Particulars of belts conveying ore at a local gold mine:

This was a balata belt, 5-ply, costing 9s. per ft., and installed to carry damp ore to the stamp mill on an incline of 18°.
Total length of belt, 750 ft.; width, 24 in.
Speed, 350 ft. per min.
Tonnage carried, approximately 50,000 per month.
Total tonnage, 1,200,000 tons.
Life of belt, 27 months.

LOADING OF CONVEYOR BELTS

It may safely be said that we are getting away from the days when the smallest width of belt compatible with the tonnage to be handled was installed, and when belts were run at speeds up to and over 600 ft. per min. The tendency nowadays, and a correct one, is to install a belt of ample width and run it at a speed of 100 to 150 ft. per min. In the case of belts used for sorting purposes a speed of 40 ft. per min. should not be exceeded.

The delivery of material to and from conveyors requires most careful consideration. Our ideas regarding the best methods are shown in the various diagrams. The chutes leading material to a belt must be arranged so as to deliver in the same direction as the belt is running, as in Figs. 25 and 26. On no account may a chute deliver at right angles to, or in opposite direction to, the run of the belt. The even loading and distribution on a belt is essential in order to get full capacity and good working conditions. If not correctly loaded, it will not run true and straight nor lie evenly on the idlers, but will swing from side to side and take on a snake-like motion which will destroy it in a short time. Chutes should be a few inches less in width than the carrying belt to allow of correct loading, and a tapering width should be strenuously avoided. A chute should deliver to a belt without causing impact, and delivery must take place between and not onto the idlers.


L
A
B
C
D
E
F
G
Speed Ft. P.M.
Any Angle
Formula L(in Inches)= Feet per Minute / 100
FIG.2
FIG.6
w
w/12
12°
FORMULA
Cu.Ft per Hr at 100 Ft.p.m.=1.5 w²
w=Width of Belt in Inches
FIG.3
FIG.7
w/12
7½°
FORMULA
Area of Cross Section in Sq.Ft=0.000583w²
Cu.Ft.per Hr at 110 Ft.p.m.=3.5 w²
w=Width of Belt in Inches
FIG.4
FIG.5

DETAILS OF TROUGHING CONVEYORS

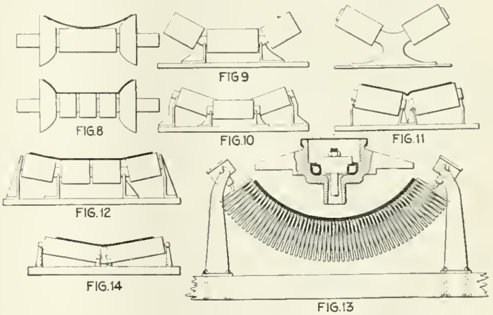
In America, which I think may justly be termed the home of conveyor belts, a progressive firm has designed and installed a method similar to the "Comet" feeder.

The delivery from a belt is of equal or even greater importance than that to a carrying belt. A bad form of chute has destroyed many conveyor belts, for if the chute is not properly made and placed, material may jam and cut the belt to pieces. Chutes wrongly placed require frequent renewal, and those delivering from one belt to another may destroy the second belt if badly arranged.

For the purpose of designing delivery chutes from belts, figures showing the actual delivery from various belts at different speeds are given, also an easy formula and diagram for obtaining the trajectory of delivery from any belt (see Fig. 2). Our ideas with regard to the placing of chutes are shown in Figs. 25 and 26, already mentioned.

BELT SCRAPERS AND CLEANERS

Dirt, chips and wet material have a tendency to adhere to the top side of all belts, perhaps more so in the case of balata than with rubber belts. As this side of the belt is the one which comes in contact with the return idlers it is desirable to have it as clean as possible to prevent wear of idlers and the accumulation of dirt under the belt. To keep the return side clean is a difficult matter, and particularly so when waste rock is carried by the belt on its return. A perfect belt cleaner has not yet been devised. If a brush is used, it gets clogged and refuses to move. A scraper of wood or belting catches the grit and wears out the belt surface. Sprays unaccompanied by scrapers only made matters worse, so that unless great care and attention is paid to the running of any scraping or cleaning arrangements, they are better dispensed with in connection with ore handling. Fig. 18 shows a type of belt cleaner driven from head end of belt and arranged to tap the belt and so knock off the material clinging to the surface. Fig. 19 shows the construction of chutes, so that wear and tear may be minimized, by having a false bottom that fills up with material which attains its own angle of repose. Guide boards used for the purpose of assisting the proper loading of a belt lead to great trouble and should be avoided.



TYPES OF IDLERS

TRAJECTORY TABLE FOR CONVEYOR BELTS[1]

Delivery from Belts (See Fig. 2) Constants

	Decimals	Fractions		Decimals	Fractions
A	0.4284	27/64	I	39.0744	39 1/16
B	1.9296	1 15/16	J	48.2450	48 1/4
C	4.3416	4 11/32	K	58.3704	58 3/8
D	7.7184	7 23/32	L	69.4656	69 15/32
E	12.0600	12 1/16	M	81.5256	81 17/32
F	17.3664	17 3/8	N	94.5504	94 9/16
G	23.6376	23 5/8	O	108.5400	108 35/64
H	30.8736	30 7/8			

This formula holds good in all cases except when material being conveyed tends to stick to the belt, or is very light and easily deflected by the resistance of the air

[1] Jeffrey Conveyor Co.

Much thought and attention have been given to the design and manufacture of conveyor idlers, and many types have been evolved. Figs. 6 to 17 show various forms of idlers. Fig. 6 is essentially wrong in principle, as is self-evident. The various peripheral velocities due to the increasing diameters cause an abrasive action, which quickly rubs the covering off any belt. Fig. 7 shows a 4-pulley idler and denotes the attempt to arrive at a better belt curvature; one disadvantage is the many roller edges which come in contact with the belt, and another is the additional number of bearings. Fig. 8 is the dishpan idler; this form soon cuts the belt, as is shown in the diagram giving loaded position.

At Fig. 9 is the usual type of idler, in which the cutting edge of the rollers is a disadvantage also the poor curvature of the belt. Fig. 10 shows a method of getting away from the cutting edges of the rollers by placing the center roller behind the inclined rollers. Fig. 11 shows the liability of the belt being cut if this type is used. Fig. 12 shows a four-roller idler to obtain good curvature of belt; idlers are also constructed with five rollers to attain this object. The number and position of bearings is a disadvantage. Fig. 13, in the endeavor to obtain good belt curvature an idler constructed of a spiral spring 5 in. diameter, with 2 coils per inch of width, has been proposed. The springs under the weight of the belt and its load stretch and sag to a smooth curve of approximately circular shape, and the belt bends to a troughed form in contact with and supported by the spring across its entire width. A pure rolling contact at all points is expected. I cannot say whether this type has ever been tried. Fig. 14 shows a type of idler with good features. It has good curvature, no cutting edges and few bearings.

CAPACITIES OF VARIOUS WIDTHS OF CONVEYORS OPERATING AT 100 FT. PER MIN. AND HANDLING MATERIAL OF VARIOUS WEIGHTS[2]

Flat Conveyor Belts (See Fig. 3)

Formula: Cu.ft. per hr. at 100 ft. per min. = 1.5w², where w = width of belt in inches.

Width of Belt In.	Cross Section of Load, in Sq Ft.	Cu.Ft. per Hr. at 100 Ft per Min.	Cu.Yd. per Hr. at 100 Ft. per Min.	Tons per Hr. at 100 Ft. per Min. Weight of Material in Lb. per Cu.Ft.				
				25	50	75	100	125
10	0.025	150	5.5	1.9	3.8	5.7	7.6	9.5
12	0.036	216	8.0	2.7	5.4	8.1	10.8	13.5
14	0.049	294	10.9	3.7	7.4	11.1	14.8	18.5
16	0.064	384	14.2	4.8	9.6	14.4	19.2	24.0
18	0.081	486	18.0	6.1	12.2	18.3	24.4	30.5
20	0.100	600	22.2	7.5	15.0	22.5	30.0	37.5
22	0.121	726	26.9	9.1	18.2	27.3	36.4	45.5
24	0.144	864	32.0	10.8	21.6	32.4	43.2	54.0
26	0.169	1,014	37.5	12.7	25.4	38.1	50.8	63.5
28	0.196	1,176	43.5	14.7	29.4	44.1	58.8	73.5
30	0.226	1,350	50.0	16.9	33.8	50.7	67.6	84.5
32	0.256	1,536	56.9	19.2	38.4	57.6	76.8	96.0
34	0.289	1,734	64.3	21.7	43.4	65.1	86.8	108.5
36	0.324	1,944	72.0	24.3	48.6	72.9	97.2	121.5
38	0.361	2,166	80.2	27.1	54.2	81.3	108.4	138.5
40	0.400	2,400	89.0	30.0	60.0	90.0	120.0	150.0
42	0.441	2,646	98.0	33.3	66.2	99.3	132.4	165.5
44	0.484	2,904	107.5	36.3	72.6	108.9	145.2	181.5
46	0.529	3,174	117.5	39.7	79.4	119.1	158.8	198.5
48	0.576	3,456	128.0	43.2	86.4	129.6	172.8	216.0

Troughing Belts with Three Idlers (See Fig. 4)

Formula: Area of cross-section in sq.ft. = 0.000583w²; cu.ft. per hour at 100 ft. per min. = 3.5w², where w equal width of belt in inches.

10	0.058	350	12.9	4.4	8.8	13.2	17.6	22.0
12	0.084	504	18.7	6.3	12.6	18.9	25.2	31.5
14	0.114	686	23.4	8.6	17.2	25.8	34.4	43.0
16	0.149	896	33.2	11.2	22.4	33.6	44.8	56.0
18	0.189	1,134	42.0	14.2	28.4	42.6	56.8	71.0
20	0.233	1,400	51.9	17.5	35.0	52.5	70.0	87.5
22	0.282	1,694	62.7	21.2	42.4	63.6	84.8	106.0
24	0.336	2,016	74.7	25.2	50.4	75.6	100.8	126.0
26	0.394	2,366	87.6	29.6	59.2	88.8	118.4	148.0
28	0.457	2,744	101.6	34.3	68.3	102.9	137.2	171.5
30	0.525	3,150	116.7	39.4	78.8	118.2	157.6	197.0
32	0.597	3,584	132.7	44.8	89.6	134.4	179.2	224.0
34	0.674	4,046	150.0	50.6	101.2	151.8	202.4	253.0
36	0.756	4,536	168.0	56.7	113.4	170.1	226.8	283.5
38	0.812	5,054	187.0	63.2	126.4	189.6	252.8	316.0
40	0.933	5,600	208.0	70.0	140.0	210.0	280.0	350.0
42	1.029	6,174	229.0	77.2	154.4	231.6	308.8	386.0
44	1.129	6,776	251.0	84.7	169.4	254.1	338.8	423.5
46	1.234	7,406	274.0	92.6	185.2	277.8	370.4	463.0
48	1.344	8,064	299.0	100.8	201.6	302.4	403.2	504.0

The figures given are for perfect loading arrangements; 25 % should be deducted for ordinary practice.

[2] Jeffrey Conveyor Co.

At Fig. 15 is shown a strong and easily get-at-able type of ball bearing. Idlers fitted with ball bearings have come into use and are likely to supplant the older types of plain idlers. Some forms of ball-bearing idlers seem much too lightly constructed considering the material to be handled and the rough usage of gold-mining operations. Types of ball-bearing idlers so constructed that the pulley has to be cut to pieces in order to get at the ball race would seem to be a wrong method. The use of side-guard idlers or boards for the purpose of keeping a belt straight is quite wrong in principle and destructive to belts. Fig. 16 is Reddaway's patented arrangement to obtain good alignment of belt. Fig. 17 shows the Johnstone idler, consisting of a number of pulleys of different diameters running free on the shaft.

DATA FOR SELECTING SUITABLE SIZE OF CONVEYOR[3]

Size of Belt, In.	Area of Normal Load, Cross Section in Sq Ft.	Rated Capacity in Cu.Ft. per Hr.	Sized Material, Size of All Lumps, Cu.In.	Unsized Material, Size of Largest Lumps, Cu.In.	Rated Capacity in Tons per Hr. at 100 Ft. per Min. Speed		Limit of Speed In Ft. per Min.
					Material Weighing 50 Lb. per Cu.Ft.	Material Weighing 100 Lb. per Cu.Ft.	
12	0.075	450	2	2	10	20	350
16	0.133	798	3½	4	17	34	400
20	0.208	1,248	5	6	27	54	450
24	0.350	1,800	6	9	40	80	500
30	0.469	2,814	8	12	62	124	600
36	0.675	4,050	10	15	90	180	700
42	0.919	5,514	12	18	122	244	725
48	1.200	7,200	15	20	160	320	750
60	1.875	11,250	18	24	250	500	800

Note. These figures are given as a general guide and must be followed with caution; the conditions under which the conveyor is loaded, whether continuous or intermittent, delivered by shovels from track hopper, whether material is wet or dry or has a tendency to roll—all these have an effect upon the capacity, and must be considered when selecting size and speed of belt.

IDLER SPACING, SPEED AND LOAD FACTORS[3]

Size of Conveyor	12 In.	14 In.	16 In.	18 In.	20 In.	22 In.	24 In.	26 In.	28 In.	30 In.	32 In.	34 In.	36 In.
Material weighing 25 to 75 lb. per cu.ft.													
Troughing idlers spaced, ft.	5½	5½	5½	5	5	5	4½	4½	4½	4½	4	4	4
Speed factor	.023	.026	.029	.046	.050	.056	.069	.069	.072	.082	.096	.106	.117
Load factor	.068	.068	.068	.075	.075	.075	.075	.075	.069	.069	.065	.065	.065
Material weighing 75 to 125 lb. per cu.ft.:													
Troughing idlers spaced, ft	5	5	5	4½	4½	4½	4	4	4	4	3½	3½	3½
Speed factor	.020	.026	.030	.048	.052	.058	.071	.071	.075	.084	.098	.108	.119
Load factor	.068	.068	.068	.075	.075	.075	.075	.075	.069	.069	.065	.065	.065

Return idlers spaced 10 ft. apart. Top guide idlers usually spaced 45 ft. apart.

To find horsepower, in the preceding table, under proper spacing of idlers, find the speed and load factor.

Formulas:
Speed factor × conveyor speed in ft. per min. = Result I.
Load factor × load in tons per hour = Result II.
The sum = Result III.
Result III × length of conveyor in ft. = Result IV.
Result IV ÷ 1,000 = hp. at given speed and load.

If conveyor is inclined: Tons per hour × height lifted in ft. added to Result IV, and then ÷ 1,000 = hp. required.

If conveyor has trippers, either fixed or traveling: Add for each tripper the hp. as given below under proper speed, this result = total hp., add 15% for contingencies.

HORSEPOWER OF TRIPPER OF VARIOUS SPEEDS OF CONVEYOR[3]

	Size of Conveyor	12 In.	14 In.	16 In.	18 In.	20 In.	22 In.	24 In.	26 In.	28 In.	30 In.	32 In.	34 In.	36 In.	42 In.	48 In.
Fixed Tripper	Conveyor Speed in Ft. per Min. 100	.10	.10	.20	.30	.30	.40	.40	.40	.40	.40	.40	.50	.50	.60	.70
	200	.30	.30	.40	.50	.50	.60	.60	.70	.70	.80	.80	1.0	1.0	1.2	1.4
	300	.40	.40	.50	.70	.80	.80	1.1	1.1	1.2	1.2	1.3	1.5	1.5	1.8	2.1
	400	.50	.50	.70	.90	1.1	1.2	1.4	1.4	1.5	1.6	1.7	1.9	2.0	2.4	2.8
	500	.60	.60	.90	1.1	1.4	1.6	1.8	1.8	1.9	2.0	2.1	2.3	2.5	3.0	3.3
Traveling Tripper	Conveyor Speed in Ft. per Min. 100	.20	.20	.20	.30	.30	.40	.40	.40	.50	.50	.50	.60	.60	.70	.80
	200	.30	.30	.40	.50	.60	.70	.80	.90	1.0	1.0	1.0	1.2	1.2	1.4	1.6
	300	.40	.40	.60	.90	1.0	.90	1.3	1.4	1.5	1.5	1.6	1.8	1.8	2.1	2.4
	400	.60	.60	.80	1.1	1.3	1.4	1.7	1.8	1.9	2.0	2.2	2.3	2.4	2.8	3.2
	500	.70	.70	1.0	1.3	1.5	1.8	2.1	2.3	2.4	2.5	2.6	2.8	3.0	3.6	4.0

[3] Robins Conveyor Co.

Regarding the tensile strength of rubber conveyor belts, when you have obtained the actual hp. required for driving the belt, it is easy to find the actual working tension the belt has to stand. To obtain the actual pull as compared with the useful pull the following figures may be used:

Bare single pulley	1 6	Tandem bare pulley	1.3
Lagged single pulley	1.5	Tandem lagged pulley	1.2

These figures may be safely used.

MAXIMUM ALLOWABLE TENSION PER PLY

4-ply = 23 lb. per inch per ply.
5-ply = 22 lb. per inch per ply.
6-ply = 21 lb. per inch per ply.
7- and 8-ply = 20½ lb. per inch per ply
Over 8-ply = 20 lb. per inch per ply

The use of snub pulleys should be avoided if possible by giving the belt a long lead to the first return idler; if they cannot be dispensed with, they should be of large diameter, say 18 or 24 in. Head and tail pulleys should be of the largest diameter admissible. A pulley 5 in. diameter for each ply of the belt is the minimum, and 8 in. should be adopted if possible. Large pulleys increase the life of belts considerably by eliminating the heavy strain that is imposed when made to bend round a small diameter. In this connection an interesting point has been advanced by some makers of belts—namely, that belts should be constructed with an uneven number of plies, and instead of the usual 4, 6 or 8, it should have 5, 7 or 9 plies, especially in the steeper drives.

The theory advanced for the known fact that many even-ply belts have been known to open down the middle seam, while an uneven ply remained intact, was that with, say a 6-ply in passing over a small diameter pulley, the strain set up temporarily by the difference in distance from the center of the pulley to the pulley side and carrying surface of the belts, seems to center and have its greatest effect in or about the middle of the belt in thickness, this action causing three plies to remain more or less firmly cemented together in what might be termed the upper and lower halves of the belt, and whereas the frictioning between the upper and lower halves of 3-ply each is comparatively soon destroyed, or reduced in strength to such an extent that the third and fourth ply will come apart when the other plies and the rubber surfaces are in perfect condition.

An 8-ply belt which was put on pulleys 20 in. diameter within four months after installation was found to have separated in layers and into spaces two or three yards long along the whole length of belt.

The most usual form of tension end is the screw take-up, which requires careful adjustment. A method of obtaining an even and uniform tension is shown in Figs. 22, 23 and 24. Fig. 5 shows a poor form of take-up gear, which was necessitated owing to the under side of the belt being used to convey waste rock on its return.

The amount of take up usually allowed is 18 in. for belts up to 100-ft. centers, 24 in. for belts up to 200-ft. centers, and 36 in. for belts over 200 ft. centers.

The driving gear for a conveyor belt should be placed at the discharge end, so as to pull and not push the material along.

ANGLES AND SPEEDS OF BELTS

It is not considered advisable to run belts at a steeper angle than 18° with the horizontal, although coal and material generally can be carried at an angle of 20° elevation if particular attention is paid to the loading, but this is not good practice.

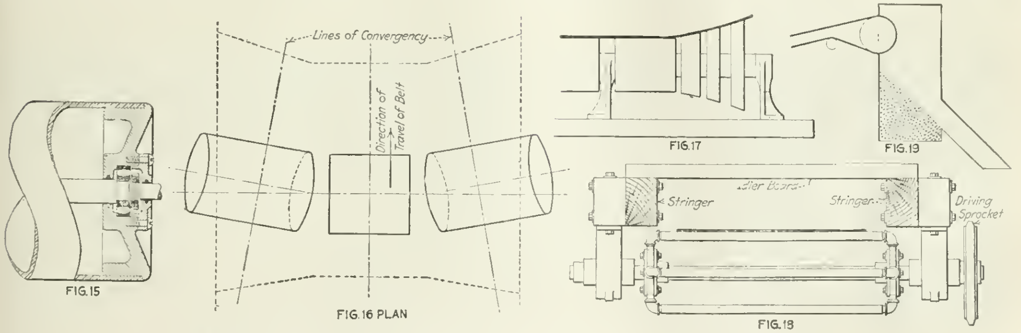
Sorting belts should be run horizontal, or may be run at an angle up to 10° if elevation is necessary. Belts should not be made to change direction from horizontal to inclined in one piece. Where such an arrangement is necessary, two separate belts, one horizontal and one inclined, should be installed, as shown in Figs. 20 and 21.

Belts should be of ample width for the tonnage to be carried at comparatively slow speeds, say from 100

TABLE OF POWER CONSTANTS

Width of Belt, In.	C Power Constant	Hp. for Each Tripper	Width of Belt, In.	C Power Constant	Hp for Each Tripper
10	0 55	¾	30	2 45	2
12	0 65	¾	32	3 15	2
14	0 75	1	34	3 35	2
16	1 05	1	36	3 55	
18	1 35	1½	38	3 75	
20	1 70	1½	40	3 95	
22	1 85	1½	42	4 15	
24	2 00	2	44	4 35	
26	2 15	-	46	4 55	
28	2 30	2	48	4 75	

For conveyors under 50 ft. in length add 20% to horsepower obtained above; over 50 ft and under 100 ft. add 10%; over 100 ft. and under 150 ft. add 5%. To the horsepower at the head shaft as obtained above there should be added an additional 5% for each reduction through chain, belting, or cut gears, and 10% for each reduction through rough gears.



SOME OF THE DETAILS DISCUSSED AS TO THE USE OF CONVEYOR BELTS

WEIGHT OF BELTS

Rubber Belts with 1-32 In. Rubber Cover, Plain or Stepped, for North British Rubber Belts

24-in., 2-ply = 2 lb., 1 oz. per ft.
24-in., 3-ply = 3 lb., 10 oz. per ft.
24-in., 4-ply = 4 lb., 6 oz. per ft
24-in., 6-ply = 5 lb., 12 oz. per ft.

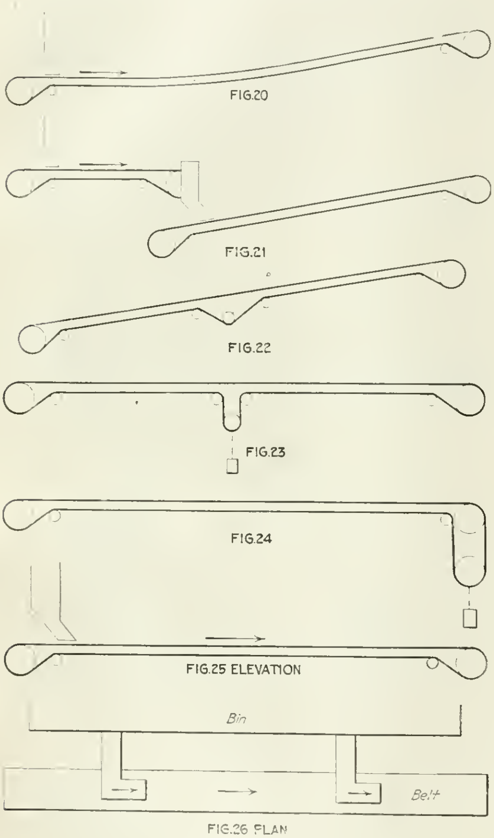
Lincona Belts (Balata)

	Lb.		Lb.
12-in., 6-ply, 100 ft. =	144	18-in., 8-ply, 100 ft. =	320
12-in., 8-ply, 100 ft. =	192	18-in., 10-ply, 100 ft. =	400
12-in., 10-ply, 100 ft. =	240	20-in., 5-ply, 100 ft. =	236
14-in., 6-ply, 100 ft. =	188	20-in., 6-ply, 100 ft. =	294
14-in., 8-ply, 100 ft. =	264	20-in., 8-ply, 100 ft. =	392
14-in., 10-ply, 100 ft =	330	24-in., 5-ply, 100 ft. =	240
18-in., 5-ply, 100 ft. =	206	24-in., 6-ply, 100 ft. =	288
18-in., 6-ply, 100 ft. =	240	36-in., 6-ply, 100 ft. =	432

to a maximum of 200 ft. per min. For sorting belts 40 ft. per min. is about the maximum. To find the probable tonnage of coal or ore which a 100-ft. long conveyor belt will handle, multiply the width of belt in inches squared by 500.

EFFICIENCY OF CONVEYOR BELTS

The efficiency of belts is usually taken at from 40 to 50% for inclined conveyors. Everything depends on the care and attention paid to the design and maintenance of any installation. The use of ball-bearing idlers and proper attention in the running of belts should tend to increase the previously obtained efficiencies considerably.



ARRANGEMENTS OF CONVEYOR BELTS

Formulas:

$$\text{Approximate hp. required} = \frac{\text{lb. carried per min.} \times \text{elevation in ft.}}{16,500}$$

Capacity of belt:

$$\text{Approximate tonnage carried per hour} = \frac{\text{width in inches}^2 \times \text{weight per cu.ft. material} \times \text{vel. ft. per min.}}{70,000}$$

Horsepower required (Jeffrey Conveyor Co.):

$$\text{For horizontal belt, } Hp. = \frac{(CS + 2.33T)L}{33,000}$$

$$\text{For inclined belt, } Hp. = \frac{(CS + 2.33T)L}{33,000} + \frac{T \times H}{990}$$

where

L = Length of conveyor belt in feet;
T = Load in tons per hour;
S = Speed in feet per minute;
C = Power constant from table.

Owing to existing war conditions it is quite impossible to give even comparative figures relative to the cost of various belts and their accessories. The cost of handling material varies considerably at different mines, and close figures are not always obtainable. The following are a few general figures: Transferring sand from collectors to treatment tanks by truck haulage, 1.978d. per ton; by conveyor belt, 1.22d. to 1.63d. per ton. Sand to dump, endless rope haulage, 4.236d. per ton; conveyor belt and boom, 4.118d. per ton; aërial rope haulage (Langlaagte Estate, length two miles), 3d. per ton; steam haulage (Simmer & Jack) 0.86d. per ton.

BELT STATISTICS

The tables giving the life, cost and tonnage carried of various belts have been compiled from a great number of returns, from which endeavor has been made to choose the most favorable examples available. The average cost of the belt only, per foot per month, for all classes of belt was approximately: For belts handling rock, 1s. 3d., and for belts handling sand, 7¼d.

⁂

The Gold Hunter Mill

The process in use at the Gold Hunter mill, Mullan, Idaho, is concentration, employing jigs, tables and flotation. The maximum capacity is 120,000 tons per annum. The total cost of the mill was $95,000, and the horsepower required to operate it is 300.

A total of 700 gal. of water per minute is used in the mill, which employs 26 men for its operation. Blake-type jaw and gyratory crushers are used with rolls and tube mills as auxiliaries. The ratio of concentration is 10:1, and the percentage of extraction averages about 80. No changes have recently been made in the mill, the Callow flotation system being used as customary, Pachuca tanks serving as mixers. These latter have not been discarded as has been the case at some other plants. Each Callow cell requires 9.6 hp. to supply it with compressed air.

The matter of concentrating the flotation tailings on tables has been considered and will probably be put into effect. A 30x6-ft. Dorr tank has been installed to thicken flotation concentrates ahead of the Oliver filter. There has also been installed a 30x6-ft. Dorr tank to thicken some dirty slime overflows that were escaping from the mill in several places. Another change of some importance is the removal of the quick-discharge device from the tube mills. Otherwise, the mill continues to operate after the same procedure described in the *Journal* of Dec. 25, 1915.

⁂

Zincfoil as a Substitute for Tinfoil is reported by Consul Harry G. Seltzer, at Breslau, Germany, under date of Apr. 27, who states that one of the Breslau tinfoil factories has succeeded in providing this substitute. The new product is not to be distinguished from tinfoil and is supposed to render the same services.

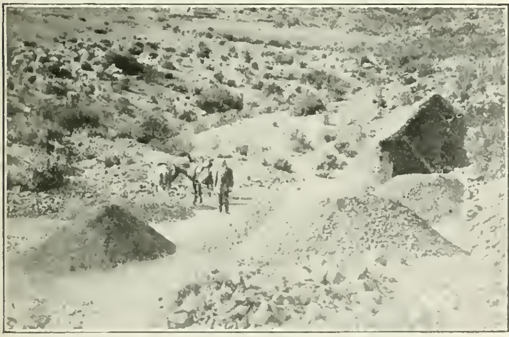
Don Luís Charme's Tremain Steam Stamp

By M. R. Lamb*

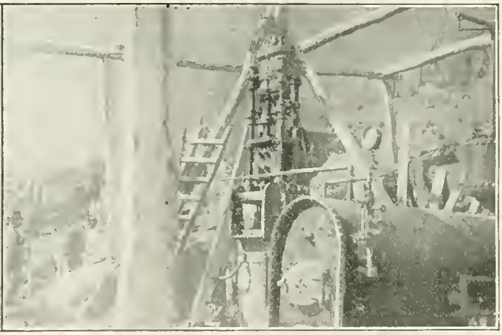
SYNOPSIS—Some details of the worries which come to consignees of mining machinery in South America; in this case, Don Luís Charme, who had a little mine of his own. The troubles of setting up the little steam stamp and getting it running were compensated by the successful results of its running and the satisfactory recovery made. Don Luís was treated to his first experience of that sinking feeling at the pit of the stomach when the noise of the mill suddenly stopped for the first time.

Sr. Charme is the owner of several gold mines in the Petorca mining district. His serious business is agriculture, but he likes to experiment with mining. Petorca is famous for its *past* production of gold. This is a peculiarity of practically all the gold and silver mines of Chile. At present there are but few gold and silver mines being operated, and the opportunities of getting hold of these old mines are excellent.

Sr. Charme had accumulated about 100 tons of hand-crushed, sorted ore, but as there is no custom plant near and as shipping and "returning charges" are high, he decided to put in as small a practical plant as he could find. About this time, by good luck I decided to use as an advertisement, a telegram received from Sr. Felipe Herrera concerning *his* Tremain, with the result that Sr. Charme investigated the Herrera plant and bought one like it. As things were a little slack and as I am a long way from the home office, it was possible to promise to set up the Tremain and show his mechanic how to run it. First payment was made, the order was cabled, and within eight days the little plant was on the cars, bound for New York.



HAND-CRUSHED, HAND-SORTED ORE AT DON LUIS' MINE



THE TREMAIN STAMP AND BOILER PLANT DURING ERECTION

When it comes to guaranteeing delivery, the best that can be done is a promise of New York delivery. The steamers from New York deliver at Panama or Colon without knowing or caring what ship will take the material on down the coast. And there is no way to hurry the reloading. And there is no way except by cabling to a friend, to find out if the material is there, and even he cannot tell you when it will be reshipped. There is no routine way of learning upon what ship the material will be sent from Panama, nor is there anyone to whom complaint can be made. The ship from New York has done its part in delivering at the Isthmus, and as there are several lines on this side, none of them is to blame. I have had a rheostat on the way 13 months now, and no one can give any information concerning it. But to get back to the Tremain.

Upon being advised by our New York office of the steamers name and date of sailing, I gave the ship seven days to reach Colon and then cabled (reply paid, always) one of the steamship lines for name and sailing date of forwarding connecting steamer. This was promptly supplied, and Sr. Charme seemed to have an excellent chance of receiving his equipment in record time.

However, there is always something to interfere. I remember one shipment that was very urgent. Every effort was made—and successfully—to have a complete cyanide plant reach New York in ample time for a certain ship. The goods were received by the steamship company, but when the ship arrived at Valparaiso—no plant! Inquiry developed that it was coming on another ship of the same line a month later. Further inquiry of Captain Dexter, of the second ship, developed the fact that his ship was new and the plant was held back to favor the steamer, as she had little cargo.

But to get back to Sr. Charme's Tremain. When his ship arrived, there was no Tremain. After further cables it developed that the first ship decided not to bring the Tremain, so a later one was carrying it. The net result was a loss of three weeks.

While the shipment was being taken from Valparaiso to the mine (total unloading, agent, duties and other charges, $100) the bench was being cut in the hillside, a small dam was built to impound the water for the boiler and Tremain and a trail a hundred yards long was cut from the mine dump to the mill site. The pit for the mortar block was 40 in. square and 10 ft. deep. The bench cut was contracted on a basis of 40c. per day for each of the men employed. As they are the same gold miners that taught the '49ers how to get gold in California, it will be seen that labor is cheap in Petorca. Carpenters receive 50 cents.

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*Allis-Chalmers Mfg. Co., Santiago, Chile.

The cut was finished in plenty of time, and when the equipment arrived it was seized roughly and put into place as quickly as possible. As the town of Petorca, though inhabited by 1,500 souls and several foreigners, cannot supply nails, much less tools, Don Luís had us send him a real good and complete set of tools and supplies, which cost him $200. These might have been purchased in the States with the Tremain, but the difference in price would have been little, as American tools are carried by several hardware stores here in Santiago.

Pipe was required to bring water from the dam to the Tremain, besides the pipe sent with the equipment. We discovered *again* that English and American pipe threads are different. English thread is cut parallel to the surface of the pipe like bolt thread—American is taper; English pipe fitters put steam and water and gas pipe together with *string* in the threads, because it is not possible to make a tight joint otherwise. Besides this, the number of threads per inch and the shape of the threads are different. Taken altogether, a plant with two systems of pipe thread is some pleasant mixture. It is possible to *force* an English pipe into an American valve *once*, but both the valve and the pipe threads are incapacitated for subsequent use. The English merchant has had the start of the American in this question of pipe threads, so that as American manufacturers will not conform to English standards, confusion is bound to increase, especially as the U. S. S. P. Co. will and does supply any thread ordered.

Roberto and His Troubles

Roberto, the mechanic and mill man, had his first experience with American taper threads and pipe-graphite grease. In spite of positive instructions he was unconsciously trying to put the piping together with string and ravelings from sacks and from an old shirt. He was sure every joint would leak. (The plumber who installed all the pretty bathroom things in my house, made up every pipe joint with string and red lead, afterward burning off the excess with a torch. Even the nickel fittings are treated this way.)

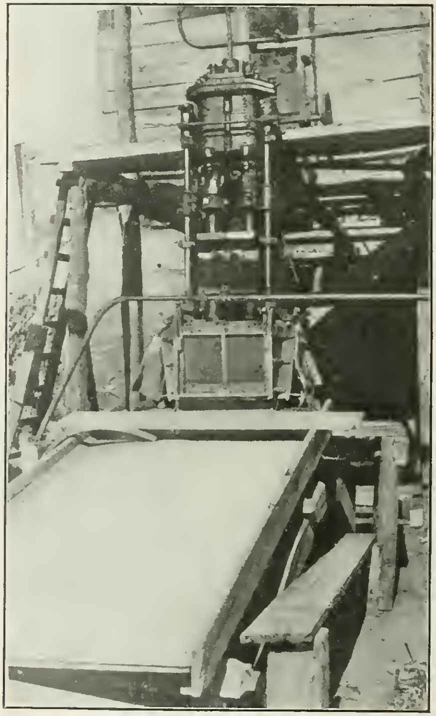
But to get back to the Tremain. We could not find a timber in Valparaiso to fit the instructions, so made the mortar block of three 12x12-in. sticks bolted together, with 3-in. planks nailed on the sides. The block was set in position, being first sawed off square. This sawing was done carefully, so that no planing was necessary. The "book" says to plane off the block, but fancy planing off the end of 18x36-in. block! This planing looked like a large order. It was easier to saw carefully and then set the block plumb and level.

The Tremain came on heavy skids in a thick oak box, all assembled, ready to set on the foundation. As boxing for the West Coast trade is specified "heavy enough to break anything that bumps it," it was no small job to unpack the shipment. The boxes were saved and serve for tool boxes and for supplies.

After the box was off the Tremain, it was skidded to its position back of the mortar block and stood upright. We had no chain block strong enough to lift it bodily, so the six men with three levers in the screen openings raised it four inches at a time, while I steadied it with a one-ton differential suspended on a tripod. This constant raising and blocking required over an hour to place the Tremain on the mortar block.

While this was going on, a carpenter was framing a set of crooked trees to serve as a bin and building. It was a delight to see him get his sticks out of wind without any help—and at 50c. per day of 10 hours.

The boiler is a 20-hp. locomotive type and was therefore ready to run as soon as it was connected to the water supply and to the Tremain. Hereafter I shall supply a 30- or 40-hp. boiler. Already Don Luís is talking of laying a steam line to the mine for a pump, of a small engine and concentrating table, and of a few hand drills and a compressor.


THE TREMAIN STAMP AND AMALGAMATING PLATE READY FOR OPERATION

The locomotive-type boiler is best suited to this type of plant because it is so easy to erect. In this case fuel costs $1.30 per ton of an excellent, free-burning resinous wood. It is brought in on burros from the neighboring hills, and for such a small plant the supply is everlasting.

When Saturday came, we were so nearly ready to run (and I was so tired and anxious to get back to Santiago) that we persuaded the men to work Sunday. Of course they had no supplies for Sunday, as they buy for a week at a time in Petorca. We agreed to supply the food for Sunday and Monday and to let them off Tuesday when the job was done. So we took coffee, sugar and bread for their breakfast, beans, bread and wheat for lunch, and bread and tea for supper, and everyone was contented. At Braden the Chilean miners earn around $3 per day, and so have got into the habit of eating meat three times a day, but in the smaller camps and in the farming districts, meat eating is not the custom.

Only one holiday caught us. It seems that San Lorenzo is the gold miner's saint. No miner would think of working on that day, as something unfortunate was bound to happen. The workings would be dangerous, water would come in, the vein would pinch or evil spirits would be met in the mine. These evil spirits or *duendes*, are long-bearded dwarfs dressed in priests' raiment and are not at all pleasant to meet. There is nothing like them in the States. It would seem possible to argue that building a Tremain mill was not gold mining—but this argument failed.

While the piping between the boiler and Tremain was being connected, the bin was put together, and the ore packers filled it from the piles of ore at the mine, using rawhide bags.

Monday evening all was ready for a start. It was too late that night, but Roberto and I were up at 5 a.m. to make a trial before Don Luís and his friends arrived.

Roberto's First Lesson on the Plates

As there are no sleeping or eating arrangements at the mine, it meant a ride to and from Petorca four times daily. On Sunday it was agreed that we were to have roast turkey and all that goes to make a good lunch, provided the mill ran as promised. For this reason we got an early start. We warmed the stamp up a few minutes and then, too impatient to do this thoroughly, gave her full steam. The silvered copper plates had been beautifully dressed with mercury and a bit of cyanide, and Roberto got his first lesson in applying elbow grease to a plate. His lesson was fully as thorough as my first one was at Gold Cross in California, under old Adam.

When Don Luís arrived with his friends, we had been running an hour or so and even in that short time could show him some little points and splotches of amalgam on the lip plates. All the visitors, including the ladies, must needs hold the hose on the plate and examine the first gold produced in Petorca for many years.

The ore was already crushed by hand to one inch, and as it is a porous quartz, the Tremain fairly ate it up. We had tonecap screens and they are partially suited to this mill. The amalgamation plate was set with a grade of three inches to the foot, in order to make the short supply of water reach as far as possible.

It used to take us a week of milling at Gold Cross to get the showing on the plates that we got here in four hours, so you can guess the grade of ore. The screen was rather too coarse, so the tailing is being impounded for cyaniding.

About the time the cook said lunch was on the table in a near-by hut, we felt that the Tremain would never stop. Roberto, who is running the plant now, was very anxious not to stop, so it was agreed that he would stay on at the mill while we lunched. While we were gone, the noise suddenly ceased, and Don Luís had his first experience of that sinking feeling at the pit of the stomach when the mill stopped. It took quite a while for us to discover that a bit of rubber packing had gone between the valve chest and cover. When that was replaced, we were off for a regular, uninterrupted run.

It required seven days, six men (one half-witted) and about ? dollars of total cost from the date of placing the order to the day the Tremain started, including tools, spares, pipe, dam, lumber and building and bin. With any luck in the mine, the mill will be paid for in two or three months.

Roberto is a good mechanic, but he had not seen a Tremain before. He has no trouble with it—at least, none that he tells me about, and he has gone through it thoroughly by this time. He has ordered spare shoes, dies and screens, and as Don Luís has arranged with him on a percentage basis of gross output, he finds means to work day and night.

Later—The plant has now been running for six months, and when the mine does not supply sufficient ore, waste which amalgamates ⅓ oz. has been used to keep the Tremain busy. An additional mill will probably be put in, and the same men will run it. The waste is even softer and finer than the mine ore, and the 24-hr. capacity at times reaches 18 tons.

Roberto wants finer screens, and we are sending him the finest listed. He has lost all faith in the horn-spooners of that neighborhood and spends a little money occasionally on assays to check his amalgamation.

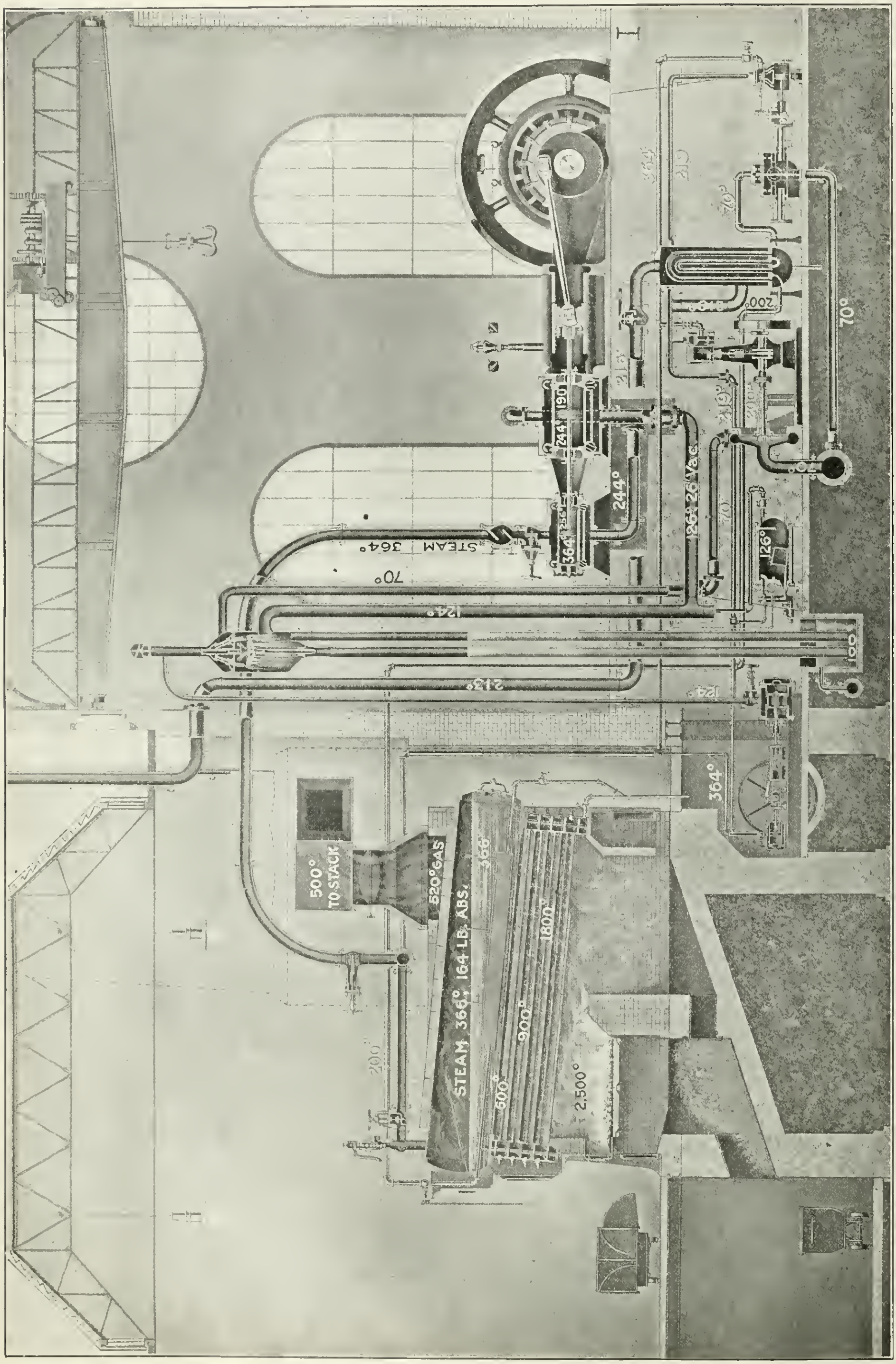
Flotation at Goldfield

The reports from Goldfield indicate that the flotation equipment now being installed, which includes 28 Callow cells, will be designed to replace, at once, or eventually, the cyanide treatment. It is pointed out that the use of flotation equipment treating 1,000 tons daily may save between $360,000 and $400,000 annually. This does not take into account the higher extraction that will be made. The avoiding of necessity for selective mining is also one of the important parts. Recent reports issued by the company indicate that development work is being resumed on the deeper levels, where large quantities of copper-bearing ore have been exposed. Heretofore, with treatment by cyanide, only ore carrying less than 0.5% Cu. has been milled; deep level ores carry more copper.

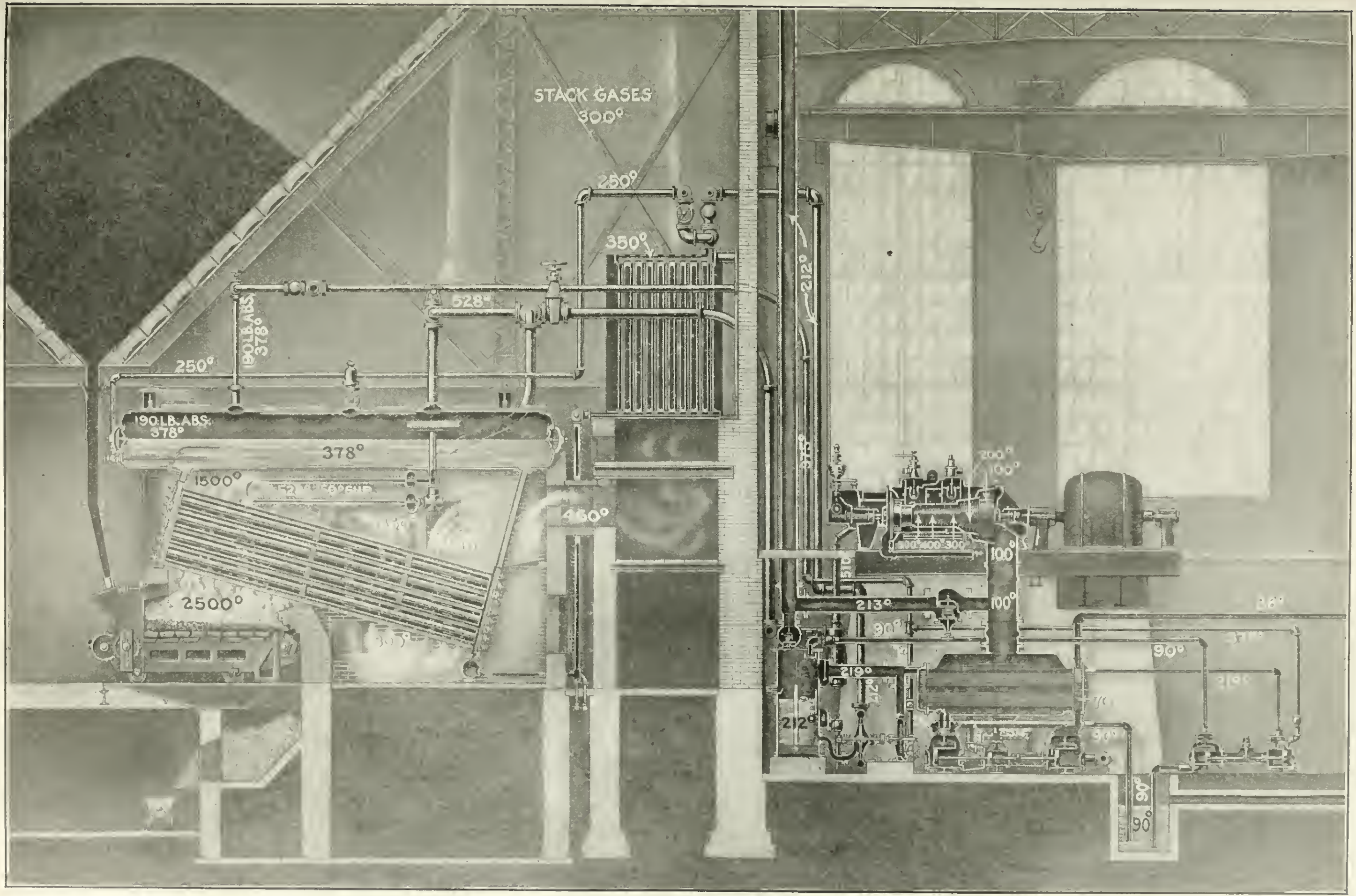
The ore treated during the past few months has been of low grade, much of it yielding a profit of less than $2 per ton, and the workings underground have been cleaned of everything that would yield the smallest profit. The limited extent to which the mines have been explored has already served to expose large deposits of gold-copper ore.

Power-Plant Steam-Temperature Diagrams

On the two pages following are published two sectional views of equipment and piping of typical reciprocating-engine and steam-turbine power plants, originally published in much larger size by our esteemed contemporary, *Power*. These diagrams show the temperatures throughout the power-plant equipment, from the firebox to the waste gases in the stack and from the feed water, through the boiler, through the engines and back to the hotwell. The difference between reciprocating-engine and turbine practice cannot be better portrayed than by a comparison of these two diagrams.



SECTIONAL VIEW OF EQUIPMENT AND PIPING OF A TYPICAL RECIPROCATING-ENGINE POWER PLANT, SHOWING TEMPERATURES OF BOILER GASES, AND TEMPERATURES AND PRESSURES OF STEAM DURING ITS COURSE FROM BOILER THROUGH ENGINE AND AUXILIARIES AND BACK TO BOILER



SECTIONAL VIEW OF EQUIPMENT AND PIPING OF A TYPICAL STEAM-TURBINE POWER PLANT, SHOWING TEMPERATURES OF BOILER GASES, AND TEMPERATURES AND PRESSURES OF STEAM DURING ITS COURSE FROM BOILER THROUGH ENGINE AND AUXILIARIES AND BACK TO BOILER

Cyaniding Copper-Bearing Ores

By Paul W. Gaebelein*

The ores of the Baker Mines Co. consist of quartz gangue carrying sulphides of iron, copper, lead and zinc. The gold is partly free, and a large proportion of the silver occurs as sulphide. These ores are treated in a twenty-stamp mill, with amalgamation, and the sands and slimes are treated separately, the cyanide treatment consisting of leaching, agitation in Dorr agitators, filtration over Portland filters, and zinc-dust precipitation. Owing to the great distance from the railroad and the consequent high haulage charges the ore is not concentrated, but cyanided direct.

The most objectionable constituent of the ore is copper, which occurs in quantities varying from 0.10% to 0.75%. It is in several forms, the principal ones being primary chalcopyrite, secondary chalcopyrite and carbonates. There is also an occurrence of bornite. An analysis of the mill heads is useless in determining what effect the copper will have because the primary chalcopyrite is only slightly attacked by the solutions, while the other forms of copper dissolve readily. In the operation of the mine and mill, therefore, it is necessary to keep careful watch on the ore being sent to the mill and to mix it in such a manner that the copper content will have the least detrimental effect.

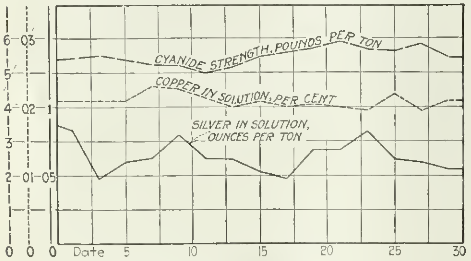


FIG. 1. COPPER, SILVER AND CYANIDE IN STRONG SOLUTION, AUGUST, 1915

Owing to the sulphide character of the ore a rather long leaching period is necessary to obtain a satisfactory extraction, and 5 days of treatment with an average strength of solution of 5.5 to 6 lb. KCN is found necessary. When the copper content becomes too high for economical treatment of the ore, it is manifested in two ways—first, by the rapid dropping off of the solution in cyanide strength and, second, by the reduction of the pregnant solution in silver content, a strong solution being necessary for good silver extraction. The solution naturally shows, also, an increased percentage of copper. Thus the effect of an increase in percentage of easily soluble copper in the ore is noticeable at once. The remedy is, first, to attempt to reduce the copper content in the ore and, second, to bring the solution back to normal strength. The latter cannot be done at once, but must be carried on gradually, depending upon the amount of copper present in the ore and how quickly this can be reduced.

In treating this ore the cyanide consumption is variable, ranging from 1.50 lb. KCN per ton to 4 lb. per ton, but by careful regulation of the ore it is kept to an average of 2 to 2.50 lb. The action of copper and its effect on the solutions is best illustrated by the accompanying diagrams, which are taken from the mill records. They are based on daily assays and anaylses of the solutions. Fig. 1 represents a normal month, the variations in silver and copper being due to variations in the grade of the ore. Figs. 2 and 3 represent October and November, 1915, during which period the copper in the ore became troublesome. About Oct. 16 the solution began to drop off in cyanide strength, and the addition of a greatly increased amount of cyanide did not serve to keep it from dropping still further. It was apparent, then, that an undue amount of soluble copper had appeared in the ore. It was inadvisable to increase the additions of cyanide further, as the cyanide was consumed rapidly and in consequence there was a still greater reduction of strength of solution, as shown by the curve in the illustration. At the same time, owing to the lower strength of solution, the silver was reduced to a very small amount. As will be noticed, the copper content of the solution also increased, in spite of the greatly lowered cyanide strength, showing the presence of a large amount of easily soluble copper in the ore. About Nov. 10 the increased additions of cyanide began to take effect and the solution rose rapidly in cyanide strength without any increase of copper content in the solution, showing that the copper of easily soluble composition had passed out of the ore. With the return to normal strength the silver returned to its normal amount in the solution. During the period that the high copper ore was passing through the mill, the cyanide consumption reached a figure of 5 lb. per ton, and even this amount did not serve to raise the solution to its normal strength.

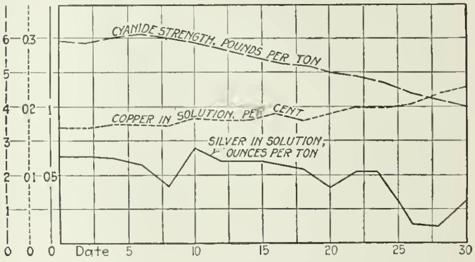


FIG. 2. COPPER, SILVER AND CYANIDE IN STRONG SOLUTION, OCTOBER, 1915

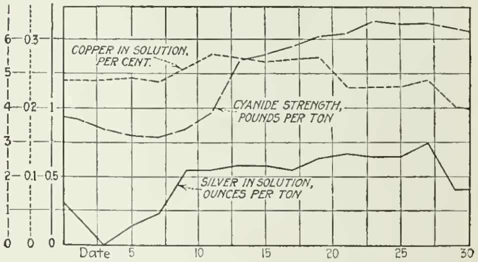


FIG. 3. COPPER, SILVER AND CYANIDE IN STRONG SOLUTION, NOVEMBER, 1915

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*Mill superintendent, Baker Mines Co., Cornucopia, Ore.

Fig. 4 gives the curves for a period of 6 months. By reference to the latter part of the period the effect of the copper ore handled during October and November can be seen. The increased consumption of cyanide, coupled with the lower strength of solution and the lessened silver content of the pregnant solution, gives a graphic picture of the effect of copper in the treatment of the ore.

In the treatment of an ore of this kind it is essential that a complete daily record be kept of the solutions. This, coupled with the fact that there is a considerable variety of ore in the mine, makes it possible to work off gradually the difficult copper ores. The extraction obtained in the plant is normally from 85% to 86% on a grade of $20 to $25 per ton, but this is reduced when copper appears to a detrimental amount, as it did in the example cited previously. The silver extraction is affected to a much greater extent than the gold.

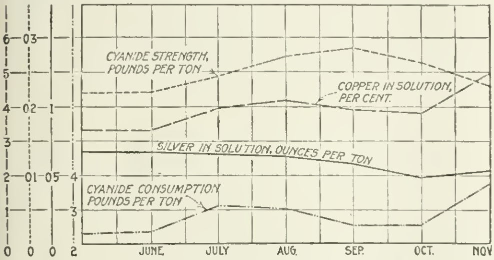

FIG. 4. RELATION BETWEEN CYANIDE CONSUMPTION AND CONTENTS OF SOLUTIONS

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Hollinger Mining Costs

The following mining costs are from the 1915 annual report of the Hollinger Gold Mines, Ltd., Ontario, during which year 334,750 tons of ore was milled.

DISTRIBUTION OF MINING COSTS

Account	Labor	Stores	Per Ton of Ore Milled
General mining charges..	$6,970.91	$3,871.65	$0.032
Superintendence	12,785.25	....	.038
Diamond drilling.........	5,792.24	7,676.22	.040
Crosscutting	10,490.19	13,728.63	.072
Shafts	8,006.43	6,433.99	.043
Drifting	27,355.66	31,454.96	.176
Raising	8,239.00	6,672.23	.045
Winzes	8,469.69	5,222.07	.041
Backfilling	302.79	291.59	.002
Timbering and repairs, shafts	6,511.29	12,339.67	.056
Stoping	109,359.07	116,911.60	.676
Scaling	8,552.34	......	.026
Timbering and repairs, stopes	24,629.77	13,053.57	.113
Track laying	6,267.32	7,232.71	.040
Tramming and mucking..	103,685.66	1,256.16	.314
Pipe-fitting underground..	3,639.17	7,010.37	.031
Mine drainage............	3,570.97	6,679.39	.031
Hoisting	37,065.77	15,641.93	.158
Landing and dumping....	4,424.63	749.69	.015
Drill repairs............	2,471.67	15,729.49	.054
Sharpening steel.........	16,947.50	6,758.55	.071
Collecting steel.........	10,057.37	63.94	.030
Mine sampling............	5,152.50	....	.015
Assaying	1,117.40	670.57	.005
Change house.............	994.71	2,523.53	.001
Surveying	4,505.06	1,255.93	.017
Mine lighting............	326.31	5,117.33	.016
Electric haulage.........	4,441.99	582.42	.015
	$442,132.66	$288,958.19	$2.183
Less credit for excess ore and waste rock broken..			.285
Net cost of mining			$1.898

RECAPITULATION OF MINING COSTS

Account	Labor	Stores	Per Ton of Ore Milled
Exploration	$5,792.24	$7,676.22	$0.040
Development	87,059.18	58,039.46	.433
Production	286,424.54	190,762.78	1.425
Deferred development.....	47,575.09	23,113.58	.211
Broken ore reserve.......	15,281.61	9,366.15	.074
	$442,132.66	$288,958.19	$2.183

The costs per ton milled are not absolutely correct in all details, as they include the cost of breaking 35,170 tons of excess ore and 42,124 tons of waste in development. A deduction of $95,800 from the total cost of mining is therefore made, to cover these items, making the net cost correct.

The following unit costs per foot are given as a matter of interest: Diamond drilling, including power, diamonds, labor, $1.60. Crosscutting, $6.40; shaft sinking, $42.32; drifting, $10.10; raising, $16.17; winzes, $39.20; stoping, $0.70 per ton; all including power, explosives and labor. Mucking and tramming, power and labor, $0.28 per ton of ore milled.

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The Wrong Mill

By Charles Labbe*

Have you ever installed or run the wrong mill? I mean the wrongly designed mill with the wrong flow sheet, the machinery not suited for the ore or too antiquated for obtaining capacity—the mill built for the kind of ore that cannot be found in the district, or the ornamental mill; one erected where there is no ore.

The design of the mill is of capital importance, for on it will depend largely the success of the mine. It should be left to an experienced and reliable mill designer, not to a draftsman or amateur designer, for mistakes, however small, are expensive. A glance at the ore does not tell much as to the nature of treatment required, although in many cases this has been the only test made. A complete analysis of the ore should be made and its treatment decided after several mill tests made by disinterested parties. Be careful of the machinery seller. His language is convincing, and if you let him speak, he will tell you that his machines were made just for your ore. He will even name you some of the largest mining companies in the world using them, but he won't tell you the time and money they have spent in trying to fit the machines to the ore.

Use of Optical Tests Alone

I remember a mill where a glance at the ore had been the only test made and the owner decided it was concentrating ore. He once had seen jigs working and decided to install them. He also decided on roll crushing—why and how nobody knew. When the mill had run a short time, it was found impossible to make enough clean concentrates to pay, so it was transformed by replacing the rolls with Huntington mills, and the ore then concentrated on tables. This required a change of engines, so that the junk pile outside is larger than the mill itself.

In using the word junk I am not mistaken in my word. Years ago I used to believe that a machine, being only iron, could always be fixed to give good results, but now I have it strongly and deeply fixed in my mind that old machinery, worn out and tired, is only good for the cupola of the foundry. From my experience it is only lost time to consider it. When you have made all the repairs you thought necessary, you find that you did not make half of them, you have spent nearly the value of a new machine and the total result is that you have only trouble ahead. Mining machinery does not improve with age, especially if it has been through a fire. You can always get it cheap, but it has always proved the most expensive.

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*Mechanical engineer, Nelson, Nev.

In milling, tonnage and extraction must always be kept in mind. We have seen a mill where the ore was sufficiently high in grade to pay for all mistakes and experiments, and while from a distance it looked like a success, we know that had it been treating a lower grade of ore, there would have resulted a disastrous failure. In these days of large bodies of ore of low grade that must be treated in mills of big capacity, nothing but the best and most suitable machinery should be used.

NEWLY INVENTED MACHINERY

A common mistake in small plants is the use of just-invented machines—too numerous are the gold-saving machines, from the dry concentrator to the mercury appliances, to catch gold that cannot be found by assay. Those inventors remind me of an old party who had a mine and mill for sale. The prospective purchasers agreed that if the ore plated an ounce, they would buy the mine at his price. Several tons of ore were milled, but they reported it did not plate an ounce. The old man told them that could not be for he himself had put in two ounces. Inventors are over-confident of themselves. Let someone else experiment with their machines—there are other good ones that have been tried and have stood the test. If you employ an engineer, it is up to him to find the right sort of machinery for your ore.

I have not yet heard of any mine that failed through having a stamp mill. Not that they are the most efficient crushers for the amount of power consumed, but I do not know of any other simple machine that will crush as efficiently from 1½-in. to 40-mesh, but they would do poor work crushing from 6-in. to 1-in. or from ¼-in. to 200-mesh.

The tube mill has become common in metallurgical plants. There are many kinds to choose from, and mistakes are being made in their selection. According to the diameter they must have a certain speed and a certain load. Like all other mining machinery, the tube mill that will grind all the different kinds of ore and give satisfactory results is still to be invented. I do not see why they have not been used for amalgamation to greater extent. They do not differ much from the clean-up barrel; of course they will flour mercury if the speed is too great and the pulp too thin.

A mill should be compact but not too crowded. Light must be plentiful day or night; the floor should be of concrete draining toward a sump where the runovers, leaks or sweepings can be saved. A good board floor often needs repairing, and if the boards do not join perfectly there will be much loss through the openings. The dirt floor is too expensive in the long run—muddy when wet, dusty when dry and anything small falling upon it is lost.

Too often a mill is designed with insufficient power, there being a great difference between the theoretical formulas and the actual power required. Too many times the power unit is bought as small as possible and when the pulleys are placed on the shaft and the engine connected with belts, it is found that the engine is overloaded, and then the operator is surprised that the shafting gets out of alignment, that boxes heat and that the bearings are rapidly worn and rendered useless. To keep up the speed, the engine must be forced and the boiler pressure raised, when the remedy is a larger engine.

From personal experience I can include dry mills in the classification of wrong mills, and I have yet to see one of them working right. Most of them have plenty of elevators in their flow sheet. This, I supose, is for aëration of the pulp or dusting of the premises. There is always such a dust that the belts are continually slipping and the shaft bearings are doing lots of grinding. The dry mills are successful in one way—sending men to the hospitals.

The management of a mill should not be given to one of your relatives who failed on a farm or in business; but like the mine manager, get a man with a few gray hairs, a training and a reputation as a successful millman. With the right man in charge and an assay office, you will soon know whether or not you have the wrong mill and much good may it do you then.

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Cyaniding Costs at Douglas Island, Alaska

The Alaska Treadwell, Alaska United and Alaska Mexican mines, Douglas Island, Alaska, run a joint cyanide plant to treat the concentrates recovered, which in 1915 treated 19,177 tons for the Alaska Treadwell, 4,769 tons for Alaska Mexican and 11,556 tons for Alaska United. Costs were as follows on a total of 35,502 tons treated:

COSTS PER TON

	Grinding	Dissolving	Filtering	Precipitation	Refining	Total
Direct Labor:						
Operating	$0.175	$0.208	$0.145	$0.084	$0.174	$0.786
Repair	.021	.010	.035	.009	.028	.103
Supervision	.020	.020	.020	.020	.019	.099
Clerical	.007	.007	.007	.008	.008	.037
Total direct labor	$0.223	$0.245	$0.207	$0.121	$0.229	$1.025
Direct Supplies:						
Cyanide	....	$0.476	....	....	....	$0.476
Lime	....	.049	....	....	....	.049
Pebbles	$0.116	....	....	....	....	.116
Zinc dust	....	....	....	$0.228	....	.228
Precipitation cloth	....	....	....	.010	....	.010
Filter cloth	....	....	$0.031	....	$0.010	.041
Lead acetate	....	.044	....	.019	....	.063
Fluxes	....	....	....	....	.025	.025
Sulphuric acid	....	....	....	....	.023	.023
Filter paper	....	....	....	.010	.002	.012
Miscellaneous supplies	.014	.013	.004	.005	.028	.064
Total direct supplies	$0.130	$0.582	$0.035	$0.272	$0.088	$1.107
Subsidiary Accounts of Mixed Labor and Supplies:						
Building repairs	$0.001	....	....	$0.001	....	$0.002
Electrical repairs	....	$0.002	$0.001	.001	....	.004
Mechanical repairs	.033	.010	.007	.006	$0.032	.088
Electric power	.216	.010	.005	.012	.010	.253
Steam heat	.012	.013	.007	.004	.002	.038
Compressed air	.015	.012	.019	.012	.020	.078
Water	....	....	.013	....	....	.013
Train service	....	....	....	....	.001	.001
Assaying	....	.040	....	.021	.027	.088
Fire insurance	.008	.008	.009	.008	.008	.041
General expense	....	....	.001	....	.001	.002
Interest	.102	.101	.101	.101	.102	.507
Seattle office expense	....	.001	....	....	.001	.002
Fuel oil	....	....	....	....	.005	.005
Total mixed labor and supplies	$0.387	$0.197	$0.163	$0.166	$0.209	$1.122
Total cost	$0.740	$1.024	$0.405	$0.559	$0.526	$3.254

RECAPITULATION

	Cost per Ton
Grinding	$0.740
Dissolving	1.024
Filtering	.405
Precipitation	.559
Refining	.526
Total	$3.254
Labor	$1.025
Direct supplies	1.107
Subsidiary accounts	1.122
Total	$3.254

Flotation of Flour Gold

By Ralph W. Smith*

SYNOPSIS—In treating an ore containing lead, silver, zinc and gold, gravity concentration failed to make a salable product. Flotation was tried, and it was determined that by floating the slimes and treating the coarse portion by gravity and electrostatic separation, a thoroughly good result could be obtained.

Not so long ago there arose an interesting question in the treatment of a difficult ore which presented a common but undesirable problem. In the early history of the mine the ore ran high in gold and silver. Later, mixed sulphides of zinc, lead and iron became dominant. The first concentrating mill of modern design was erected about three years ago and succeeded in saving, to a certain extent, the zinc, iron and lead sulphides, but the gold and silver recovery was not satisfactory. This mill was treating ore of an average assay of 0.3 oz. gold, 2.5 oz. silver, 5% lead, 8½% zinc, 3½% iron and 0.5% copper. The gold was free and so fine that panning would not show a color. No hand specimens of gold were ever seen in the crusher feed, although occasionally a small piece was caught on the jig screens. Since the gold was fine, it was necessary to grind the ore very fine to liberate for concentration. Tests of cyaniding showed that treatment to be impossible commercially. Since fine grinding caused high sliming loss of the sulphides, the designers were literally "between the devil and the deep sea," and they chose a middle course.

Difficulties of Gravity Concentration

After grinding to 8-mesh, as much sulphide as possible was removed on Card concentrators and one Harz jig. The tailings from this treatment were reground to minus 30-mesh, washed over amalgamating plates, and reconcentrated on Card concentrators. At various times this scheme was alternated by using carpets in place of the plates, the free gold from the first riffle on the table being amalgamated in an arrastre. The simplified flow sheet indicates the source and disposal of the slimes. The high maintenance cost of the slimes concentrators, together with the large amount of floor space they occupied and the low saving they made, rendered this arrangement undesirable.

The difficult problem, however, still remained. The zinc concentrates from the tables were unsalable, since they assayed 0.75 oz. gold, 5 oz. silver, 10% lead, 33% zinc, 10% iron, 2.2% copper and 11% insoluble. In order to raise the percentage of zinc in the concentrates, the Huff electrostatic separating system was employed. A plant was erected that would treat all the zinc concentrates from the wet mill, and under these conditions the saving did not exceed 55 to 65% on any mineral. With such a loss it was natural to seek a process that would make a better saving. Flotation was suggested, and since a few rough preliminary tests gave promising indications, a systematic campaign of testing was inaugurated.

The early tests were run on the entire mill tailings, coarse and fine. They showed that a small quantity of salable concentrates could be made, but the tailings operated upon were so lean that a 90% recovery of all the minerals of value did not justify an expensive installation. The average feed for these tests was minus 30-mesh and and assayed 0.12 oz. gold, 2.3 oz. silver, 2% lead, 0.3% copper, 1.5% iron and 3.5% zinc. From this feed froth concentrates were recovered that assayed 0.5 oz. gold, 2.8 oz. silver, 3.1% copper, 10.1% lead, 12% iron and these tests weighed heavily against an installation, operating under these conditions. Acid would have necessitated a more costly plant, more floor space, more difficult operation and additional boilers for generating steam, besides which the cost of acid alone would have been almost prohibitive.

Floating the Slimes Portion

The plan of testing the entire mill tailings was abandoned, and the testing was confined to the slimes alone. A small amount of clean lead and a slightly greater amount of zinc was made from these slimes by the gravity treatment. The latter was dirty and had to be recleaned on another table, riffled especially to treat the slimes. The accompanying table shows some results obtained by this arrangement.

RESULTS FROM TREATMENT OF SLIMES ALONE

	Au, Oz.	Ag, Oz.	Pb, %	Zn, %
Feed	0.14	2.3	4	6.3
Lead concentrates	3.00	8.8	38	15.0
Zinc concentrates (to be recleaned)	0.70	6.0	12	18.0
Zinc concentrates (cleaned)	0.35	7.0	8	36.0
Lead concentrates (from recleaning table)	2.00	9.0	40	10.0

The slimes concentrators received a total of 30 tons of feed each day, of which 90 to 95% would pass a 200-mesh screen. The first series of flotation tests on these slimes was made with acid and heat. All normal variations of testing were tried, and some very fair products were obtained. A saving of 80% was common on all the minerals, and inasmuch as this feed was richer than in the tests of the entire mill tailings, the concentrates obtained per ton of feed increased also. However, calculations showed that the cost of acid was still a serious item. About this time certain tests disclosed the possibility of simplifying and cheapening the process to a considerable extent. The important changes embodied in this new set of conditions were the elimination of acid, heat and any considerable thickening of the pulp. The products formed under these conditions assayed 0.65 oz. gold, 12 oz. silver, 18% lead, 35% zinc, low iron and 4% insoluble. This assay shows that there was still further treatment to be made on this concentrate to separate it into salable products. The high percentage of lead in the concentrates indicates that a fair separation might be expected. Furthermore, in the tests the froth was not hard to break up.

These tests were so promising that construction was started on the commercial unit, and from the day the feed was turned on, better results were obtained than in the testing. The froth concentrates, as removed from the separator, were washed with clear water to a Wilfley table. The table classified the relatively coarse lead and zinc and made a perfect separation of them, but had very little effect on the remaining fine slimes. The coarse lead and zinc products were heavy enough to settle and were easily dried and handled. The difficulty was found with the fine products. The slimes concentrates were pumped into a settling box 14x8x2 ft., and the clear-water overflow was conducted back to the flotation machine. To facilitate unloading this settling box, it was lined on the bottom with $\frac{1}{16}$-in. iron. In order to dry the products, a 2-in. steam line was laid on the iron bottom, with the coils far enough apart to allow a shovel to pass between. Steam at boiler pressure was used in the coil. The concentrates were dried only sufficiently to allow them to be stacked. A list of assays and tonnages is given in the accompanying table, showing how satisfactory the results were, particularly when compared with those obtained by the former test.

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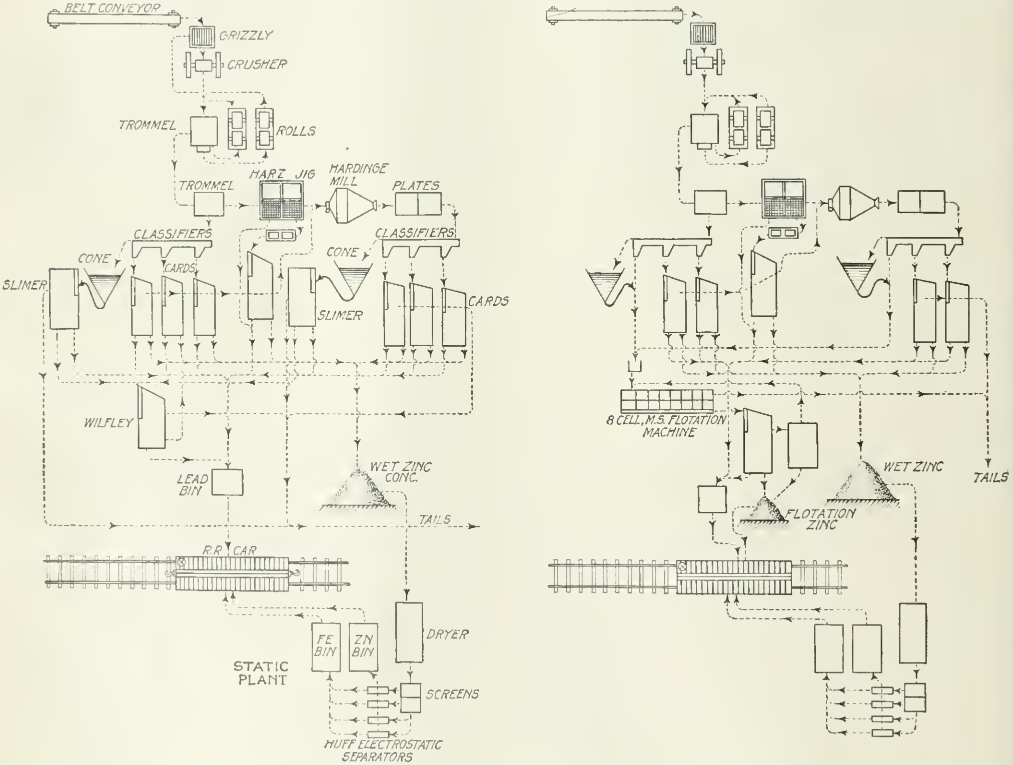
*1845 Grant Ave., Denver, Colo.



THE MILL FLOW SHEET BEFORE AND AFTER THE CHANGE TO FLOTATION

One of the first things noticed in the operation of the flotation machine was the fact that the free gold floated. The greatest gold values were in the first riffles of the Wilfley table, although the lead content extended over many more than did the high gold value. It was also shown positively that the lead did not contain any marked amount of gold. At times there was a small accumulation of gold on some spots of the table that had become greasy, and then the flour gold could be easily seen. Since the primary object of this flotation installation was to save the zinc and lead, the gold recovery was rather astonishing. Assays showed that much cleaner gold tailings were being made than by any other machine in the mill. The percentage saving of gold reached about 85.

RESULTS FROM FINAL TREATMENT SYSTEM

Sample	Tons per 24 Hr.	Au, Oz.	Ag, Oz.	Pb, %	Zn, %	Fe, %
Flotation feed	30-35	0.14	2.5	3.0	5.5	1.0
Flotation tailings	28-30	0.03	0.8	0.8	1.5	..
Flotation froth (total)..	4-5	0.65	10.0	15.8	36.0	..
Flotation zinc (coarse), after table treatment.	2-3	0.50	9.0	5.0	54.0	4.0
Flotation zinc (fine) after table treatment.	1-2	0.50	12.0	11.0	40.0	5.8
Flotation lead, after table treatment	½-1	3.40	11.0	75.0	5.0	..

ADVANTAGES OF THE FLOTATION SYSTEM

After noting the work of this machine, it is interesting to observe the numerous advantages and peculiar adaptability of flotation at this mill. The machine cost approximately $1,000 total, including the material, labor and designing. The peculiar advantages of flotation here are that no acid is used, no artificial heat, no additional pulp-thickening devices are necessary, the froth is easily broken down after removal from the machine, no classification is necessary before concentrating on the tables, and the saving on all valuable slimes contents is raised from 20% to 75 or 80%.

In addition the process is very simple in operation, it produces better products than were ever before possible at the mill, and no slime losses in dust occur. The static plant was relieved of undesirable slimes, and there was no royalty to pay, as with the static process. But one man per shift was required to operate the plant, which will run successfully on a lean-slimes feed. Not only are the actual mill results extremely favorable but there are other considerations that tend to make the whole property more valuable. Among these facts may be mentioned: The impounded tailings dump of approximately 50,000 tons carrying gold, silver, zinc and lead, which can be retreated at some future date; lower grade ore can be sent down from the mine, as the recovery of concentrates per ton of feed is higher with the flotation installation; many tons of low-grade ore from the mine dump can now be profitably treated; and last, the possibility of radical changes in the milling system are open, which changes might result in lower treatment costs, better products and higher recovery. This might be accomplished by laying more stress on the flotation and giving less work to the static mill.

It is only to be regretted, as is the case in many other mills, that the process was not applied earlier in the operating history of the company, thus eliminating the steady losses that have been going on which cannot ever be recovered. Although this installation was in the experimental stage, it actually paid for itself and the test in two weeks of operation. Inasmuch as the installation demonstrated beyond a doubt that flotation can be used commercially to float gold, this plant has shed further light on modern milling practice, which will be welcomed by the engineering fraternity.

New Type of Tube-Mill Lining

By A. J. Weinig*

A new system of tube-mill lining has been devised and put into use at the mill of the Liberty Bell Gold Mining Co., at Telluride, Colo. Hard cast-iron ribs are laid with the regular courses of silex blocks, greatly increasing the life of the lining as a whole. A lining in a 5x22-ft. mill, containing seven rows of ribs, or one rib for every four rows of blocks, gives a life of 2 yr. and 7 mo. of continuous operation. In all our 5x22-ft. mills, we have placed 10 rows of ribs, or one rib for every three rows of silex blocks, and to all appearances our expectance of a life of three years will be reached.

The material used in lining a 5x22-ft. mill includes 900 silex blocks averaging 4½x5x8½ in. and weighing approximately 13 lb., also, 19 cu.ft. of portland cement, 19 cu.ft. of clean sand and 10 rows, or 50 pieces, of hard cast-iron ribs. These ribs are given a taper, measure 1¾x2x4½ in., and are 47½ in. long. They weigh approximately 110 lb. each. They are cast in Telluride, since the local foundry provides the best hard iron that we have been able to obtain.

Two picked men line the mill in three shifts. The lower half is lined in one shift. Live steam is then turned in for 8 hr., and the mill is allowed to cool by draft for 8 hr. more. Next the mill is given a quarter-turn, and one-quarter more of its lining is put in, followed by the same heating and cooling. On the third day the lining is completed, and it is afterward steamed for 12 hr. loaded with pebbles and then cut into service.

Where the cement is uncertain or slow setting, or where it is necessary to use it on minor repairs, soda ash is added to the mortar. This cement mortar sets rapidly and allows the mill to be put into use in 8 or 10 hr. The ribs are laid in mortar only, and no bolts are used in the lining. Experience has not developed any difficulties in holding the ribs or the lining by this method. No timbering is used in putting in the lining. The system seems to us to be advantageous from all points of view and will probably continue to be our standard practice.

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*Mill superintendent, Liberty Bell mine, Telluride, Colo.

Dewatering Table-Sands and Concentrates

By L. A. Delano*

In the Bonne Terre mill of the St. Joseph Lead Co. the Wilfley tables have been riffled with Butchart riffles during the last six months. This has enabled the flow sheet to be greatly simplified and has resulted in removing the multiplicity of launders required to carry tailings and concentrates.

The table and jig tails were formerly run into a concrete tank in which a shovel wheel revolved, dragging the dewatered chat upon a belt conveyor, the shovels on this wheel containing holes for draining the water. The objectionable feature of this method of dewatering was that the sands did not settle enough and a large tonnage was carried by the overflow into the mill race and settling ponds. This made it necessary to sluice the race and ponds periodically to remove the sand, consequently using a large amount of water and labor.

A small wooden cone was installed over the chat belt for experimental purposes, and the tails from two Butchart tables were run into it. The sands settled rapidly, giving an overflow containing nothing over 150-mesh material. The spigot discharge to the chat belt averaged about 31% moisture. This was as good as the chat wheel gave on this material and showed that the water in the race could be kept free from sand.

In order to handle the necessary tonnage of sands, two 6-ft. steel Caldecott cones were placed over the chat belt. The tailings from two table sections were diverted to one Caldecott cone, giving approximately 400 tons of minus 2-mm. sand as feed. The overflow from the cone was free from plus 150-mesh material. The dewatered sands from the spigot discharge averaged from 28 to 30% moisture and were easily carried on a conveyor belt with a slope of 2.8 in. per ft. The sand settled rapidly in the cone, a constant level being maintained about 2 ft. below the overflow. Very little attention is necessary, there being no mechanical operation in the cone. The tonnage of tailings being fairly constant, the chat-belt man easily takes care of the slight adjustments due to any variation in load.

The concentrates (galena) from the jigs and tables were formerly cleaned in screw drags, the coarser sizes going to the mineral conveyors and then to cars. The sands and fines in the concentrates washed over the tail of the screws and were settled in tanks and shipped as slimes. The concentrates are now recleaned on Butchart tables, the clean galena being sent to a 6-ft. Caldecott cone. It settles rapidly, the overflow being perfectly clear even when the cone is two-thirds full. The concentrates are discharged through the bottom gate to the mineral conveyor. The moisture content averages 11%, which later drains to about 4 or 5% in the cars before reaching the smeltery. The discharge is operated intermittently as the tonnage varies too much to set the spigot gate at any given opening. However, it has not been difficult to operate, the mineral loader keeping a close watch on it so the cone will not become too full.

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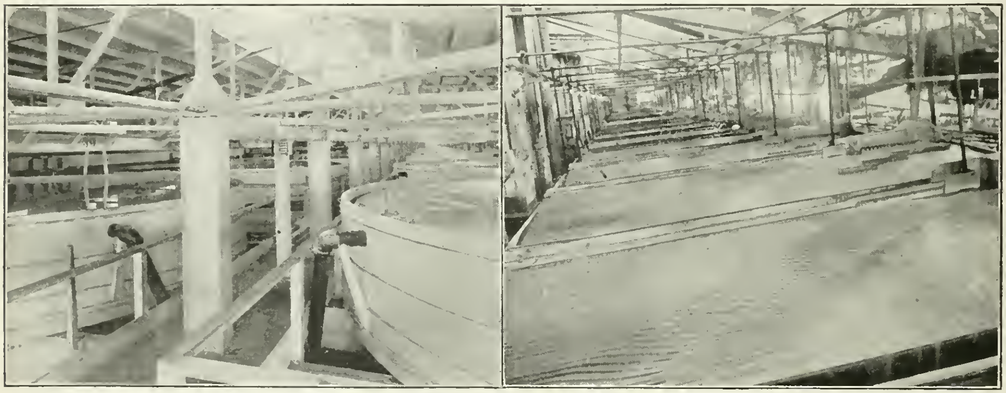
*Mill superintendent, St. Joseph Lead Co., Bonne Terre, Mo.

These cones have given better results than any other form of dewatering device and have the advantage of being purely gravity devices. There are no chains or scrapers to be broken or worn out as in chain drags, and no power is required.

Concentration at Anaconda*

On Jan. 25, 1916, the last section of the remodeled concentrator of the Washoe Reduction Works, Anaconda, Mont., was placed in commission. Water concentration has been retained for everything above 2 mm. in diameter, this being the maximum size of material sent to Hardinge mills for regrinding, and the product of the Hardinge mills is treated by the Minerals Separation flotation process. The concentrator consists of eight sections, each having a capacity of 2,000 tons of feed daily or, allowing for repairs, etc., a total average capacity for the entire mill of 15,000 tons.



INTERIOR OF THE CONCENTRATION PLANT AT ANACONDA, MONT.

To the left is the Dorr-thickener installation, and to the right the Wilfley tables equipped with Butchart riffles

In the crushing department there is no essential change, and the Harz jigs and upper tier of Evans jigs are as before. The two lower tiers of Evans jigs have been taken out and one set of 18 Wilfley tables, with Butchart riffles, substituted. These tables are roughers, and here ends the water concentration.

POWER REQUIRED IN MILL OPERATION

	Hp.
Feeding and coarse crushing	125
Roll crushing	220
Jigging	60
Screening	37
Conveying and elevating	237
Table concentration	25
Fine grinding	655
Flotation of sand and slime in mill	426
Dewatering slime pulp	3
Flotation of slime in slime division	109
Dewatering flotation concentrate	25
Sampling and assaying	1
Total	1 923
Tonnage daily	2,000

Next come the Hardinge mills, replacing the Huntingtons, but they grind much finer. The discharge of the Hardinge mills goes to three Minerals Separation machines in each section, while the slimes from the upper part of the mill (removed in the overflow of Anaconda classifiers) is treated in a fourth Minerals Separation machine after being thickened to 16% solids in a 28-ft. Dorr thickener. The remainder of the slimes, together with the 1,000 tons daily from an old dump is treated in a special slimes-flotation building fitted with 20 Minerals Separation machines. The concentrates from all the Minerals Separation machines are transferred by launders and elevators to 50x12-ft. Dorr thickeners, and thence to Oliver filters. The overflow of the thickeners is sent to a large settling pond to recover any values in froth that may not have settled out.

The average grade of the feed to the mill is 3% copper. About 25% of the feed is removed in the upper part of the mill in the form of concentrates by water concentration, 11.50% is recovered as concentrates from the flotation machines. The average tailings (slimes and sands) run 0.15% copper. This, after allowing for loss in overflows and leakages, gives a net recovery in the form of concentrates of 96% of the copper in the original ore. The tailings from the flotation machines have been found to be quite suitable for the manufacture of building brick, and a plant with a capacity of 17,000 bricks daily is now operating on this material.

The equipment for each of the 7 sections of the concentrator is:

1	12x24-in. Blake crusher
2	8x20-in. Blake crushers
6	coarse-concentrate Harz jigs
6	⅜-in. concentrate Evans jigs
12	fine-concentrate Evans jigs
4	sets of 55x24-in. rolls
18	Wilfley tables using Butchart system of riffling
8	8-ft. Anaconda classifiers
6	7½x72-in. Hardinge mills with individual 225-hp. motors and using steel lining and steel balls
6	Dorr Simplex classifiers in closed circuit with Hardinge mills
4	Minerals Separation flotation machines, having 15 agitators and 14 spitzkasten each, and individual 150-hp. motors

The necessary elevators, trommels and dewatering tanks

Section No. 1 has 4 fine-concentrate Hancock jigs instead of Evans jigs and uses 8x12-ft. tube mills instead of Hardinge mills. The remainder of the equipment is practically the same.

The product of water concentration is drained in suitable tanks and then transferred in cars to the smelteries. The concentrates from the Minerals Separation machines are thickened in Dorr thickeners 50 ft. in diameter and 12 ft. in depth, and the thickened material is filtered in Oliver filters, whence it is conveyed on belts to the roasting plant. The tailings are sluiced away.

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*Excerpt from a paper presented to the Canadian Mining Institute by E. P. Mathewson, manager reduction works, Anaconda Copper Mining Co., Butte, Mont

Some Notes on Flotation

By R. C. Canby*

SYNOPSIS—Some personal reminiscences of the early days of flotation practice. Experiments on Teziutlan ores and introduction at Miami. Confusion of physical and mechanical factors influencing practice. Flotation is believed to be more broadly applicable than any other process.

About four years ago I was called upon to consider the relative advantages of utilizing a magnetic plant that was available for removal to Teziutlan, as an alternative to flotation. A shipment of some of the ore had been sent to England for test by the Elmore vacuum process and later, at my suggestion, part of a shipment was diverted to Minerals Separation for trial by the agitation froth method. The extraction of the ore by the two processes was almost identical.

At that time flotation had made little progress in the treatment of copper ore, but a great change has taken place since that time. Then experienced metallurgists would ask, "Do you mean to tell me that if there was anything in flotation, all of our big copper companies would not use it?" That was the prevailing attitude, but the successful introduction of the process at the Miami has had great influence in bringing to pass its present widespread application. It is of interest to note that the experiments leading to the introduction of flotation at Miami were due to a casual reference I made to the Teziutlan experiment.

Even now, in spite of the great number of plants in use, the metallurgist finds it impossible to point to any thoroughly established practice or to indicate any improvement that had not been largely empirical rather than the result of development from operating experience.

Experiments on Inspiration Ores

Somewhat later than the Teziutlan experiment Minerals Separation performed a series of tests on Inspiration ores, utilizing the existing crushing machinery of the original test plant that had been used to develop the gravity flow sheets for the proposed mill. In the original test the arrangement of the plant was such that the ore pulp flowed directly from the small Hardinge mill to the agitation froth type of flotation machine without any intermediate gravity or table concentration. This arrangement led to an important error of deduction. This was to the effect that while the flotation process was perfectly suited to the silicified schist, it was not applicable to the kaolinized granite ore, but that if this kaolinized granite was thoroughly mixed with silicified schist, up to about 10% of the total weight, just as good flotation results were obtainable as though none of the kaolinized granite were present. Consideration of the conditions under which the test was made lead to a purely mechanical explanation of the difficulty. It is that in the grinding of the much softer gangue of kaolinized granite in the Hardinge mill the ore was so readily pulverized that there was not sufficient attrition to grind properly all of the chalcocite, and that the tailings loss, upon this ore, was due to such particles of insufficiently pulverized chalcocite. From such mechanical explanation it is apparent that there need be no fear of any such difficulty at the Miami mill, since the tables would remove all such chalcocite particles before flotation was reached. Subsequent practice has confirmed this view.

Another confusion of mechanical and other causes of failure happened in the agitation froth experiments at the Miami mill. A Dorr thickener 4 ft. deep had been in use, and it was decided to increase its depth 8 ft. in order to clear the overflow. Upon making this change the tailings assays, which had previously been satisfactory, were most disappointing. By an unfortunate coincidence a change of oil was necessitated at the same time, which led to the suggestion that the trouble might be due to the new oil. It was the increased depth of the new Dorr thickener, however, which had made the difference, working a most decided change in the character of the feed. While the weight of feed increased only about 15%, the surface area, or number of particles, had increased enormously. As I expressed it at that time, I could readily imagine passing 80 to 100 tons of finely granulated lead through the frothing machine, but I could not conceive of passing the same weight of feathers. By suitably reducing the tonnage to correspond with the changed condition of feed, satisfactory results were forthcoming. In this case the explanation was mechanical, but there are other conditions, both in the composition of the ore and in the condition of the surfaces of the sulphide, that will greatly affect flotation results. And it is also known that oils or frothing agents that are supposed to be the same in composition will vary greatly.

General Uniformity of Mineral Characteristics

At the time of the question as to the applicability of flotation to the kaolinized granite, I expressed a belief that if chalcocite would float at all, it would float in kaolinized granite or in any other ore. Broadly speaking, this is correct of chalcocite as of other sulphides. Individuals of the different mineral groups are broadly consistent, and the physical qualities that cause flotation, whatever these may be found to be, will be as characteristic of the individual minerals as of their specific gravity, provided that perfectly clean mineral surfaces are subjected to the action. For this reason I believe flotation is just as broadly applicable as is gravity concentration.

In spite of the broad applicability of flotation, however, it is not a universal panacea. There is still the uncontrolled loss of oxidized copper minerals in flotation tailings. Counter-current lixiviation will obtain an almost complete extraction of this material, but requires a plant of impossible extent and lacks suitable methods of precipitation. In this connection the idea occurred to me of dissolving and precipitating in the flotation cell. Others have already had this idea, and it is probable that as soon as a general demand for its application is made, a feasible process will be worked out.

Metallurgists are, as a rule, conservative, so that it was perhaps to have been expected that they should assume an attitude of mistrust of so novel a proposition, particularly a process with which the contending proprietory process companies appeared to be so largely occu-

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*Consulting Metallurgist, Wallingford, Conn.

pied with legal controversies over their respective patent rights. Then, the approach of supposedly proprietory companies toward possible users was un-American. Protective patents were alluded to, but no information as to the nature of the proposed processes vouchsafed. In addition this new process was not presented as an adjunct to prevailing methods, but existing facts were to be wholly scrapped. It is possibly natural that parties promoting proprietory processes, based on tonnage royalty, should take such a view of their property, but flotation should be more largely looked upon as an adjunct to gravity concentration, especially in its consideration for adoption in operating plants. It is the exception when one would not be justified in installing one or two actual units in connection with operating plants, and flotation results, even at their poorest, would perhaps be better than any form of gravity separation upon a product which in reason should go to flotation.

Many a metallurgist makes the mistake of concluding that the process is not applicable to his ores after only superficial tests. Sulphide surfaces are so delicate that even the merest drying of wet surfaces may have an effect that is sufficient to prevent successful flotation. For this reason samples sent away to a testing laboratory may give negative results, whereas had the pulp been treated as it was produced it might have given good extractions. In fact, one of the most successful and largest of the present operating plants would never have been built had the management depended entirely upon the results from samples sent away for test.

Agitation-Froth and Bubble-Column Types

As to what would be the determining point in deciding between the agitation-froth type and the bubble column type it is hard to say. It is possible that there are instances in which the agitation froth machine is the more efficient. Some writers say it gives higher extraction, but in the Miami district this is apparently not the case. The agitation froth machine is usually operated in series, giving anywhere from 8 to 16 re-treatments. In the other process but one treatment is usually given and the cells are generally in parallel, with some important exceptions, however. The bubble column gives, perhaps, a higher grade of concentrate and is used in numerous instances for the re-treatment of agitation froth machine products. As to the amount of attention necessary to operate, this is in either type largely a matter of frothing agents. Some oils require almost constant attention upon the part of the operator, while in other cases not so much is required. With good normal working conditions, one man can handle more flotation machines than he can of any form of gravity machines for an equal tonnage, and there is no considerable advantage of one type over another so far as this particular point is concerned. As to the relative power, one of the largest experimenters finds that the power consumption is about equal, but at the Miami the power was found decidedly in favor of the bubble column. Power consumption increases greatly with pressure. The pressure for a given volume varies also with the freedom or otherwise with which the air passes through the porous medium. There is room here for experimentation to reduce the pressure to the minimum.

Coming to the question of the oil, or the frothing agent, it is almost impossible to say anything without venturing into the basic reasons for flotation. The question of the oil and the underlying principles are closely associated, and as yet we cannot fully answer the question as to what the unvarying qualities of an oil are so that they can be determined, except experimentally, nor can we give absolutely the definite explanation of flotation causes. The claim has been made that all the flotation processes are of exactly the same nature and based upon the phenomena of surface tension. Careful experimentation seems to bear this out.

The Use of Oils and Acids

The question of the selective affinity of oils for sulphide surfaces is confusing, but this confusion becomes less or is overcome when we look at the subject from the point of view of adsorption. This branch of the chemistry of colloids seems to simplify the matter and to offer an opportunity for the experimental demonstration of all the features of flotation. But even with this, it is still a considerable step to the practical predetermination of absolute essentials in the modifying agents. If we are to find all our embracing theory in adsorption, it would seem not to demand the two characters of oil, for frothing and collecting. Nor in practice does the evanescence of the bubble-column froth seem to suggest this necessity as possibly might the requirements of the separating spitzkasten of the agitation froth machine.

At Teziutlan I found that acid was necessary to cause the zinc to float. I found, however, that the actual presence of acid during flotation was not necessary, but that if the ore was given an acid treatment and then washed thoroughly upon a filter until no trace of the acid was discernible, the same result was obtained as though the acid had not been washed off. In such a case it is difficult to believe that it is the effect upon the emulsification of the oil that gives its effectiveness to the acid. An extremely small trace of acid might have the effect of preventing emulsification. I visited a plant recently in California where a distinctly acid froth appeared necessary, the acid consumption being almost prohibitively high. The possibility of a preliminary acid treatment and circulation of the acid solution was discussed both as a matter of economy in acid and its effect on porous-bottom blankets. If one assumes that there is insufficient coating oil present, it is conceivable that the prevention of emulsification of the oil might have effect. But the question of oil quantity is too broad to discuss in a single paper. It is noticeable, however, that in none of the various explanations that have been offered recently as to the causes of flotation, does any single theory, so far as I have seen, indicate that there are any experimental data tending to controvert the statement that all forms of flotation are dependent upon surface-tension principles.

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Hydrated Lime in Concrete

In a recent paper before the Engineers' Club of St. Louis, H. E. Wiedemann gave the following as his conclusions regarding the use of hydrated lime in concrete. The use of small amounts (8% on a 1 : 2 : 4 mix up to 16% on a 1 : 3 : 5 mix) will:

1. Render the concrete highly plastic and homogeneous, producing density and uniformity in the finished product.
2. Add to the life and efficiency of a concrete pavement or floor, on account of the uniform resistance to wear and internal stress, produced by its use.
3. Render concrete waterproof by filling the voids in the fine and coarse aggregate. These functions are of the greatest importance and warrant the use of hydrated lime.

Froths Formed by Flotation Oils

By William A. Mueller*

SYNOPSIS—The froth character of the oils used in flotation is constant with each oil, but differs with change of oil. Pine oil is most widely used and has typical qualities, as has each of the other oils described.

Before attempting to do flotation work, it is essential that one should know something about the nature and character of the froths produced by the various oils used. In this discussion it is my intention to give an outline of results that accompany the use of the most common oils.

For experimenting with various oils for flotation small flotation machines of various makes are used. For studying the various froth characteristics of an oil one of these machines works pretty well and is handy to use. The froth produced by various oils differs with the machine in which it is made. For instance, in the Minerals Separation type of machine, where the froth rides in the spitzkasten for some time before leaving it, there is plenty of time to collect and mat together, and in this case the froth always lies in a "dead" state, only coming off as it is forced out by other froth from the rear. In this case the froth loses its characteristics so far as the bubble itself is concerned.

In the Callow type of machine the froth is always in rapid motion and no dead froth accumulates. It is kept overflowing by the constantly rising bubble column formed. In the Cole-Bergmann and Flynn-Towne types of machines the froth acts as in the Callow type. In these two, however, a deeper froth column is carried and this makes a slight difference in the froth, making the bubbles slightly smaller. In the Hebbard type of Minerals Separation machine the froth is in more rapid motion than in the regular machine, owing to there being no settling compartment and also owing to the introduction of air. Here again there is no accumulation of dead froth except at times around the shaft of the agitators.

In adding oils for flotation it is of the utmost importance that they be well mixed with the pulp before flotation is attempted. This is usually done by adding the oils in the mills during grinding, and this is the most desirable method. Sometimes where this cannot be done, as is the case where primary slimes are treated by flotation and the oils are not wanted in the rest of the feed, a Pachuca tank is used for the mixing. This works fairly well, although it is not the most desirable way of mixing where the entire pulp is to be treated. If not thoroughly mixed, the oils kill froth rather than produce any. When a machine is in good working order and some raw oil suddenly gets into the pulp, the froth immediately seems to dissolve, leaving the pulp showing through the froth. In these cases the froth rushes back and forth in the machine, the bubbles become very brittle and finally disappear.

Raw oil must not, however, be confused with a high water-level. Sometimes a machine is operated with a high water-level; that is, the froth will be very shallow, sometimes only several inches in depth. In this case the pulp will show up through the froth and give much the same appearance as raw oil. This condition can easily be distinguished from the raw-oil condition by noticing the height of the pulp level. The practice of using a shallow froth is considered good by some metallurgists, but does not really aid except where there may be a temporary air shortage in the air type of machine. The usual depth of froth in the Callow type of machine is about 15 in.; in the Cole-Bergmann and Flynn-Towne machines it is from 24 to 36 in., while in the Minerals Separation type the froth level varies from 6 to 12 in. in the spitzkasten, and in the Hebbard type it runs from 6 to 10 in. The raw-oil condition in a machine can readily be distinguished from the high level of pulp condition by the depth of pulp from the top of the machine at the time the condition is noticed. The raw-oil action is detrimental to flotation and should be avoided. Cup greases and lubricating oils give the most trouble of this kind in plants, as it is very easy for a lump of grease or some oil dropping from bearings to find its way into the flotation-feed launder. Wherever detected these faults should be immediately remedied. Greases and lubricating oils are not the best of flotation oils, and their action will be discussed in a later paragraph.

FROTH FROM COAL-TAR CREOSOTE

Another important feature in adding the flotation oils is that they be fed in some continuous way and not spasmodically, since the latter would entail constant attention at the machine and abnormal conditions at all times. There are several devices for uniform oil addition. One is by a pump in which the stroke of the piston can be varied, thus giving any desired amount of oil, from a drop at a time to a steady stream. Another satisfactory device is a method whereby the oil is taken from the rim of a wheel which operates so that the rim passes through oil contained in a reservoir. A piece of flat metal is then fixed by a setscrew and spring to rest against the rim. By adjustment of the screw the piece of metal can be shifted across the rim so as to take in a greater or less area, thereby increasing or diminishing the oil flow. Still a third method consists of a small bucket or two on an endless chain passing over a pulley, much the same as a bucket pump, located above the launder where the oils are to be added and another pulley in a barrel or drum containing the oil mixture below. The bucket carries its small amount of oil up, discharges into the launder and is refilled again on passing through the barrel, etc.

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*Magma Copper Co., Superior, Ariz.

In making any changes in increasing or decreasing the amount of oil or adding different kinds of oil, make them very gradually. In increasing or diminishing especially, be careful and only change the rate very slowly, allowing enough time to give the change a chance to show up in the machine. Especially is this important when the oils are added in the mills, as it takes some time for a change in oil to make its appearance, since it is diluted to such an extent and worked over such a comparatively large volume.

The froth characteristics here described apply to live froths such as are formed in the air types of machines. The agitator type, with the exception of the agitator-and-air type combined, usually has a spitzkasten or settling compartment in which the froth congeals and so loses its bubble characteristics. In these machines the froth characteristics are not so noticeable.

CHARACTERISTICS OF PINE OIL

Perhaps the most common oil used in flotation work is pine oil. There are several grades on the market, but as the various kinds have practically the same effects on the kinds of froth, I will treat this oil in a general way.

Pine oil is rather soluble, and it is this characteristic that is largely in its favor, as its presence, once used, is always detected in the mill water as long as the tailings and concentrates are dewatered and the water reused. After using pine oil a short time, only a little of it need be added—just enough to make up for any small amount that may have been lost or carried away by the concentrates after dewatering.

The pine-oil froth is brittle and the bubble produced is small, the largest one being only about $\frac{1}{4}$ in. in diameter. A small amount of oil produces a large quantity of fine-grained froth. The bubble film is very delicate and, on rising to the surface, breaks immediately. Its burden of mineral, if there is any, is deposited on the bubble immediately following, and thus the mineral is carried along on the surface until it flows over a lip or otherwise is removed. Pine oil as a general rule is a rather poor mineral collector, but a good frothing agent. For this reason it is generally used only as a frother, although there are some cases where it will take the place of a mineral collector as well as the frothing agent. Its action is delicate, and at plants where pine oil is largely used, the machines will require much closer attention. For instance, it is a good mineral collector on ores carrying chalcocite and on some zinc ores. A pine-oil froth, in addition to being brittle, is also watery and at times, when there is too much of it present, it tends to make a dirty froth and low-grade concentrate. When present in these large amounts, the concentrate froth will often carry large particles of silica and gangue material; that is, some that will pass 28-mesh and stay on a 60-mesh screen. The froth, however, does not toughen up because of its excess oiling, and in this way pine oil differs from most others. The froth will be dirty, as is the case with other oils, and cannot be cleaned, but the latter is due largely to excess froth rather than to the toughness of the froth as is the case with other oils. By the addition of acid, or sometimes a caustic, its action as a mineral collector can often be increased, but it still retains the same characteristics of brittleness and delicacy.

Next to pine oil perhaps the most important flotation agent is coal tar. As a general rule the coal tars are too stiff and thick to be used by themselves and so must often be diluted with some other oil, preferably one in its own class. The oils commonly used for this purpose are coal-tar creosote, cresol and other coal-tar products. Sometimes, however, wood creosote, fuel oil or others are used.

The action of coal tar varies somewhat with the coal and the heat treatment by which it is produced. For these reasons all coal tars are not suitable for flotation. I published some experiments along these lines in the *Journal* of Oct. 9, 1915. As a rule the froth produced from a coal tar suitable for flotation is uniform. The bubbles are somewhat larger than the pine-oil bubble, ranging from $\frac{1}{4}$ in. to several inches in diameter and sometimes, when the tar contains a large amount of creosote, the bubbles are even larger than this, reaching as much as 6 to 8 in. diameter.

Coal tar is a poor frothing agent, but a good mineral collector, and it is seldom used without mixing with some pine oil or other frothing agent. The bubble from coal tar itself is also brittle, but in the presence of mineral it often seems to become tougher, the mineral and oil film apparently mating together. The froth from this oil is always mineralized to a high degree when it is mineralized at all. Coal tar, with a suitable frothing agent, is adapted to almost any ore. By this statement I mean that it is not adapted to any one mineral, but works as a rule with the minerals of copper, zinc and some others. The froth does not acquire any great depth unless some other oil is mixed with it. For this reason we seldom see a straight coal-tar froth except in an experimental machine. Coal tar is hard to mix with the pulp, and it cannot be done well except by grinding. I have seen coal tar, even when mixed with pine oil, separate when reaching the machine, although in this case it had been added in a Pachuca tank at the head of the machine. When coal tar shows up in the machine as raw oil, it hasn't the strong froth-killing power of the other oils, but lies on the froth in flakes, sometimes deadening the froth in the immediate vicinity and at other times seeming to mate the small bubbles together, forming a sort of hole in the froth, toward which the bubbles in the vicinity have a strong tendency to rush. Arriving, they seem to be swallowed up much as a cork will act when thrown into a whirlpool. Raw coal tar in the machine is not so detri-

EFFECT OF FOREIGN OIL ON FROTH

ANOTHER EXAMPLE OF CREOSOTE FROTH

mental as the other oils, but nevertheless it should be avoided. When in great excess, coal tar has a strong tendency to separate, as has been noted, even when apparently well mixed. Even though it has no strong frothing power, when too much is used it will cause some excess frothing and a dirty froth, though not so easily as other oils.

Coal-Tar Creosote

Coal-tar creosote is used mostly as a dilutant for the cheaper coal-tar oil, and for this purpose it is very good. The creosote bubble has a tendency to be rather large, ranging in size from about an inch in diameter to as much at 12 in. and sometimes even more. The bubble has a tendency to be tenacious. It is very tough and in breaking, the bubbles tend to expand rather than be destroyed altogether. With two bubbles side by side, the breaking seems to take place in the film uniting them, so that where there were two bubbles at first, there is only one after bursting. This enlarging of the bubble, of course, has its limit, and we seldom see them much over 12 in. diameter unless there is a great excess of creosote, when they may get to be of such size as to reach across the machine. On bursting, the mineral burden is drawn by the film to the film of the neighboring bubbles with which they were in contact before bursting. The bubble has good carrying capacity for mineral. When too much oil is present, however, there is the same tendency to carry gangue, and this is usually at the expense of the mineral. The oil mixes rather easily, the action in the Pachuca tank being sufficient, although mixing in the grinding mills is at all times to be recommended.

Wood-Creosote Bubbles

Wood creosote has some of the same characteristics of the coal-tar creosote, but differs widely in others. The toughness of its bubble is even more marked. The size of the bubble is also somewhat different. The two oils are not interchangeable—that is, the one cannot be used as a substitute for the other, as coal-tar creosote seems to work better on copper-bearing ores than the wood creosote and the latter seems to work better on zinc ores. Wood creosote is often used as dilutant for coal tar in the flotation of zinc ores. The size of the bubbles varies greatly. The characteristic froth shows small ones resembling the pine-oil bubble, together with the larger ones. There will be a large one about 3 in. diameter as a maximum; then there will be a group of smaller ones, ranging in size up to maybe ½ in. diameter, which separate the larger ones from each other. This is the characteristic wood-creosote froth. The froth, like that of coal-tar creosote, is tough, and a small excess of oil makes a dirty and voluminous froth that is hard to break up. The bubble varies from this type when an excess of oil is used, tending to become larger and more elastic.

Turpentine is not used so much at the present time as when flotation first appeared in this country. The turpentine froth is persistent and elastic. It has a tendency to hold everything that comes in contact with it, and for this reason it was formerly used to bring up the middlings and was added after the concentrates were taken off. For this purpose it was good, but the froth is so tough that it is hard to break down, so that cleaning it is difficult. Usually the middling produced by means of the turpentine could not be cleaned to any appreciable extent. The turpentine bubble ranges in size from ½ in. to 2 or 3 in. diameter. It is elastic, and the volume of froth produced is always excessive and, as a rule, low-grade. For this reason it is not used much at present.

Cresol, or Cresylic Acid

Cresol, or cresylic acid, formerly was the chief flotation agent used in the flotation of copper minerals, but its use is now limited to small proportions in the mixtures with coal tar. The cresol bubble is of medium size—that is, from ½ to 2 and 3 in. diameter—and as a rule the bubble is not too brittle and not too tough, but made a good froth to handle. The nature of the oil, however, made it disagreeable to handle and also somewhat dangerous; this, together with the bringing out of coal tar and the advance in price of cresol, gradually brought it to a point where only a comparatively small amount is now used.

The oil was a good frothing agent as well as a good mineral collector, and its use was almost universal a short time ago. The froth is rather easy to break down, and for this reason the concentrate produced is rather easily cleaned. The oil is very slightly soluble in water and mixes rather easily. Violent agitation, as in a Pachuca tank or in the Minerals Separation type of machine, is often enough to give good distribution and a good flotation froth.

The froth produced by fuel oil is of the same appearance as that of coal-tar creosote as far as the bubbles are concerned, which are nearly the same size, ranging from 2 in. to 4 and 6 in. diameter. The froth, however, is very brittle when the right amount of oil is used and is much cleaner than the creosote. In fact, the froth is almost too clean, so that a clean tailing is hard to make with fuel oil alone. Mixed with some oil like creosote, however, it sometimes does good work. The concentrates from the preliminary treatment often need no further treatment. Where a final product is made as concentrate the tailings are usually re-treated, and in these cases the creosote effects seem to carry through to the other treatment, while the fuel oil often has to be added in the second treatment. Various ores differ slightly on this point. Again, a little fuel oil in a coal tar-creosote mixture will sometimes aid in cleaning the froth.

When fuel oil is in excess, the froth produced is stringy and the bubbles often get to be of such size as to stretch across the machine. I have seen them over 2 ft. in length. The froth under these conditions is also dirty and will pass through a cleaner with practically no better grade being produced than before entering. Acid is sometimes an aid in the use of fuel oil, especially when the oil is in excess. The froth from excess fuel oil is hard to break down.

Pine-tar oil is coming into the lime-light more just now as a possible flotation agent for copper carbonates, but I doubt whether it will be useful alone. It is stiff and flows poorly, so that it must be mixed with some other oils in order to make it of such viscosity as to flow so that it may be added steadily and slowly.

The froth resembles that from wood creosote and pine oil in appearance of the bubbles, but in texture it is very much more fine-grained than the wood creosote. It is a powerful frothing agent similar to pine oil. It is easy to flood the plant with froth from this oil. The froth is characterized by being dirty, but, like pine oil, is capable of holding up considerable coarse mineral as well as gangue. When a flood of this froth reaches the cleaner, it is subjected to very little cleaning owing to its frothing character. Often the addition of a small amount of fuel oil will tend to make a cleaner froth, but with the pine-tar oil a very clean froth must not be expected except at the cost of high tailings.

Oleic acid is used at several plants in this country and is confined mostly to zinc ores. It produces large bubbles and a tough froth. The size of the bubbles varies with the amount of oil used, but ranging from several inches to a foot in diameter. The froth is very persistent and stringy, and the bubble film is often strong enough to support light objects.

Eucalyptus oil is used mostly in Australia, although a small amount of it may be encountered in this country at times. Its cost, however, is very much against it here.

Introduction of Foreign Oils

Under this head I will also discuss the effects of greases, as they really come under the same heading, even though they are not literally oils. As mentioned in the beginning of this article, under no circumstances should these oils or greases be permitted to come into the feed delivered to the flotation machines. The sources are numerous, and I will not go into them in detail, but a mention of several of the more common ones will probably not be amiss. A common place to find some of this trouble is around the bearings and gears of the pebble and ball mills: here an enormous lot of grease and oil is used and a great deal wasted. Dripping bearings give their share of trouble. How often do you think, when you have a hot bearing and pour water on it, that you may be giving your flotation department trouble? If foreign oils get into the feed before entering the mills, it is then mixed and its effect is distributed over a large amount and does not give quite the trouble as when it finds its way in after leaving the mills. Sometimes acid will remedy the effect of foreign oils when they cannot be avoided in any other way, if their source is ahead of the grinding mills, but the effect of the acid on the flotation must also be considered. Acid in some cases is as deterimental to the flotation as the oil itself would be; in this case the only thing to do is to find the source of oil and eliminate it. Froth from lubricating oils is tough and stringy and carries little mineral value and is almost uncleanable. The bubbles are hard to break down and, when once broken down, will form again at the slightest opportunity. A large amount of foreign oils come from cleaning up around the plant. The mineral content of tailings is not reduced by the action of these oils; they merely act as an annoying frothing agent that may bury the plant in froth.

The Use of Oil Mixtures

Most plants are working on mixtures of various oils and do not depend on any one. These mixtures vary with the ores to be treated and the conditions around the plant. In experimenting with the various oils we can readily see which are doing the best work; also, we can tell after a little while what the various oils may need as an aid to make them do better work. There are several things that determine this, as for instance, suppose we are trying a coal tar with a certain ore and we should get a rather brittle froth and at the same time one of a high grade. The froth would probably be shallow, and in this case it is evident that we should need a frothing agent of some kind and should probably add a small amount of pine oil. After adding this we should still get a rather brittle and watery froth, as both pine oil and coal tar will produce such a froth. Probably we should let this go if it was capable of giving the right results. Suppose, however, that it was a tougher froth that we were after, then we should look for an oil that was capable of producing the kind of froth that we wanted and we should, in all probability, select coal-tar creosote. Varying proportions of this oil would give us a froth that would have the desired characteristics. All oils and mixtures must be determined on the ground, and there is no better way than in the large plant. Small testing machines are procurable, but even these sometimes lead us on the wrong track in oil selections. On the other hand, these machines are often reliable in a way, as for instance, in testing for the amounts of oil to be used. To select an oil for the large plant from a test on one of these small machines is often poor policy. Mixtures are determined by other factors as well. One of these, and an important one, is a mixture that will be liquid enough at any time during varying temperatures. Some plants to get around this have what they call a "warm-weather mixture" and a "cold-weather mixture." The two mixtures have each varying proportions of the oils constituting it, as, for instance, the warm-weather mixture may be something like this—coal-tar 80% or more and creosote 20% or less. The cold-weather mixture may go as low as 40% coal tar and the other 60% creosote, cresol or other oil in order that it will be liquid at that certain temperature. The viscosity of coal tar makes these mixtures a necessity at times. Other plants sometimes heat their mixtures either by steam pipes, electrically or by blowing compressed air through the tank holding them. The last can only be done where the mixing tank is near the compressor so as to receive warm air.

Persistency of Pine Oils

A coal-tar mixture usually contains at least 75% coal tar when it can be kept liquid at that point, although some tars will exceed this figure while others will not use quite as much. There is not so much difference in the appearance of the froth produced by the mixture containing 80% coal tar and the one produced by one containing 50%, provided, of course, the same oils are used in the dilution of the coal tar.

Many operators get an oil that will work well with their ore and are then satisfied, but this is the wrong idea. It does not take much to experiment a little on the large plant, and one can easily tell after a little while whether he is doing good or not before any serious trouble results, and in this way valuable information can often be gained that well repays the effort made.

Where pine oil is used in the mixture and the water from the dewatered products returned to the mill, this oil can easily be cut down to practically nothing after a short time. While pine oil is considered expensive, the amount used after the first month or so is so small that its cost per ton of ore milled can almost be neglected. I know of one plant that is operating on pine oil as its main flotation oil and the consumption per ton of dry ore milled is only 0.13 lb., and tailings of 0.17% copper are produced. At another plant, operating with a mixture containing pine oil, the oil consumption the first few months ran about 1½ lb. per ton of ore. After the first few months this consumption was cut to ¾ lb. per ton of ore. This drop was due to the dissolved oil in the returned water. In mixtures the pine oil can be cut to less than this, and in some plants it is omitted altogether, the amount in the returned being sufficient. Occasionally a little is added from time to time, and then again a little is added separately by just a drop or so every few minutes to make up for any loss and extreme dilution, so that the amount used is a negligible quantity and its cost is also minute.

Where the heavier oils are used that are less soluble it seems to make no difference whether the water is returned or not. This is accounted for by the fact that these oils exert a selective action with the mineral—have a tendency to stick with the mineral when it goes off in the froth. For this reason there is practically none of this oil that is returned except that which is soluble in the water, and with the heavier oils this is a negligible quantity. The returning of the water also has its disadvantages because where there is much oil in the returned water, an inexperienced operator is often deceived by the appearance of the machine. The froth may be of good appearance, and yet the machine will not be doing its best work, because the returned water may contain such quantities of oil that on addition of the regular flotation mixture, the froth is excessive. The natural thing to do is to cut off the oil mixture. This done, the machine will again produce the froth characteristic of the pine oil or other soluble oils present which are not good mineral collectors, and consequently the benefits of the machine are sure to lessen owing to loss of mineral. In these cases the returned water is a bad rather than a good thing. This factor is a cause of the falling off in flotation recoveries and other troubles in many plants today. Where this trouble exists, it should be remedied by dilution of the returned water with fresh and a decreasing of the frothing agent in the mixture used. Sometimes it may be best to discontinue the use of any frothing agent until the returned water is of such dilution as to warrant further addition of this type of oil.

As a general rule the best froth to be used is one in which the bubbles are of a medium size and rather tough, although too tough a bubble should be avoided. For chalcocite, pine oil works best, but this froth is delicate and a froth of this kind needs constant attention, so that an operator is not able to care for as many machines under circumstances of this kind. Coal-tar mixtures of from 50 to 80% coal tar and 50 to 20% creosote, with small amounts of pine oil added from time to time, will often give the same results and much steadier conditions than the pine oil on chalcocite ores. The best mixture would have to be worked out in the plant.

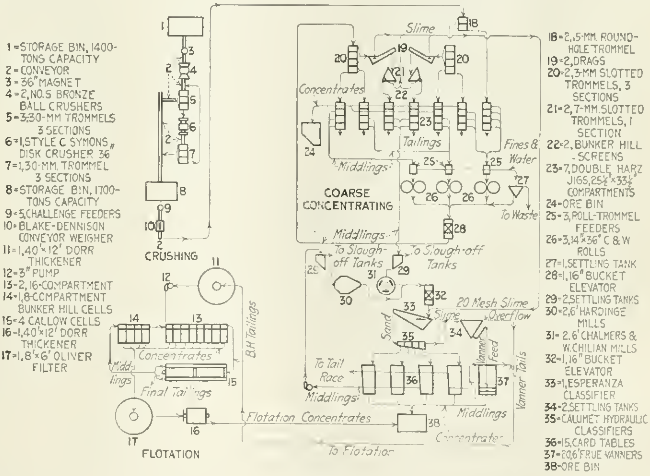
Chalcopyrite responds readily to the same mixtures as chalcocite, but the pine-oil froth does not do very well with the chalcopyrite. Zinc and lead ores vary greatly. Some will respond beautifully to mixtures of coal tar and wood creosote and some with coal-tar creosote, while others will not respond with any oils but mixtures of wood-distillation products. Then there are still others that seem to require the addition of acid in order to do anything at all.

Bunker Hill and Sullivan Milling Data

By R. S. Handy*

The Bunker Hill & Sullivan Mining and Concentrating Co. has concentration equipment with a maximum capacity of 585,000 tons per year. The total horsepower required is 1,500. Bronze ball crushers, No. 5, and Symons disk crushers are used as preliminary breakers. The ratio of concentration is 7½:1. The total mill water used is 4,500 gal. per min., and 45 men are required for the mill operation.

The mill heads assay 9% lead and 3.5 oz. silver, while the tailings run 1.4% lead and 0.9 oz. silver. The percentage of extraction, therefore, is 84% lead and 78% silver. The accompanying flow sheet shows the scheme of operation at the mill. The system is about as it has been in recent years, and since the adoption of flotation no radical changes have been made. The overflows from the slime-settling tanks have been arranged so that they are now all perfectly clear and are being used for wash water in the mill. The floor washes, dirty overflows from the grinding-mill feed boxes, overflows from the roll feeder tanks, etc., which have been more or less of a problem for years, are now satisfactorily taken care of by the slough-off system, as shown in the accompanying drawing. The overflow from these tanks is now also clear, effecting a material saving over the old system of floor tanks, which were used for this purpose. There is now no mineral-carrying pulp leaving the mill except that which flows through the automatic sampling devices, so that there is no danger of loss of anything of value.


1=STORAGE BIN, 1400-TONS CAPACITY
2=CONVEYOR
3=36" MAGNET
4=2, NO. 5 BRONZE BALL CRUSHERS
5=3, 30-MM TROMMELS 3 SECTIONS
6=1, STYLE C SYMONS DISK CRUSHER 36"
7=1, 30-MM. TROMMEL 3 SECTIONS
8=STORAGE BIN, 1700-TONS CAPACITY
9=5, CHALLENGE FEEDERS
10=BLAKE-DENNISON CONVEYOR WEIGHER
11=1, 40'×12' DORR THICKENER
12=3" PUMP
13=2, 16-COMPARTMENT
14=1, 8-COMPARTMENT BUNKER HILL CELLS
15=4 CALLOW CELLS
16=1, 40'×12' DORR THICKENER
17=1, 8'×6' OLIVER FILTER
CRUSHING
FLOTATION
Concentrates
Midd-lings
Final Tailings
BH Tailings
Flotation Concentrates
To Flotation
Slime
Concentrates
Tailings
Middlings
Fines & Water
To Waste
COARSE CONCENTRATING
Middlings
To Slough-off Tanks
To Slough-off Tanks
20 Mesh Slime
Slime
Overflow
Sand
Vanner Feed
Vanner Tails
To Tail Race
Middlings
Middlings
Concentrates
18=2, 15-MM. ROUND-HOLE TROMMEL
19=2, DRAGS
20=2, 3-MM SLOTTED TROMMELS, 3 SECTIONS
21=2, 7-MM. SLOTTED TROMMELS, 1 SECTION
22=2, BUNKER HILL SCREENS
23=7, DOUBLE HARZ JIGS, 25½"×33½" COMPARTMENTS
24=ORE BIN
25=3, ROLL-TROMMEL FEEDERS
26=3, 14"×36" C & W ROLLS
27=1, SETTLING TANK
28=1, 16" BUCKET ELEVATOR
29=2, SETTLING TANKS
30=2, 6' HARDINGE MILLS
31=2, 6' CHALMERS & W. CHILIAN MILLS
32=1, 16" BUCKET ELEVATOR
33=1, ESPERANZA CLASSIFIER
34=2, SETTLING TANKS
35=CALUMET HYDRAULIC CLASSIFIERS
36=15, CARD TABLES
37=20, 6' FRUE VANNERS
38=ORE BIN

FLOW SHEET OF BUNKER HILL & SULLIVAN MILL

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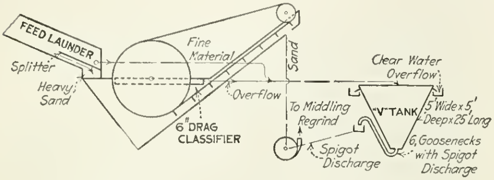
*Mill superintendent, Bunker Hill & Sullivan mill, Kellogg, Idaho

The present arrangement of flotation equipment is shown in the flow sheet. The vanners are now run to produce a concentrate above 60% lead; tailings are correspondingly higher than they formerly were and are pumped to the flotation thickener, where they are joined



BUNKER HILL SLOUGHING-OFF SYSTEM

by the dirty portion of the slime-thickener overflows to provide feed for the flotation plant. The details of the Bunker Hill flotation cell are shown in the accompanying drawing. The pumps are a specially made Gould type, with white-iron liners, wearing plate and runner. In the stuffing-box is a cast-iron bushing of special design that allows the use of water packing to protect the shaft without unduly diluting the pulp in the cells. The water for this purpose comes from the concentrate thickener and contains considerable oil, which is an advantage. Compressed air is blown directly into the suction of these pumps under a constant head so that this important regulation is easy to maintain. The present pumps have been in constant service for seven months and show little signs of wear.

In the development of flotation our constant object has been to secure as high-grade products as possible for the same reason that we have striven for high-grade products throughout the mill—namely, to obviate high freight and treatment charges. The sloping discharge for the froth of the Bunker Hill cell and the natural tendencies of the treatment itself have enabled us to get from these cells a froth assaying between 50 and 55% lead. The Bunker Hill cleaner cells give a product running between 62 and 65% lead. The Callow roughing system consists of standard equipment with the exception that the pneumatic frame in the bottom is made up of eight sections, and around each section a groove is cut so that the cloth cover may be secured by driving rope over the cloth into this groove in the same way that filter bottoms in cyanide tanks are secured.

ECONOMIC MILLING DATA

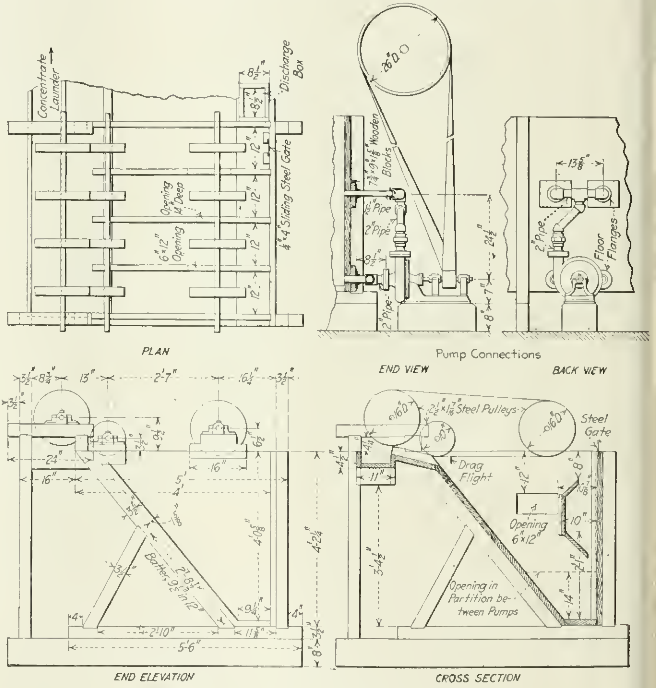
Day's run	356
Tons milled	454,636
Assay feed, % lead	9.9406
Assay feed, oz. silver	3.8277
Contents feed, tons lead	45,198.72
Tons concentrates	59,901.14
Average assay concentrates, % lead	62.2565
Average assay concentrates, oz. silver	21.6738
Contents concentrates, tons lead	37,292.37
Per cent. extraction, lead	82.52
Contents feed, oz. silver	1,740,217.50
Contents, concentrates, oz. silver	1,298,284.22
Per cent. extraction, silver	74.61
Value feed	$5,144,653.74
Value concentrates	$2,384 543.28
Economic extraction, %	46.35
Tons milled per 24 hr.	1,277.06
Tons concentrates produced per 24 hr.	168.26
Tons lead produced per 24 hr.	104.75
Cost per ton milled	$0.421
Cost per ton concentrates	$3.103

COST OF SHIPPING

The company shipped 59,423 tons concentrates at the following cost:

	Per Ton		Per Ton
Labor loading	$0.182	Contingent expense	.007
Representatives at smelteries	.041	Administrative expense	.012
Supplies	.006	Repairs	.011
Assaying	.021		
Heating	.008	Total	$0.288

The grade of froth from the Callow cells is about 30% lead, the object of these machines being to produce low-grade tailings, and the froth is cleaned up in a Bunker Hill machine. The flotation equipment in each section handles from 95 to 100 tons per day of material, about 95% of which passes 200-mesh. There are 16 pumps and 32 cells in the main Bunker Hill section and four pumps and eight cells in the cleaner section. Pine oil is used in one section of the mill and eucalyptus oil in the other. The latter makes a higher-grade froth than the former, and the consumption is a little over half that of pine oil, making it a better oil to use.



THE BUNKER HILL FLOTATION MACHINE

For keeping the dilution constant at 3 to 1 we use a Troemner bullion scale, upon the sliding scale of which is laid out a curve giving the dilution due to a given weight of pulp.

The constant volume of pulp is suspended in a vessel from the top part of the scale, and when the scale is balanced, the sliding pointer reads directly in dilution.

COST OF CRUSHING AND CONVEYING

	Average per Ton for the Year		Average per Ton for the Year
Crushermen	$0.002	Crushing parts	(a)....
Conveyormen	.005	General machine parts	.002
Roustabouts	.001	Oil and waste	.001
Laborers	.006	Miscellaneous	(a)....
Screens	(a)....	Liners	(a)....
Belts	.007	Machine-shop repairs	.001
Buckets	.001	Building repairs	.002
Roll shells	.002	Mill-shop repairs	.003
Roller shells	.001	Electric power	.025
Concaves	....		
Mullers	.002	Total	$0.061

(a) Does not show in third decimal place.

COST OF SCREENING

	Average per Ton for the Year		Average per Ton for the Year
Machinemen	$0.009	Trommel screens	.006
Roustabouts	.001	Building repairs	(a)....
Screens	.002	Mill-shop repairs	.003
Belts	(a)....	Electric power	.004
General machine parts	(a)....	Water and water power	.001
Oil and waste	(a)....		
Miscellaneous	(a)....		
Liners	(a)....	Total	$0.026

(a) Does not show in third decimal place.

COST OF JIGGING

	Average per Ton for the Year		Average per Ton for the Year
Machinemen	$0.018	Machine-shop repairs	(a)....
Oilers	.008	Building repairs	0.005
Laborers	(a)....	Mill-shop repairs	.002
Roustabouts	.001	Electric power	.013
Screens	.002	Water and water power	.004
Belts	.001		
General machine parts	(a)....		
Oil and waste	.001	Total	$0.055
Liners	(a)....		

(a) Does not show in third decimal place.

COST OF GRINDING

	Average per Ton for the Year		Average per Ton for the Year
Machinemen	$0.018	Pebbles	.002
Roustabouts	(a)....	Oil and waste	(a)....
Laborers	(a)....	Miscellaneous	(a)....
Screens	.001	Machine-shop repairs	(a)....
Belts	(a)....	Mill-shop repairs	.003
Ring dies	.001	Electric power	.022
Mullers	.002		
General machine parts	.001	Total	$0.050

(a) Does not show in third decimal place.

COST OF CONCENTRATING

	Average per Ton for the Year		Average per Ton for the Year
Machinemen	$0.019	Building repairs	.002
Oilers	.008	Mill-shop repairs	.011
Roustabouts	.002	Electric power	.018
Laborers	(a)....	Compressed air	.005
Belts	.002	Water and water power	.003
General machine parts	.001	Reconcentrating expense	.001
Oil and waste	(a)....		
Miscellaneous	(a)....		
Liners	.001		
Electrical repairs	(a)....	Total	$0.076
Machine-shop repairs	.003		

(a) Does not show in third decimal place.

GENERAL MILLING EXPENSE

	Average per Ton for the Year		Average per Ton for the Year
Superintendent and foremen	$0.013	Electric light	.005
Shift bosses and sampler	.009	Heating	.014
Roustabouts	.001	Assaying	.006
Laborers	.001	Train service	.001
Watchmen	.006	Contingent expense	.007
Experimental labor	.002	Depreciation	.031
Belts	(a)....	Administrative expense	.012
Oil and waste	.001	Taxes and insurance	.021
Miscellaneous	.002	Free rent	.001
Tool-shop repairs	(a)....	Fire protection	.002
Electrical repairs	.003	Experimental supplies	.001
Building repairs	.007	General machine parts	(a)....
Mill-shop repairs	.001	South mill	.008
Electric power	.001		
Water and water power	(a)....	Total	$0.156

(a) Does not show in third decimal place.

MILL-IMPROVEMENT COST

	Average per Ton for the Year
Building repairs	$0.001
Total	$0.001

TOTAL MILL-OPERATING EXPENSE

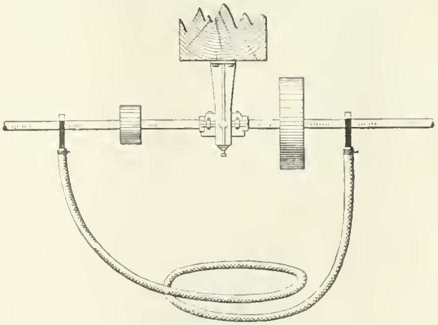
	Average per Ton for the Year		Average per Ton for the Year
Superintendent and foremen	$0.013	Electrical repairs	.004
Shift bosses and sampler	.009	Building repairs	.016
Crushermen	.002	Mill-shop repairs	.022
Conveyormen	.005	Electric power	.083
Machine men	.064	Compressed air	.002
Oilers	.015	Water and water power	.009
Roustabouts	.006	Electric light	.005
Laborers	.007	Heating	.014
Watchmen	.006	Assaying	.006
Experimental labor	.002	Train service	.001
Screens	.005	Contingent expense	.007
Belts	.010	Depreciation	.031
Buckets	.001	Administrative expense	.012
Roll shells	.002	Taxes and insurance	.021
Ring dies	.001	Free rent, light and water	.001
Roller shells	.001	Fire protection	.002
Concaves	....	Experimental supplies	.001
Mullers	.004	Mill accident (personal)	....
Crushing parts	....	South Mill expense	.009
General machine parts	.004	Reconcentrating expense	.001
Pebbles	.002		
Oil and waste	.003		
Miscellaneous	.003		
Liners	.001		
Trommel screens	.005		
Tool-shop repairs	(a)....		
Machine-shop repairs	.004	Total operating expense	$0.425

(a) Does not show in third decimal place.

The valuable data in the tables given above have been taken from the report of the company for the year ended Dec. 31, 1915.

A Simple Shafting Level

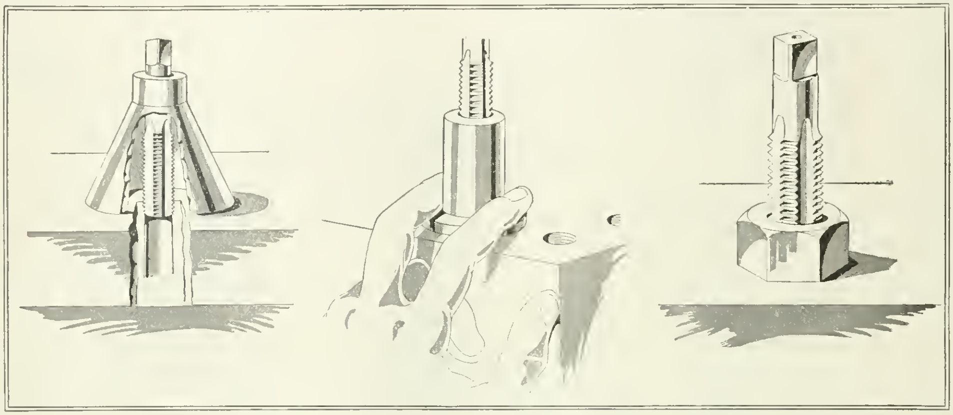
To level shafting or to ascertain the relative levels of two points some distance apart which cannot conveniently be reached with a straight-edge, it is quite a common practice among millwrights, builders and others to take a common garden or other hose, insert a glass tube in each end, and fill the crude apparatus thus constructed with water almost to the tops of the tubes, as shown in the illustration. From the level of the water in the two tubes the inequality of level between any two points compared can be ascertained with accuracy. I recently saw a backwoods mason, says S. F. Wilson in *Power,* level the foundation for a small building with a hose. He did not use the glass tubes but the result was entirely satisfactory.



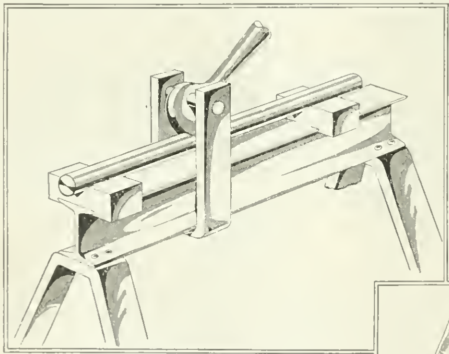
HOSE CONTAINING WATER USED FOR LEVELING

However, it is only an emergency device and the greater the load on the line shaft the greater the skill required for results.

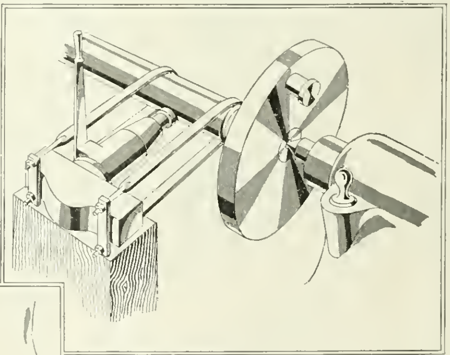
Handy Hints and Clever



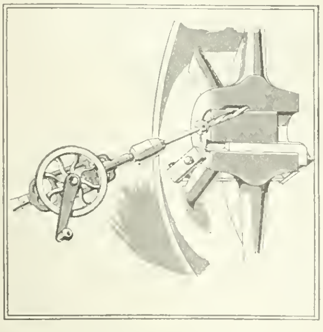
Three Devices to Square Up a Hand Tap



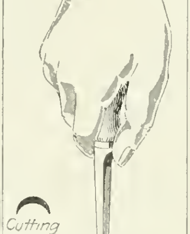
Shaft-Straightening Press



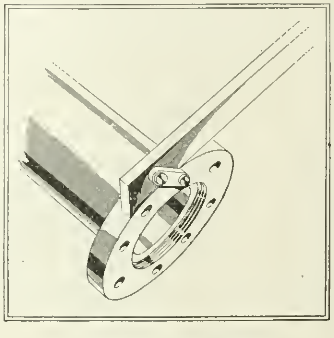
Straightening a Shaft



Oil-Grooving Device

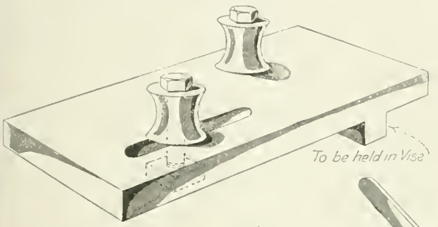


Belt Punch

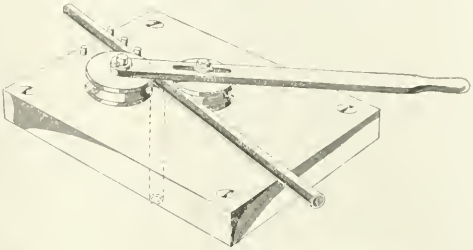


Simple Flange Wrench

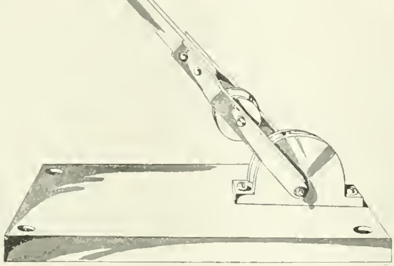
Kinks for the Milling Plant



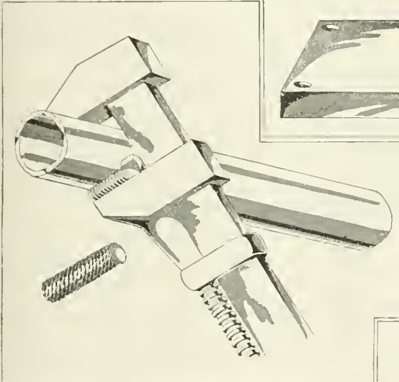
PIPE-BENDING FORM



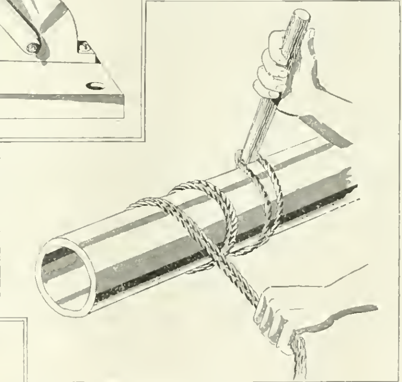
PIPE-BENDING FIXTURE



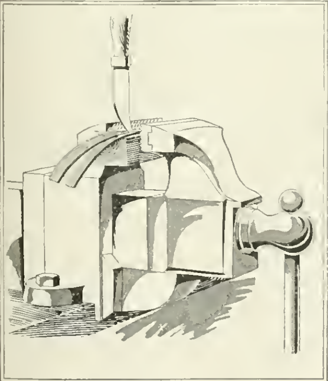
SIMPLE PIPE-BENDING DEVICE



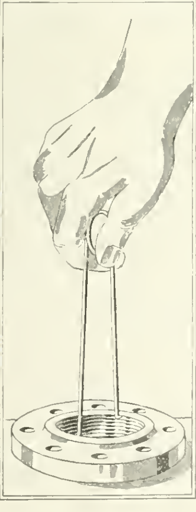
EMERGENCY PIPE WRENCH



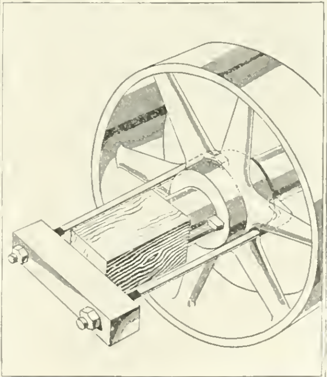
PIPE WRENCH FOR CLOSE QUARTERS



SPLITTING BELT LACE



SIMPLE THREAD CLEANER



PULLEY CLAMP

Belt-and-Bucket Elevators

By Arthur O. Gates*

SYNOPSIS—Details of design of belt-and-bucket elevators are discussed. Housing and supports should be rigid, and pulley sizes carefully considered. Wear on buckets and belts, its causes and remedies receive attention. Feeding methods and power requirements are outlined.

Most milling processes are more or less complex and involve the raising of all or part of the material treated at one or more stages of the process. For raising dry ore, coarse ore with water, slime or sand pulp, or even water, the simplest and most obvious thing to use is a bucket elevator. Occasionally the process is of such a nature and the site of the mill offers such advantages that no raising is necessary, and we have what is known as a gravity-type mill. Often the matter of elevators is the deciding consideration where choice of mill sites lies between a hillside and a flat. On the whole the elevator is regarded as a necessary machine and, as constructed and operated today, is about as reliable as any other piece of mill equipment.

The elevator familiar to the average operator is the one in which the buckets are bolted to an endless vertical belt running between head and boot pulleys; the chain-and-bucket elevator is much less common in metal mills, although used in the coal industry. Chain elevators were tried out in the metal-mining industry in the 80's and later; at that time it was the ordinary malleable link-belt that permitted grit to enter at the joints and quickly wore out. Some of the later chains with steel bushings and grit-proof features may be better adapted to the service, but there is a decided preference for belts. No further attention will be paid to chains in this article.

Supports and Housings

Mechanical and operating details have been determined largely from experience, and little experimental work has been done to determine its limitations. There does not seem to be much about it to stimulate the imagination of the efficiency engineers or the mining schools—it is just a practical man's machine. Its troubles have been largely due to light construction of the supports and of the various details, those due to improper speeds that show up at discharge points and those due to loading conditions and lack of traction on the head pulley.

The supports of an elevator should be strong and rigid as in the case of any other machine. A few are self-supporting; that is, the head shafts are carried on the housing itself, which should have heavy timbers in the corners, well-anchored to the foundation and well-stiffened to reduce vibration. In the average elevator it is possible to carry the headshaft from roof trusses or floor timbers. In this case the housing need be only a shell to retain the spills and the splashes. However, the elevators that have appeared the most satisfactory are those where the headshaft is supported from the building and the housing contains fairly heavy timbers for the purpose of stiffening it and the building at that point.

In order to prevent the escape of dust and water from an elevator, the shell of the housing may be of sheet metal (rarely in metal-milling plants), of matched lumber, of beveled boards or of shiplap. Occasionally two layers are used with building paper between; again the paper is fastened inside the housing and protected from the belt and buckets in motion by planks running up and down, the planks lapping in the direction of belt travel, as shown in Fig. 1.

Headshafts are frequently too light for the load they are to carry; some of them break, and in some the deflection may cause the pulley to work loose on the shaft. The stresses on the headshaft are largely those of bending, the torsion being but a third or a fifth as much and affecting the total stress but little. If bending alone be considered, working stresses in the neighborhood of 6,000 lb. will be good practice. The following equation may be used for calculations on headshafts; obtained by letting the external moment due to the load upon the shaft, $\frac{Wl}{4}$, equal the internal or resisting moment of the shaft, pS, where S is approximately equal to $\frac{d^3}{10}$,

$$\frac{Wl}{4} = p\frac{d^3}{10}$$

in which

W = Total load in pounds, due to belt, buckets, pulley, shaft, and ore or pulp;

l = Distance in inches between centers of bearings;

p = Working stress in pounds per square inch in the outer fiber of the shaft, say between 5,000 and 7,000 lb.;

d = Diameter in inches, of the shaft at head pulley.

The load W may be taken as $3wh$ lb., where w is width of the bucket and h is the lift, or distance in feet between centers of head and boot pulleys. The buckets make up the greater part of the load, malleable-iron buckets being here considered. The following approximate values of d^3 of those sizes of commercial shafting most used will assist in calculations: $2\frac{7}{16}$-in., 15; $2\frac{15}{16}$-in., 25; $3\frac{7}{16}$-in., 40; $3\frac{15}{16}$-in., 60; $4\frac{7}{16}$-in., 88; $4\frac{15}{16}$-in., 120; $5\frac{7}{16}$-in., 160; $5\frac{15}{16}$-in., 210.

Requirements for Head Pulleys

The commercial rigid pillow block and the ball-and-socket pillow block have sufficient bearing surface for the load and are heavy enough; in most case a bearing of about three-quarters the diameter of the shaft is sufficient, the shaft to be bossed accordingly. Take-up bearings occasionally are used in connection with head pulleys, but more usually with boot pulleys. At the headshaft the take-up has the full load to carry, while at the boot it simply keeps the belt in its place, or may be used to increase the belt tension and the traction at the head pulley. Whether the bearings should be self-oiling or grease-cup fitted is open to some difference of opinion, my own preference being for the lower-frictioned self-oiling bearing; speeds are low and are well within the field of grease.

Head pulleys should have extra-heavy rims, from ½ to 1 or even 1¼ in. thick, depending upon the diameter of the pulley. This provides for the wear between the belt and the pulley. So far as figures go, the stresses are no greater than in an ordinary double-belt pulley, and yet pulleys made from double-belt standards have failed by the arm punching through the rim, probably due to the way that the bucket was bolted to the belt, the full stress being thrown on a small area of the crown. A return flange at the rim of a head pulley is of no advantage, and in case of a boot pulley is a positive detriment, as it retains rock and sand within the rim, the rolling of which increases the wear. The diameter of an ordinary crowned pulley of 12-in. face is $1/8$ in. greater at the crown than at the edge. Some of the best mill engineers specify "high crown," which means $\frac{3}{16}$ or $1/4$ in. increased diameter in the above case, and proportionate increases for wider faces. Whether this high crown is a real advantage in keeping the belt true is open to debate; on very wide elevators where two buckets are used side by side and staggered, the ordinary crown is sufficient.

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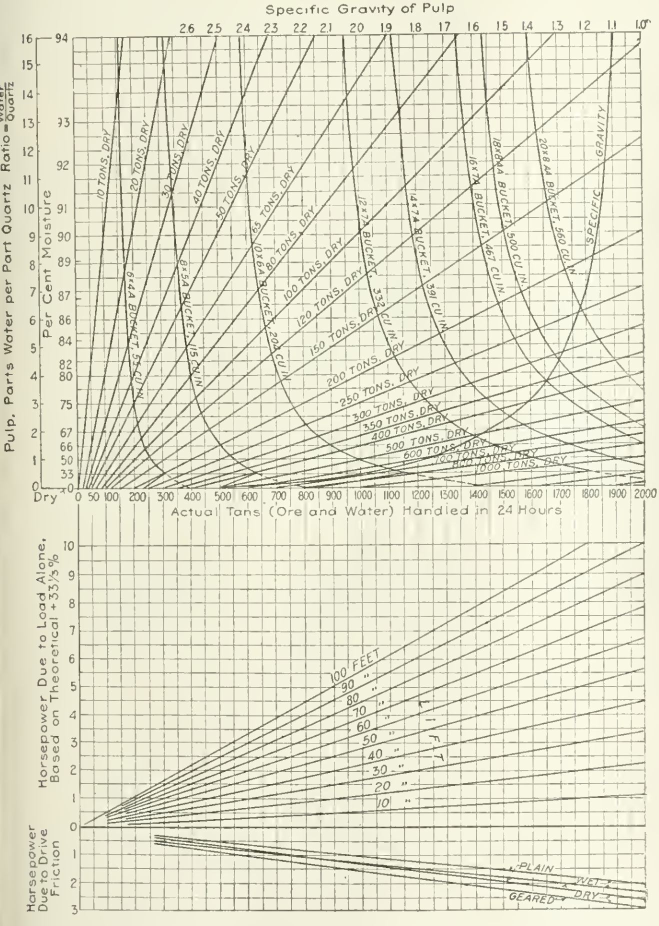
*Mechanical engineer, Mishawaka, Ind.



CAPACITIES OF ELEVATORS IN WATER, PULP OR DRY QUARTZ BASED ON 100 FULL BUCKETS PER MINUTE, EQUIVALENT TO BUCKETS ¼ FULL, SPACED 12 IN., BELT SPEED 400 FT. PER MIN.

If the shaft be a little light, or it may be where it is heavy enough, there is a tendency for sand to work in between the shaft and the pulley hub and create or exaggerate looseness. Accordingly both head-shaft and boot-shaft have their pulleys put on in a hydraulic press, using straight keys. If conditions seem to require a split pulley, it would be well to use a larger shaft, bossed if desired, to cut down the deflection. If pulleys are not pressed on the shaft the accuracy of the bore is important; manufacturers of pulleys ream them to a uniform diameter, while the mechanic in the average small shop is liable to get them a hundredth of an inch larger in bore than is necessary for the fit. If the rim is specified of a given thickness, the matter of arm dimensions and whether single or double arms are to be used may be left to the reputable pulley manufacturer with safety. For elevators of considerable lift or where the material handled has some lubricating qualities (as flotation slimes), the traction of the head pulley is important. Increased traction may be obtained in three ways: By lagging with rubber belting (about 4-ply is usual), using flathead elevator bolts through the rim; by roughening the rim surface, either using the unfinished rim as it comes from the sand without machining, or a special pulley with cast bars and spaces around the periphery (slat construction), or having a series of depressions parallel to the shaft around the periphery; by increasing the diameter. In a previous article[1], the theoretical relations between diameters of head pulleys and speeds were developed and the theory was shown to check closely with practice. In that article it was shown that it was theoretically possible to use any diameter of head pulley provided the proper rotative speed is given to it, and some of the advantages of larger head pulleys, aside from increased traction, were shown. At that time I had no knowledge of pulleys and the average in mining mills was around 36 in., but today 54-in. and 60-in. head pulleys are not uncommon, and 72-in. pulleys have been considered if not installed. However, the grain elevators have been using 60-in. diameter pulleys for years and at speeds approximating those I advocated. A simpler method of studying the theoretical phases of the problem and investigations of practical elevators make advisable a slight revision of the conclusions in the previous article as to speeds. Within a body rotating upon a horizontal axis, all masses are under the influence of two forces, centrifugal and gravity, the resultant of which may be found, both in amouut and direction, by the graphical method described in that previous article, to be proportional to a line drawn to the point under consideration from a point P vertically above the center of rotation, and such that under the rotative conditions obtaining, the centrifugal force upon P is just equal to the force of gravity, as X in Fig. 2. The actual force on X may be found by assuming the radius OP equal to the force of gravity, when PX may be measured to the same scale. We are not particularly interested in the actual values, except to know that the resultant force is small as it nears the point P. The rotative and linear speeds of the point P have been designated as "critical speeds," which may be of use in connection with other horizontal-shaft machines.

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[1] "Eng. and Min. Journ.," Oct. 18, 1913.

Without going into the matter too deeply, we find that liquids within a rotating body on a horizontal axis will tend to lie in circles about the point P, as in Fig. 2. These lines may be designated liquid-level lines, which, being equidistant from the point P, have equal pressures. Now the discharge of an elevator bucket depends upon its relation to these liquid-level lines and the critical point P, as it swings around the head pulley. A good way to study this is to take a piece of plain paper filled with concentric circles and rotate over it a piece of tracing paper on which have been drawn to scale the elevator-pulley circle and one or more buckets. The center of the concentric circles P should be at the point where for the speed considered, W, the gravity force, equals C, centrifugal force, equal to $\frac{Wv^2}{gR}$, from which $v^2 = gR$; v being velocity of point in feet per second, $g = 32.2$, and R = radius in feet per minute. Figs. 3, 4, 5 and 6 show such studies. The eye can sometimes catch glimpses of what is happening in a bucket as it reaches the head pulley. For instance, in a dry elevator the rock would be jerked to the lip of the bucket at the instant it touched the head pulley, and under favorable circumstances the liquid-level lines might be caught.

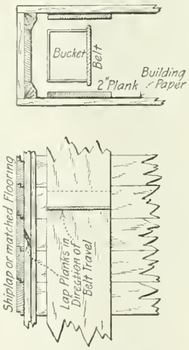
Bucket
Belt
Building Paper
2" Plank
Shiplap or matched Flooring
Lap Planks in Direction of Belt Travel

FIG. 1. HOUSING SECTION

If a 36-in. pulley has a rotative speed that makes the belt travel at 300 ft. per min., the standard practice of 10 or 15 years ago, the point P will lie well outside the path of the buckets (Fig. 3), the pulp will be forced to the belt when at its highest point and will be discharged with the velocity of the belt, which, being slower than that of the bucket tip, may allow some of the pulp to be trapped within the bucket and be carried down into the boot. This condition is no doubt responsible for the practice that puts the divider between the discharging pulp and the descending buckets very low down, as low as on a 45° line from the bottom of the head pulley.

I previously advocated making the critical speed that of the bucket tip. Fig. 4 shows how this works out—still with a tendency for the pulp to flow down on the belt and to discharge with the velocity of the belt.

If, however, the critical speed be that of some point well within the head pulley, as in Fig. 5, the pulp will be squeezed out of the bucket long before the bucket reaches the top position and may progress by steps around the head pulley with splashes down into the boot. I have been told of a case where a belt was run at about double critical speed and it discharged all on the rising side.

Much nearer the ideal condition is shown in Fig. 6, the critical point being 2 or 3 in. out from the pulley, there being no flow to the belt and no probable splashing on the rising side. Based upon this ideal, pulley and belt speeds for all diameters have been plotted in Fig. 7, while two additional curves are drawn in, one for critical speed that of the belt, and the other, critical speed that of the bucket tip, as previously proposed. Probably these should be taken as the limits, although Timber Butte Milling Co., at Butte has a 60-in. pulley running at a little over 600 ft. per min., belt speed, and it discharges from a point well back of the top, and into the receiver above the horizontal center line of the pulley.

Driving Pulleys and Belts

Headshafts are driven through a pair of spur or bevel gears, or by means of an exceptionally large pulley at a comparatively low transmission-belt speed. The product of diameter by face of this driven pulley should be nearly equal to that of diameter and face of the head pulley.

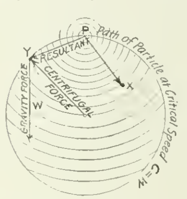

FIG. 2. LIQUID-LEVEL LINES IN BODY ROTATING ON HORIZONTAL AXIS

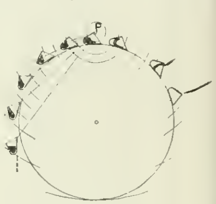

FIG. 4. CRITICAL SPEED AT BUCKET TIP

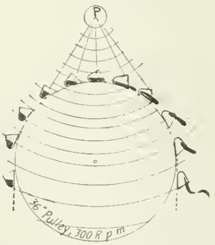

FIG. 3. LOAD AND DISCHARGE, 36-IN. PULLEY, 300 FT. PER MIN.

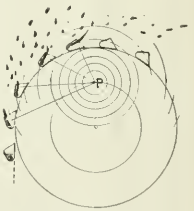

FIG. 5. EFFECT OF EXCESSIVE SPEED

For all but very short-lift elevators the spur-gear drive is the most common. A well made cast-tooth gear should be about as satisfactory as any, its proportions determined by Lewis' formula for gearing with not over 5,000 lb. as the value of the static stress. Unless gear patterns are well taken care of and gone over carefully before going into the foundry, the teeth will be uneven in pitch and not lie on a true pitch circle, and thus it is we have noisy gears. Some prefer cut gears on account of probable increased efficiency before wear is appreciable. On account of the hard skin on the cast tooth the wear will be less until the skin is worn through. Some prefer cast-steel gears. Probably it is well to use a cast-steel pinion, because its tooth is weaker than that of its mating gear, and each tooth has several times the contact and wear. It is all a matter of giving the gearing sufficient wearing surface; they all wear, and as soon as wear becomes appreciable, all theoretical advantages disappear. One point that is important is to keep the gear and pinion in line and well tied together by means of a double-adjusting baseplate; this is well worth the little added expense.

If objection is made to the noise of spur gearing, mortise gears may be used, the wood teeth being in the driven gear, both gear and pinion being cut. The average mining man will say that mortise gears belong to the dark ages, but there are many still in use. They are still being made in fair quantities, and one of the largest mining companies in the world continues to use them on some of its largest hoists, the cogs lasting in some cases six to eight years.

High-reduction worm gears have no place on elevator heads. They are a delusion and a snare, usually fearfully inefficient, the inefficiency showing in the rapid wear of the teeth. The efficient worm gears have no greater ratio of speed reduction than it is possible to obtain with ordinary gears.

If the elevator head is rather inaccessible from the mainshaft of the mill transmission, it can be driven by motor or by an up-and-over or around-the-corner rope drive. Considerable excess capacity should be provided in the motor to take care of starting and slipping loads. The motor capacity should be nearly double that given in the chart. Two or three ropes will ordinarily handle the elevator, the gearing being so arranged that the speed ratio between the driving and driven sheaves is within rope-drive limits.

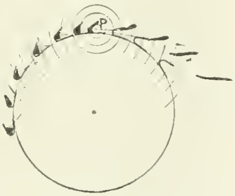

FIG. 6. LOAD AND DISCHARGE AT RECOMMENDED SPEEDS

The total lift possible by one of these elevators is limited by the traction of the head pulley and by the ability of the belt to stand the pull. In a following table lifts out of ordinary practice are suggested, it sometimes being stated that if one wishes to lift over 60 or 70 ft., two elevators should be used. I do not agree with this, for in grain-elevator practice, lifts of 140 ft. are used and probably more. It may be necessary to space the buckets farther apart in order not to have a whale of a belt.

The majority of mining districts use the malleable A or AA bucket, while in southwestern Missouri and thereabouts the buckets are of steel, all of the same cross-section, and sold at so much an inch. About one-third of the capacity of the bucket is available, and it is perhaps better to figure on quarter capacity for ordinary duty and to take care of sudden rushes of feed.

In order that the buckets discharge freely, holes from ¼ to ⅜ in. in diameter, about 5 in. apart, are drilled in their bottoms. This practice, I am told, was started in Colorado years ago. It is used in the Cœur d'Alenes and was called to my attention by Mr. McGillivary, foreman of the Timber Butte mill, to whom I am indebted for many practical suggestions and corroborations. This sounds like bailing with a sieve, but it works out nicely. Probably there is a complete change of the pulp in a bucket from the time it starts up until it reaches the head pulley. The holes prevent the sands from concentrating in the bottom of the bucket. At other places jets of water to clean out the buckets appear to be necessary.

The spacing of the buckets is from 12 to 20 in., it being generally recognized that there should be sufficient room between them to prevent interference in filling—a spacing of twice the projection seems to approximate practice. When the bucket is bolted directly to the belt, there is sufficient relative motion between the two to cause considerable wear; leather or rubber washers are used to keep them apart and to allow free passage to the sand and grit which otherwise might work in between. Sometimes the belt has been protected from the impinging stream of ore by a short piece of belt running perhaps halfway to the next bucket above and to which the protected bucket may or may not be fastened. As this has not become general practice, it may have been because sand could get between the belts and cause wear on the belt.

The big item of first and operating cost is the belt. Its strength and number of plies should be based upon the load it is to carry, the load increasing directly as the lift if bucket spacing remains constant, and increasing spacing slightly with the width. As larger head pulleys with increased belt speed would be used for those lifts that are now considered outside the realm of bucket elevators, the spacing of buckets could be increased for the same capacity, and the belt pull need not be excessive. In the table following, some consideration has been given to this: the number of plies of the belt is rather tentative, based on experience and judgment rather than calculation.

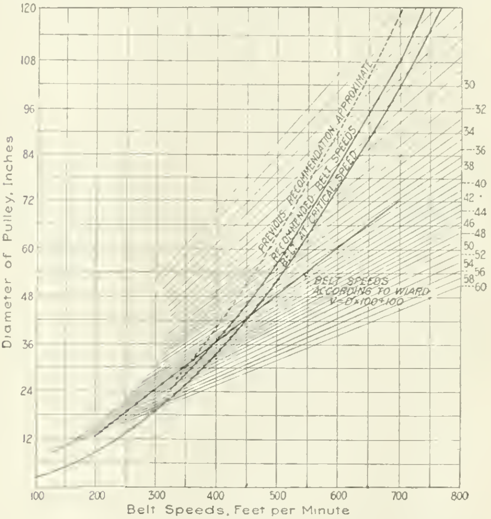

FIG. 7. ELEVATOR SPEEDS FOR DIFFERENT PULLEY DIAMETERS

TABLE 1. BELT-AND-BUCKET ELEVATOR DATA

Height C.-C., Ft.	Min. Diam., In.	Recommended Diameter	Belt, No. Plies	Height C.-C., Ft.	Min. Diam., In.	Recommended Diameter	Belt, Pli
20	24	30	5	80	60	84	12
30	30	36	6	90	66	96	1[illegible]
40	36	48	7	100	72	108	1[illegible]
50	42	54	8	120	84	120	1[illegible]
60	48	60	10	140	96	132	18
70	54	72	10	160	108	144	20

The life of the belt depends upon external conditions rather than upon the normal stretching and releasing of stress as it picks up and discharges the load and bends over the pulleys. Besides the wear mentioned in the previous paragraph, what is usually a greater wear takes place between the belt and the pulleys. Boot conditions, some of which may be reduced, are responsible for this. In many plants the material is fed directly into the boot, or even where the ore is supposed to be fed into the buckets there are spills, the boot is filled up with coarser material, some of which gets between the belt and the pulley, is pressed into the belt and acts as a grinding medium for both pulleys and belt. Old rubber belting on mill scrap piles will show several plies worn through on the pulley side, the impressions of the elevator bolts indicating the side. On small pulleys with not enough tractive surface to prevent abnormal slips of the belt, the wear will be excessive and the loss of power serious. So far as I can determine, it is better to divide up any rubber covering between the two sides of the belt.

Boot pulleys will average about 6 in. in diameter less than head pulleys, and even more metal should be put in the rims if anything, for the boot pulley is working down in the sand and rock. It is even more necessary to press in the shaft to prevent sand working in and wearing it loose. Various types of boot bearings are used, depending upon the conception of the difficulties there in the mind of the deviser. In southwestern Missouri a loose-fit hard cast-iron bearing is stuck down in the dirt with no protection. When it wears out, another is used. Others use fairly long shafts that bring the bearings away from the trouble; another uses bearings with stuffing-boxes on the pulley side, the bearings having closed ends on the opposite sides. In another case a collar on the shaft fits into a recess on the end of the bearing and protects the wearing surfaces. All these should have grease lubrication, depending upon a ring of grease to keep the dirt out. Take-ups are really nothing more than these bearings so mounted on a frame that a screw may be used to bring the boot pulley into proper relationship with the belt. Manufacturers' catalogs show quite a variety.

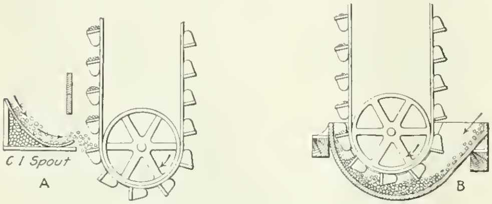

FIG. 8. SUGGESTED METHODS OF FEEDING

Two special types of boot pulleys have had considerable success—the one used by the Utah Copper Co. and its subsidiaries and the M. P. Boss pulley, both of which, I believe, have been described before in the technical press. The Utah pulley uses a fixed axle and has an oil well in the hub, the ends of which are closed with stuffing-boxes. The Boss pulley may be said to be rimless, for in place of rim are a number of bars connected to a double-cone hub, the idea being to give less contact, to let the pieces of rock and sand fall between the bars and to deflect them out of the pulley by the cone.

Methods of Feeding Elevators

Boots run all the way from a close-fitting cast-iron or steel affair to a cellar as big as the ordinary hotel room. Where the rock is coarse it is desirable to spout directly into the buckets and let the few spills be picked up by a following bucket, usually in a close-fitting boot. In some dry elevators a steel plate close up to the path of the buckets is used in a wooden boot; it is hinged at one end, and the other has a small ratchet drum so that it can be quickly emptied and closed again. If the material handled is fine sands or slimes with plenty of water, the cellar boot is all right, the spouting can be led in anywhere and the agitation of the passing buckets keeps things stirred up and from settling and piling up. Provision should be made for emptying the boot by means of a door or trap.

Except where very fine material is discharged into the boot at any convenient place, the best practice spouts into the rising buckets at a point high enough up so that there is an additional bucket below to catch the spills. Some say that the material should enter at a point 18 in. above the center line of the pulley, others on a 45° line through the center of the shaft. They all amount to the same thing. In southewestern Missouri, where they do not spout into the buckets but into the boot, the claim is made that the impinging sharp rock particles cut the belt more than the wear caused by digging out of the boot with its extra wear on buckets and increased power consumption.

Mill men will agree that it is theoretically desirable to load the buckets with the least shock, which might be accomplished by spouting the feed in the direction of motion of the buckets. Using a scheme as shown in *A*, Fig. 8, the relative velocities of feed and buckets would be about one-half of that where the spouting is straight in; *B* is a sort of reverse of the present cast-iron boots, spouting in the direction of motion of the buckets. In both cases a suitable boot must be provided. For the *B* case a 3-ft. free fall would give the velocity of the buckets to the feed for ordinary elevators.

The average bucket elevator is vertical. Sometimes the line of the rising buckets is inclined ahead from 2 to 6 in., the theory being that the bucket should "lie" on the belt and so reduce the pull on the elevator bolts. I question whether this practice has any advantage over a truly plumb belt. Some belts are inclined as much as 10° in the direction of the discharge. Except as a horizontal displacement is obtained, there is no advantage, and the belt must be kept tighter. That the horizontal displacement may be a distinct advantage in some cases goes without saying. In some of the Lake Superior mills are elevators of about 20-ft. centers running on an incline of about 45°, raising reasonably small quantities of table middlings. The belts are 4 and 6 in., pulleys about 30 in diameter with a single supporting roll midway between the pulleys under the carrying side. Speed is about 15 ft. per min., and the feed is spouted into the buckets. In western Nevada I saw a belt conveyor inclined about 35° or more, handling fine dry sands, strips of old belting being riveted on at short intervals to hold the material; thus the gap between the elevator and the conveyor is spanned.

It is probably unnecessary to refer to the elevator that is a prominent feature of gravel- and rock-crushing plants for construction purposes, some of which find their way into the mining game. The belt rises at an angle about 22½° ; rubber belt is generally used. The buckets are of steel, V-shaped and close-spaced, rollers are placed under the rising belt at short intervals, head pulleys are relatively small and belt speeds are around 200 ft., per min

On the flat mill sites of southwestern Missouri and its allies in the neighboring corners of Kansas, Oklahoma and Arkansas, the elevator seems to thrive best. There they can make two elevators grow where one was before. Their practice must be recognized as designed to fit the local conditions, for in addition to the flat mill sites they have an ore which invariably breaks, large or small, into near relatives of the Indian arrow-head with never-failing cutting edges, and they use a flood of water in their jigs. Perhaps 15% of the power in the mill is for lifting water. Five elevators make a very ordinary mill; there must be close to 400 mills in the district—a grand total of two thousand elevators. Feed is spouted into rather open wooden boots with the bottom planking close up to the path of the buckets. Here the pulley sizes are smaller than in other camps—24, 30 and 36 in. are the customary diameters of head pulleys, while boot pulleys are 20, 24 and 30 in., some of them crowned and some of them straight face. Lifts are rather low except in the case of tailings elevators, which may run to 50 ft. Where additional elevation is needed on a tailings pile, a second or a third elevator is added; they call them "dummies." The belt is somewhat inclined, the housing conforming to the belt on the rising side and vertical on the descending. Belt speeds are around 300 ft. per min., although one or two are up around 500 ft. per min.

Belt elevators are reasonably efficient, probably more so than the centrifugal pump except in cases where the head pulley does not afford sufficient traction or where not enough attention is paid to details. The chart gives in convenient form the data on capacity and horsepower that one ordinarily has to consider when selecting an elevator and providing the drive. It checks fairly well with examples from practice. To select an elevator for capacity, the point is found where the horizontal line of moisture or water ratio intersects with the diagonal of equivalent dry tons; the curve to the right of that point indicates the bucket to be used. The equivalent dry tons per 24 hr. is found in the following manner: Suppose a 60-in. head pulley is used, buckets to be spaced at 16 in., and considered to carry one-third capacity. From Fig. 7 we find that a belt speed of 500 ft. per min. is about right; there will be 125 full buckets per minute. If 250 dry tons per day, carrying 6 parts of water, is to be raised, the equivalent dry tons on a 100% full-bucket basis will be 200, so we use the diagonal of 200 tons dry and find that a 20-in. AA bucket should be used. The specific-gravity line was drawn in at the time of making the diagram, and was left in, thinking it might be of value to those whose daily business requires consideration of pulps. It connects the specific-gravity values at the top with the pulp ratio and moisture values at the side. Note that for dry rock the specific-gravity relation no longer holds. There are air voids between the pieces of material, and accordingly the curves are stopped at the 33% moisture line and come back as straight lines to the dry line on a basis of 20 cu.ft. to the ton. The vertical lines in the diagram represent actual tons of live load of ore, water and other material lifted in 24 hr. The horsepower in the middle diagram is that considered as due to load alone, while the lower part takes care of the friction in the bearings and drive.

Many of the practical data used in this article have been taken directly from practice. The section of the housing in Fig. 1 is from the mill at Cananea; perhaps David Cole will not recognize the offspring. If anyone finds anything of value belonging to him herein, it is a pleasure for me to return it to the owner.

Flotation in Joplin District

By Lucius L. Wittich*

Several experimental flotation plants have been installed in the Joplin district, but with one exception (that of the Mining and Flotation Co.) of Denver, none has yet proved successful. The first experiment was conducted two years ago on slimes from the Priscilla mill of the Underwriters Land Co., west of Joplin. This plant is no longer in operation. The Picher Lead Co. has at Picher, Okla., an experimental plant that is not yet productive. The American Zinc, Lead and Smelting Co. is experimenting with flotation at its Prosperity, Mo., mines, but has not yet reported profitable operation. Other smaller experiments along this line have been tried.

The plant of the Mining and Flotation Co. of Denver is on a lease of the Granby Mining and Smelting Co., in Leadville Hollow, two miles northwest of the business center of Joplin. The work of bringing the plant to a point of profitable operation has been in the hands of S. P. Warren, who holds the secret on the nature of the composition of oils employed. The chief ingredient is pine oil, the cost of which is 50c. per gal. The plant is handling 80 tons of ore a day, taken from a tailings pile of the old Gravity mill, operated many years ago. The tailings have already been run through one mill that operated on the lease several years ago, and the metallic contents down to barely more than 1% have already been removed. This extremely thin dirt is yielding about 1% blende, and a small percentage of galena, the daily recovery in 10 hr. being about 1,600 lb. of concentrate out of 80 tons of tailings handled. Half of the recovered concentrates comes from a flotation cleaner and a single Arbuthnot table, used to improve the grade of the concentrates, while the other half comes from four Wilfley sand tables that handle the coarser ore that does not pass through the flotation cleaner.

Although the plant has not yet reached the state of perfection that the operators expect of it, the approximate daily cost of operation is $20, while the concentrates recovered are valued, at present prices, at $50 to $60.

Two teams and drivers scrape the tailings to the mill hopper, where the ore is elevated to a revolving screen of 1-mm. mesh, the oversize being discarded, as no crushing devices are employed. Undersize passes into a hopper from the bottom of which the coarser ore is elevated by a screw classifier into a separate hopper whence it passes onto the four sand tables. The fine ore, escaping elevating by the screw, passes into a settling tank from the bottom of which it is drawn off through four openings and pumped up to the top end of a six-cell flotation cleaner. From ½ to ¾ lb. of oil is used per ton of dry slime. The oil froth, after leaving the Arbuthnot table at the bottom of the flotation cleaner, passes back, along with the middlings from the table, to the settling tank and is used again.

In each of the six cells of the cleaner is an impeller that revolves at a peripheral speed of 1,100 ft. per min., thus whipping the oil, water and ore mixture to a froth that rises to the surface of the water in a layer about 2 in. thick. From each cell this froth is skimmed off with a slowly revolving scraper. The froth goes direct to a launder that feeds onto the cleaning table, where clean water washes the oil free from the ore. From the sixth cell are drawn off the tailings, consisting of material that does not float in the oil froth.

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*Joplin, Mo.

The dry slime that passes into the flotation cleaner, having been relieved of a large percentage of coarser ore and much gangue matter, passes into the flotation treatment materially enriched above its formation when being scraped into the first hopper from the tailings heap. The loss of blende in the flotation tailings is reduced to a minimum. The little plant is operated by a 50-hp. motor, and there is enough material in sight to keep it in operation for years.

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Stamp Milling at Alaska Treadwell

The 240-stamp mill of the Alaska Treadwell company in 1915 had a duty per stamp day of 4.31 tons. One pound of chrome steel in the shoes crushed 2.7 tons of ore and 1 lb. in the dies crushed 5.83 tons. In the 300-stamp mill the duty per stamp day was 5.31 tons and 1 lb. of chrome steel in the shoes crushed 2.44 tons of ore and in the dies crushed 4.09 tons. The cost of milling was $0.312 for both mills.

DETAIL COSTS OF MILLING

Labor Cost:	240-Stamp Mill Cost per Ton	300-Stamp Mill Cost per Ton
Crushermen and helpers	.....	$0.002
Laborers	$0.001	.003
Feeders	.039	.025
Amalgamators	.025	.016
Vannermen	.023	.015
Sampler	.002	.001
Foremen	.006	.004
Carpenters	.002	.003
Engineers	.005	.....
Total direct labor	$0.103	$0.069
Supplies:		
Shoes	$0.015	$0.016
Dies	.003	.003
Cams	.004	.001
Bossheads	.005	.008
Tappets and keys	.002	.004
Mortars	.005	.007
Mortar extras	.003	.004
Screens	.003	.002
Copper plates	.....	.001
Quicksilver	.004	.006
Lubricants	.001	.....
Vanner belts	.002	.012
Belting	.001	.003
Miscellaneous	.005	.010
Total direct supplies	$0.053	$0.077
Subsidiary Accounts:		
Building repairs	$0.013	$0.004
Electrical repairs	.002	.004
Mechanical repairs	.018	.012
Power	.050	.054
Train service	.001	.001
Assaying	.002	.001
Douglas Island general expense	.014	.009
Electric lights	.002	.002
Steam heat	.005	.002
Tailings expense	.....	.008
Pumping salt water	.010	.006
Compressed air	.002	.001
Central crushing	.037	.036
Central tramming	.014	.015
Experimental	.002	.001
Total subsidiary accounts	$0.172	$0.156
Total costs	$0.328	$0.302
Recapitulation.		
Crushing	$0.038	$0.038
Tramming	.014	.016
Stamping	.210	.189
Concentrating	.066	.059
	$0.328	$0.302
Labor	$0.103	$0.069
Supplies	.053	.077
Subsidiary accounts	.172	.156
	$0 328	$0.302
Tons ore crushed	349,153	551,058
Tons sulphurets saved	6,618.91	12,558.34

Sulphuret Expense. 19,177.25 Tons Total

	Cost per Ton
Labor	$0.436
Supplies	.090
Train service	.087
Sulphuret car expense	.101
Assaying	.020
Cyaniding	3.244
Douglas Island general expense	.062
San Francisco office, charges on cyanide bullion	.344
	$4.384

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Air-Lifts at a Cyanide Plant

By Paul W. Gaebelein*

At the cyanide plant of the Baker Mines Co., Cornucopia, Ore., the pulp, both sands and slimes, is handled entirely by air-lifts. In the following brief description, two of the air-lifts are taken up in detail and illustrated, the first handling sands and the second slimes pulp.

The ore, after being crushed in stamps to 25-mesh, is classified in a duplex Dorr classifier, the sands being lifted by air to the leaching tanks and the slimes being treated in three Dorr agitators 20 ft. diameter and 16 ft. deep, three Dorr thickeners, and a Portland continuous filter. The plant has three air-lifts for pumping sands and slimes, and compressed air is also required for the operation of the Dorr agitators and the filter.

Compressed air is supplied by a Sullivan compressor, class WG3, belt-driven, size 14x12 in. This compressor is operated at 120 r.p.m., and at 5,000 ft. altitude has a capacity of 215 cu.ft. per min. Air is compressed to 15 lb., which is sufficient for the operation of the air-lift system. The power consumption under these conditions is 12.5 hp.

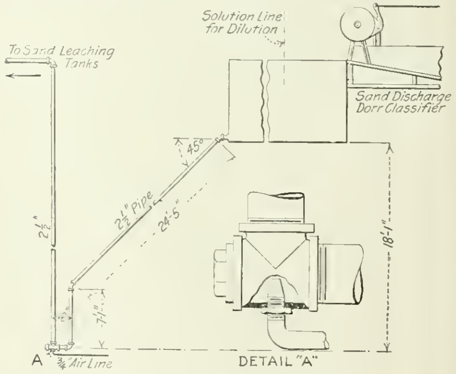

FIG. 1. DETAILS OF SAND LIFT

Fig. 1 illustrates the sands lift. As the sands are discharged from the Dorr classifier, they drop into a mixing box in which they are diluted with barren solution in the proportions of 4 of solution to 1 of sand. This rate of dilution has been found satisfactory both for the successful operation of the air-lift and the automatic distributors with which the leaching tanks are equipped. The sketch shows the construction of the lift in detail. The amount of sand handled per day is 40 tons, diluted with 160 tons of barren solution. Fig. 2 illustrates the air-lift between No. 2 and No. 3 thickeners. The situation of No. 2 thickener is such that it requires a rather long pipe line to transfer the pulp to a point from which it can be lifted to No. 3 thickener. The lift is rather a high one, owing to the fact that No. 3 thickener is at sufficient elevation to allow the pulp to flow by gravity to the filter-stock tank and thence to the filter. The slimes handled are very fine and colloidal. Fig. 2 gives the air-lift in elevation. It handles approximately 25 tons per day of slimes at a dilution ratio of 1 : 1, or 50 tons of pulp per day. The thickness of the pulp delivered by the thickener is regulated by placing nozzles of various sizes in a reducer placed as shown in the sketch. The reducer is from 4 to 2 in., and the nozzles are 2-in. plugs drilled through the top. Each thickener is equipped with a set of nozzles, and these are changed as the flow of pulp demands.

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*Mill superintendent, Baker Mines Co., Cornucopia, Ore.

While the air-lift system of handling pulp is not the most efficient, it has numerous advantages over the use of sand and slime pumps. Some of these advantages are low first cost, simplicity, absence of repairs, avoidance of delays due to repacking and repairing pumps and practically continuous operation. The system at the Baker Mines Co.'s plant has given satisfaction and practically continuous service.

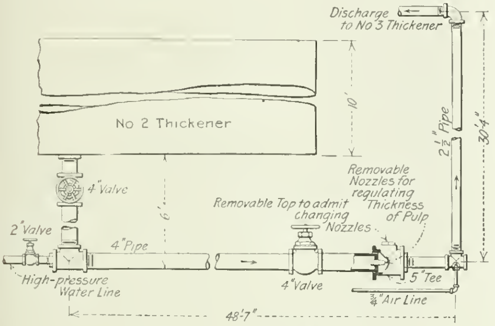
Discharge to No 3 Thickener
No 2 Thickener
10'
2½" Pipe
30'4"
4" Valve
6'
Removable Nozzles for regulating Thickness of Pulp
Removable Top to admit changing Nozzles
2" Valve
4" Pipe
High-pressure Water Line
4" Valve
5" Tee
¾" Air Line
48'7"

FIG. 2. AIR LIFT FROM SLIME THICKENER

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Hollinger Mill Operations, 1915

During 1915 the Hollinger Mill, at Timmins, in the Porcupine district of Ontario, treated a total of 441,236 tons, of which 334,750 tons came from the Hollinger mine and 106,486 tons from the Acme. The total value of this ore was $3,384,666, or $10.11 per ton. The mill treated 917 tons per day, operating an average of 93.8% of the possible running time. The mill duty per 24 hr. of actual running time was 978 tons, and the stamp duty per 24 hr. of running time was 14.72, Of the value unrecovered, $81,763 was in the form of concentrates that were stored for re-treatment and $133,090 was lost in tailings. The recovery amounted to $3,169,813, making an extraction of about 93.65%.

The amount of cyanide consumed per ton of ore was 0.574 lb.; of lime, 1.896 lb.; of zinc, 0.467 lb.; of acid, 0.0032 lb.; of lead acetate, 0.0021 lb. There were 1.909 tons of solution precipitated for each ton of ore treated, and 0.244 lb. of zinc was added for each ton of solution. The accompanying table shows the distribution of all milling costs, which total up to almost exactly $1 per ton treated.

During the year 9,500 tons of concentrates were stored for re-treatment, and now that the plant for treating this material has been put into proper shape, it will be gradually reclaimed until it has all been treated. There are in process of installation extra tube mills and a screening plant, by means of which it is proposed to relieve the stamps of the duty of further crushing on that portion of the ore that comes from the breaker in condition fine enough for direct tube milling. The continuous-decantation plant is being increased by the addition of two rows of 40-ft. tanks. Six Dorr agitators, 26 ft. diameter by 18 ft. deep, have been installed to secure a longer period of treatment for the ore. The concentrating plant has been rearranged to make room for the agitators, and a tube mill has been installed in circuit with the two smaller agitators for treating concentrates. It is expected that by means of these alterations the capacity of the mill will be raised to 1,900 tons per day and that a slightly improved extraction will be obtained, owing to the increased agitation provided.

DISTRIBUTION OF MILLING COSTS

Account	Labor	Stores	Total	Per Ton of Ore Milled
General milling charges	$7,115.83	$8,662.16	$15,777.99	$0 036
Superintendence..........	10,183.89	..	10,183.89	023
Tailings disposal	3,364.23	2,356 81	5,721.04	013
Lighting........	263.54	2,781.30	3.044.84	007
Heating....	1,594.35	8,200.72	9,795.07	022
Shoveling in bins....	3,444.55	.	3,444 55	.008
Crushing....	14,124.04	13,038.12	27,162.16	.062
Conveying..............	10,659.67	8,484.97	19,144.64	043
Stamping........	13,906.04	34,669.22	48,575.26	110
Classification and tube milling..........	11,142.92	77,709.27	88,852.19	202
Concentration.........	10,662.40	4,821.65	15,484.05	.035
Handling concentrates....	1,389.89	1,763.40	3,153.29	007
Treating concentrates....	1,231.21	1,246.66	2,477.87	.006
Handling pulp...........	4,621.18	6,420.08	11,041.26	025
Thickening..	2,471 40	1,803.66	4,275.06	.009
Agitation and continuous decantation.......	8,055.10	2,258.76	10,313,86	.023
Filtration.........	10,082.30	10,037.87	20,120.17	.046
Neutralizing...	1,334.33	4,533.17	5,867.50	.013
Clarifying and precipitation........	2.796.04	29,283.96	32,080.00	.073
Refining......	6,584.66	11,304.81	17,889.47	.041
Pumping solutions....	5,168.51	6,211.36	11,379.87	.026
Cyanide......	6.92	63,352.18	63,359.10	.144
Cleaning mill.........	6,245.94	...	6,245.94	.014
Alterations.	5,337.98	4,386.53	9,724.51	.022
Assaying..	3,067.82	1,825.57	4,893.39	.011
Maintenance of buildings.	474.39	147.31	621.70	001
	$145,329.13	$305,299.54	$450,628.67	$1 022
Less cost of treating 106,486 tons Acme ore..........			116,079.21	1 090
Cost on 334,750 tons Hollinger ore..............			$334,549.46	$0 999

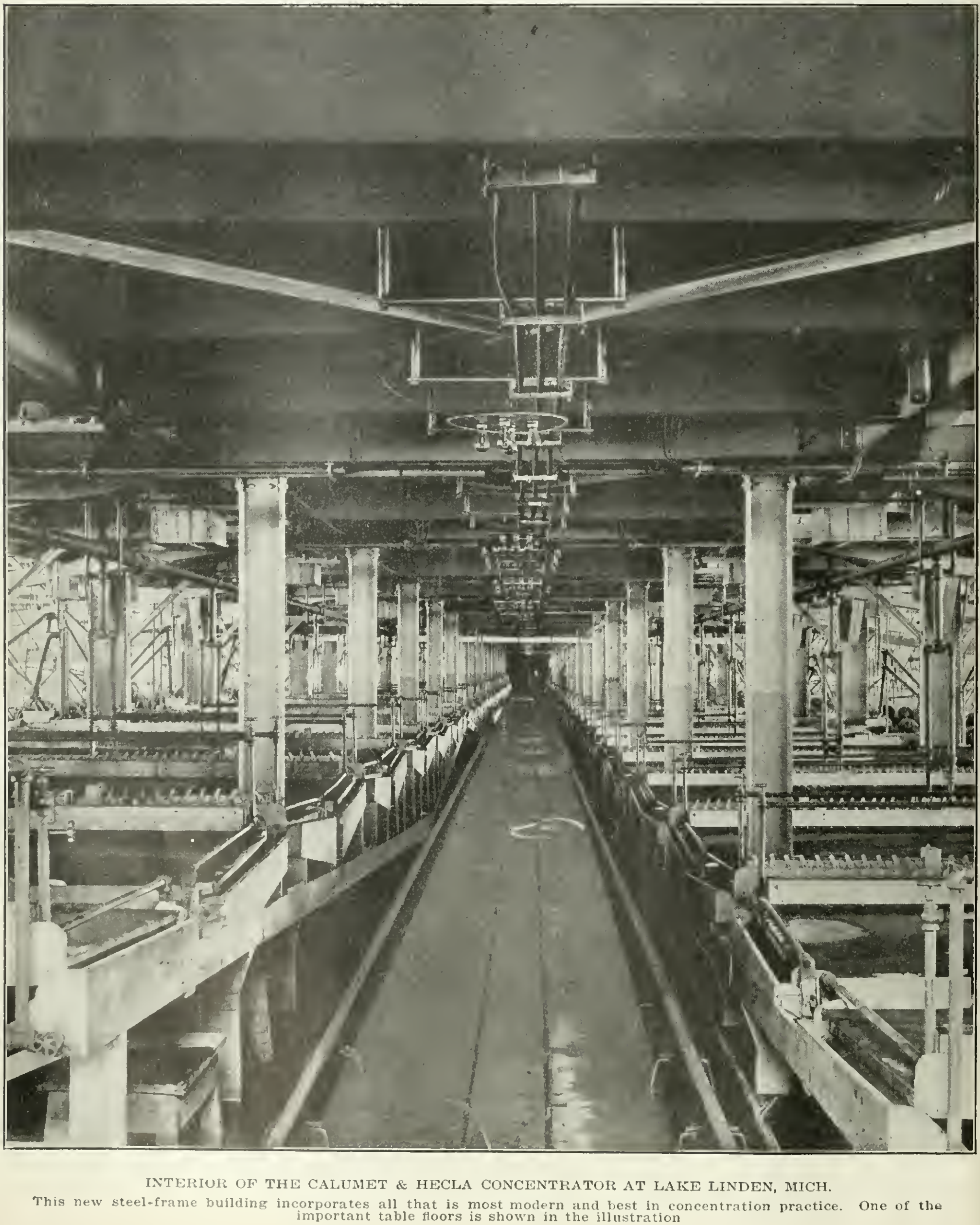
⁂

A Flotation Mystery

At the joint meeting of the New York sections of the American Electrochemical Society and the American Institute of Mining Engineers, held at the Chemists' Club, New York, May 12, Professor Richards told of flotation experiments that were carried out at a Tennessee zinc plant where a mill of commercial size was built, based on the result of laboratory tests which were very flattering. The mill operations did not coincide with the results obtained in the laboratory, and for a long time the reason for the discrepancy was a mystery.

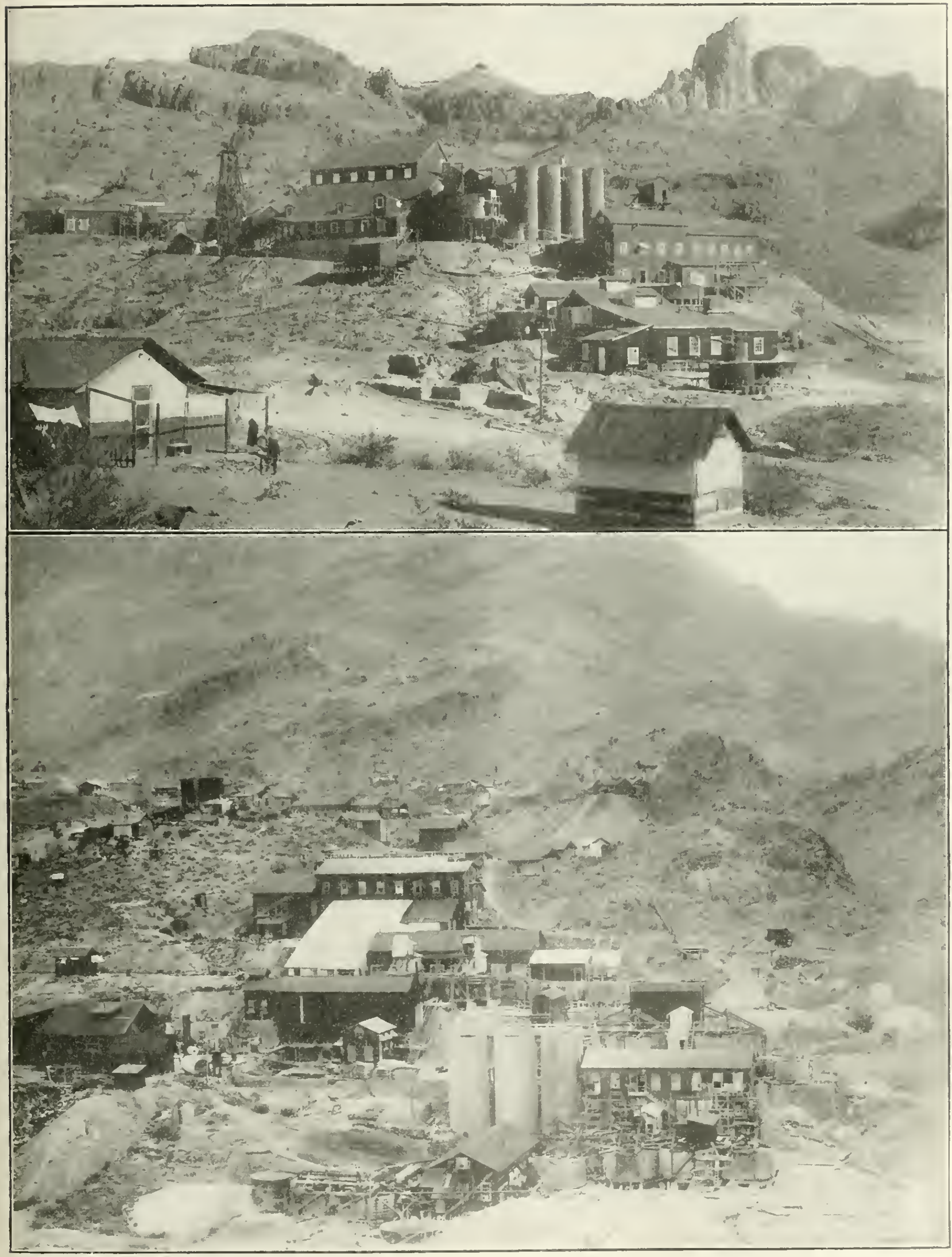
Finally, question arose as to whether the fact that the laboratory tests were carried out in a flotation machine made of brass and the mill units were made of wood did not account for the difference, assuming that the sulphuric acid had attacked the brass of the flotation machine sufficiently to get some copper sulphate in solution. Copper sulphate was experimentally added to the wooden tanks in the plant, and as satisfactory results were secured as had been previously obtained in the brass cell in the laboratory, Professor Richards said that, although the satisfactory results had thus been obtained, the particular rôle that the copper sulphate played in this instance had not been explained.

Photographs from the Field



INTERIOR OF THE CALUMET & HECLA CONCENTRATOR AT LAKE LINDEN, MICH.

This new steel-frame building incorporates all that is most modern and best in concentration practice. One of the important table floors is shown in the illustration



TWO PRINCIPAL MILLING PLANTS OF THE OATMAN DISTRICT, ARIZONA

*The upper view is of the Tom Reed mill, at Oatman, center of the newly developed gold field, and the lower is of the Gold Road mill, at Gold Road. Neither mill is a result of recent excitement in the district

Use of Oils in Flotation

By Herbert A. Megraw

SYNOPSIS—Various theories of the functions performed by oils in flotation processes have been propounded. The reduction of surface tension and the preferential oiling of mineral particles are the most prominent of these duties. The way of their accomplishment is discussed and some examples are given of how it works out in practice.

The oils used in the flotation process are many and their qualities vary within extremely wide limits, so that it appears that with ores of certain classes certain oils may be used, while with different ores oils having different qualities must be made use of in order to produce successful results. It has seemed apparently true that any particular kind of oil is not necessarily applicable to all ores, or perhaps it would be better to say that the same oil will not produce equally successful flotation results with all ores. That has been the theory heretofore and is an assumption that most metallurgists have taken for granted and have not seriously questioned. Apparently, however, the statement is not so broadly true as has been believed, and there are some who go so far as to say it is not true at all. The belief is not rare that an oil that will successfully promote flotation concentration on any particular ore can be used in making flotation concentrates on another ore, if the other conditions are so varied as to make them applicable.

Of course it is not intended to make the statement that all oils will produce satisfactory flotation froths, for it is well known that some oils produce good froths while others do not, but the point desired to be brought out is that an oil that makes a good froth in one case will produce froth in another case if the proper conditions are provided; that is, as to the nature of the pulp, solution and combination of the two. The conditions of oil quantity and the presence or absence of a high degree of agitation must also be properly arranged to suit each case.

The Purpose of Oil in Flotation

The function of oil in flotation is a point that has not yet been definitely settled. The primary function, which has been clear since the inception of the flotation process, is that the oil serves to reduce the surface tension of water and thus provide for bubbles and froth of more lasting character than could be formed without its use. In practice some operators have brought out the theory that only with the lasting bubble in the froth can the best results in flotation be obtained. If that, however, is the only use of oil, what shall we say about those surface-tension and gas-bubble processes in which no oil is used, such as the Macquiston process, the Wood process and the others of like nature? In these cases flotation is successfully accomplished without the use of any oil whatever On the other hand, the flotation processes that are used on the largest scale and the ones that are achieving the greatest success are those in which oil is used. It seems evident, therefore, that in addition to the function of reducing surface tension, which the oil undoubtedly does accomplish, there must be further work that it performs. One of the properties of oils, it may be pointed out, is their preferential adhesion to mineral rather than to gangue particles. This is a fact that has been emphasized by a large number of experimenters and one that has been accepted as true up to a comparatively recent time. Now there are many who believe that there is no selective action whatever and that the difference in action of the oiled minerals and gangue particles is due to other forces altogether. In spite of this suspicious attitude, however, it seems almost certain that there is a certain preferential action, the oil adhering to mineral particles, particularly of a certain kind, rather than to the siliceous gangue particles of an ore.

Preferential Oiling of Mineral Particles

A careful examination of a pulp containing oil that has been added for flotation purposes will show that the majority of the mineral particles are more or less oiled, while the great majority of the gangue particles do not carry oil. This is subject to some qualification, however, for oils of certain classes—vegetable frothing oils, for example—are often found in the gangue and not in the mineral concentrates. Such condition is probably due to the solubility of these oils in water, since they are not to be found directly in contact with gangue particles, but in the pulp tailings. This subject will be treated in further detail later. Whether this adherence is due to preferential action between oils and mineral, one cannot at the present time definitely say, but the fact remains nevertheless. As to why the oil tends to prefer the sulphide particles, we know practically nothing. The reason probably depends upon the fundamentals of adhesion, which is one of the few forces of nature upon which extremely little light has been thrown so far by scientists. As a matter of fact, there are only a very few persons who know much about adhesion, while to the majority of even the scientists the cause of it is as unknown as, for instance, gravitation. We can certainly say nothing about the oiling of mineral particles that will throw any light upon the preference, if such exists, for the oil to coat the mineral particles rather than the gangue particles.

It is a well-known fact that there are surface forces that may change completely the tendency of bodies to act in any particular manner. If we assume it to be a basic fact that mineral particles do become oiled in preference to siliceous gangue particles, it is not so difficult to imagine that there would be a tendency between the oiled mineral particles and the gas bubbles to remain in contact with one another, the buoyant tendency of the gas then tending to lift the mineral in the froth. The well-known fact that solid particles carry electric charges, and that these charges in the mineral and gangue particles are or may be of different kinds, should be borne in mind in the elaboration of any theory of flotation or the function of oils in the process. The additional fact that these particles with electric charges migrate in the electric field, their direction varying according to the charge they carry, must also be remembered and may serve as a hint toward the official preferential separation of minerals and gangue. In an ordinary dilute pulp this migration may be found to account for the fact that the minerals become more or less separated from the gangue, and may lso help to explain why the minerals will take an oil ilm more easily and promptly, even if not to the entire xclusion of the gangue particles.

An objection to the electric basis for a theory of this ind, however, is found in the statement by authorities on olloids that this difference in electrostatic charge is a roperty of colloids only and does not apply to particles f practical size in suspension. Such particles, say these uthorities, all carry charges of the same kind, and there vould therefore be no tendency toward separation unless he oil film on mineral particles tends to change the character of the charge or to insulate the particle.

The surface films on particles will also have an important effect upon results. Surface films may be of four kinds—solid, liquid, gaseous or electric. In solid surface ilms we have as an example the limonite coating formed on various mineral particles—for instance, bornite—which nore or less effectually prevents it from being successfully eparated by flotation. It may be noted that if this surface film is changed or removed, flotation of the particles nay take place. This is accomplished in practice by using an acid solution, or electrolyte, which removes the oxide, thus enabling the particles to be floated. The removal of this solid film may permit the oil film to be formed on the particles, which may account for its ready flotation under the changed conditions.

The Functions of the Oil Film

Thus we see that there are at least two functions of the oil: First, to reduce the surface tension of the liquid so that a more permanent gas bubble may be formed and, second, to preferentially oil the mineral particles so that some other effects, yet to be discussed, may be permitted to take place. The fact that the introduction of certain substances into the pulp solution may entirely change the effect of an oil is significant. Oils that produce a perfect froth under normal conditions may be so influenced that they will not produce a froth at all if certain substances are introduced into the solution. It may be noted that all of these substances are deflocculating agents—that is, such substances as will permit the oil to become emulsified and maintain itself in that condition. While it may still retain the property of reducing the surface tension of the water through solubility or miscibility, and may permit the formation of bubbles (although this is not usually the case), the emulsified oil is still in such condition that it apparently cannot effectively oil the mineral particles, so that its function will not be sufficiently well performed to enable it to be of use in promoting a flotation concentration, as has been noted by Van Arsdale.

As to the service performed by the oil film on a mineral particle, reference to recent discussion on the theory of flotation indicates that a prime requisite for the flotation of a particle is the presence of a surface film having the property of refusing to be wet by water. The oil increases this property. The surface-tension theory of flotation necessitates the presence of this non-wet surface.

To provide a non-wet surface on the mineral particle, the oil used to supply the film must be such that it will not be wet by water, or some constituent must be added to the water that will prevent it from wetting the oil. Many oils will not be wet by water, but some of them will, and the latter are not suitable for use in flotation unless something be added to the water to prevent the wetting action. Some acids supply this quality. If we attempt to explain the quality of an oil to be wet, or not, by water, we come again to the insurmountable barrier of adhesion phenomena, which alone can explain that quality.

It is to be remembered, however, that in spite of all this talk about oils and their effect, they are not the only materials that can form a non-wet film on solids. There are some solids that will do it; perhaps some gases, and not impossibly, electric surface charges. It has been shown that colloidal films of some kinds may be so manipulated as to produce this result.

Oils in general then, may be divided into two groups, the first containing those oils whose duty it is to provide the non-wet film on the surface of the particle; and frothing oils, which serve to make the froth possible by reducing the surface tension by water.

Coal Tar as an Auxiliary in Flotation

It is unfortunate but true that at the present time the realization of the functions that oils have to perform does not give us any advance information as to what kinds will be suitable to certain ores. So far it is altogether a matter of practice, the old rule of cut-and-fit being the only one from which much practical information can be derived. Every flotation plant finds an oil particularly suited to the ore being treated if the experiments are carried far enough. There seems to be no one oil that will give equally satisfactory results in every case. Coal tar may, however, become a universal oil when employed as a base for making good working mixtures of oils.[1] Until the latter part of 1914 the principal oils utilized for flotation in this country for copper ores were wood-distillation products and cresol. The price of cresol, about 30c. per gal., has made its use costly, even though as little as two pounds of it per ton of ore is required, as compared with coal tar, which costs only about 5c. per gal. Later, other coal-tar products less expensive than cresol came into use, and finally coal tar itself aided by some frothing agent, such as pine oil. Pine oil, however, is also quite expensive, and subsequent experiments show that coal tar with from 10 to 25% creosote gave equally good results. Until these experiments had been performed, coal tar was not considered as a flotation agent in this country, nor was it ever experimented with here, although it had been mentioned in some English patents. The experiments referred to led to its adoption in one large mill, and many others are now experimenting with it and getting good results.

There is considerable difference in the behavior of different tars, and it might be said that while classed as coal tar, the usual run of this material is really gas tar, or tar resulting from the manufacture of gas from coal. These oils are byproducts and naturally can be bought cheaply. A number of experiments have been carried out using this oil as a basis on ore of a porphyritic nature carrying about 1.6% copper, mostly chalcocite, with some chalcopyrite and about 0.15% oxide. Coal tar does not froth very well, producing a lean froth, although one of good quality. Pine oil is employed in combination with the coal tar, the pine product being a good frother and the combination of the two producing a carrying froth that gives good results in concentration. A mixture of 80% coal tar and 20% pine oil produces first-class concentrates. The price of pine oil, however, is high, and its use should be avoided whenever possible. The coal-tar products—cresol, creosote, etc.—which formerly served alone, are now mixed with the coal tar in proportions up to about 20%. The mixture thus obtained is excellent in both the pneumatic and agitation types of machines.

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[1] "Use of Coal Tar in Flotation," William A. Mueller, "Eng. and Min. Journ.," Oct. 9, 1915.

When coal tar is used long enough, it alone gives low-grade tailings together with high-grade concentrates. It requires, however, that the ore be held in agitation such an inordinately long time that the practice is not considered satisfactory, and it is usually better to add some frothing oil along with it to produce the results in a shorter time. Some tars may not give any results at all when used alone, but as soon as a very little of such an oil as pine oil is added, good results are often obtained immediately. The amount of oil will vary according to the ore, grade of concentrates and tailings desired; 0.005% of it will work a marvelous change in its effect upon some ores.

As the amount of tar increases in proportion to pine oil, the amount of concentrates increases and the mineral content of the tailings decreases. This may be on account of the proportion that coal tar bears to the mixture, or it may be because of the amount of oil resulting from increasing the amount of coal tar. Rough experiments seem to indicate that it depends upon the amount of mixture employed.

In a description of flotation tests on ores from Bisbee and Cobalt, Herbert J. French makes some interesting observations on oils.[2] In experiments on Bisbee ores the character of the material is described as porphyritic, the copper existing almost wholly as cupriferous pyrite, chalcocite and malachite. The total copper amounted to 6.04%. After testing the ore in the slide machine, the tailings were analyzed for sulphur, whence the percentage of extraction of the sulphides could be computed.

Tests on Various Kinds of Oils

Several oils, such as fish, sperm, whale, corn, cylinder, pine, pine-tar, lard and cottonseed oils, were tried under fixed conditions. Both qualitative tests, by shaking oil, acid, ore and water in test tubes, and quantitative tests on the slide machine were made. Of those oils available it was found that pine-tar oil gave the maximum extraction with the minimum weight of froth. Pine oil and fish oil both gave good results, but the froth, in addition to being of nonselective character, did not seem so lasting with either of these as that given by pine-tar oil. The character of the froth obtained by the other oils mentioned did not seem to indicate successful operation; hence the pine-tar oil was selected as the most desirable. In the experiment carried out at room-temperature on 100 grams of ore, the pulp containing sulphuric acid, with a 3-min. period of agitation, it was found that the extraction increased with the weight of oil added. A certain point, however, is reached beyond which more oil does not increase the extraction sufficiently to warrant its use in larger amounts. It is also evident that with the increase of oil, other conditions being the same, more of the gangue floats. In other words, the action of the oil becomes nonselective with increase above a certain point.

In another experiment, varying the acid, it was again found that there is a point beyond which further addition of acid is useless. When time is taken as a factor for variation, it is found that the longer agitation is continued the better the results. And again, when the temperature is the factor to be varied, it is found that from 50° to 65° C. gave as good extraction as could be had.

Experiments were then made upon ores from the Coniagas Mining Co., Cobalt, Ont. This ore contains about 13 oz. of silver per ton, mainly in the form of pyrargyrite, proustite, argentite, dyscrasite and native silver. The procedure was about the same as for the Bisbee ore, but in this case the tailings were analyzed for silver. In the first test, which was made with different kinds of oil, pine-tar, fish, sperm, corn, whale, cylinder, rape-seed, lard and cottonseed oils were tried, and it was clearly demonstrated that pine-tar oil was far superior to the others. Rape-seed oil gave a comparatively good extraction, but it was noticed that the froth was not so lasting as that produced by the pine-tar oil. The amount of oil was next varied, and in this case there was a recurrence of the phenomena of critical quantity. It was shown that beyond 2½ grams per 100 grams of ore, no benefits were derived from additional oil.

Examples of the Use of Mixed Oils

At the Gold King mine, at Gladstone, San Juan County, Colo.,[3] a low-grade silver-lead ore is treated by flotation, the oils used being carbolic and creosote. Carbolic oil is fed to the pump used to hoist the pulp to the stock tank, while creosote oil is fed to the first compartment of the agitator and pine oil is fed to the fourth compartment of the agitator, 300 c.c. of total oil per ton of pulp being used. In this case no acid is found necessary.

At a flotation mill in Mexico,[4] the best flotation agents among those tested were pine oils, a low-grade giving as good results as the better varieties. The F. S. pine oil of the General Naval Stores Co., which costs 26c. per gal. f.o.b. factory, has given exceptionally good results. For the best work in flotation it was necessary to have this oil present to the extent of 0.6 lb. per ton of ore. In actual plant practice, where the water is returned again and again to the top of the mill, the consumption of oil would reach about ¼ lb. per ton of ore. Pine-tar oil is much cheaper. It gives good extraction, but the grade of concentrates are low. Cresylic acid, when used with pine oils, increases the extraction about ¼ oz. of silver per ton. This hardly pays for its use. It may be said in connection with cresylic acid, however, that aside from any function it may have in assisting the actual formation of froth, it has the property of reducing the adhesion between oils that would ordinarily be wetted by water, and the water itself. Therefore the function of cresylic acid in the flotation process would seem to be in its quality of robbing water of the ability to wet certain oils.

It may be noted that so far in the review of the oils used coal tars have proved themselves to be poor frothers, and to get a sufficient volume of froth to make good recovery it is necessary to add something else as a frothing agent. Pine-tar oil, pine oil, creosote, etc., are the ones usually required. At the Inspiration mill, in Arizona, the flotation mixture is 80% crude coal tar, 15% light oil or creosote and 5% pine oil. At the Daly-Judge, a mixture containing 40% crude coal tar, 40% creosote and 20% pine oil is used. In the Coeur d'Alene country, wood creosote is used on zinc ores, and on some copper es plain turpentine will work, but pine oil is better. ne latter seems to have the property of making a brittle oth that does not seem to last long on reaching the surce of the floating machine, an advantage in many cases. eosote and light oil makes an elastic envelope that will pand to great size before bursting. The pine-oil bubbles ll rarely be over 1/4 to 1/2 in. in diameter. Castor oil, ive oil, oleic acid, palm oil, sperm oil and other oils a lubricating nature have in general been replaced by ls more or less soluble or miscible in water, such as rpentine, pine oil, eucalyptus oil and all other coal- nd wood-tar distillations. Extremely volatile oils, such naphtha, gasoline, ether and alcohol, do not, apparntly, have any effect themselves aside from the property ey have of dissolving oils and thus making them more luble or miscible in water.

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[2] "Colorado School of Mines Quarterly," November, 1914.

[3] "Eng. and Min. Journ.," Oct. 16, 1915.

[4] "Flotation in a Mexican Mill," "Min. and Sci. Press," July 24, 1915.

On some of the mixed lead-zinc ores of the Coeur Alene country a mixture of three parts pine oil and one rt creosote seems to work very well. The quantity used about 0.5 to 0.7 lb. per ton. At the Silver Peak mill, erranderie, N. S. W., Australia, the best flotation reults were obtained by the use of two oils. *Eucalyptus nygdalina* was used as a frothing agent and a dark ubricating-oil mixture as a carrier.[5] The pulp was heated 120° F., at which best results were secured. The conumption of eucalyptus oil was 3/4 to 1 1/2 lb. per ton, and f the mineral-oil mixture 2 to 2 1/2 lb. per ton.

THE QUALITIES OF PINE OILS

In discussing flotation oils up to this point it will be oticed that there have been references to products from ine distillation, sometimes called pine oils and somemes referred to as pine-tar oils. It might be assumed t first hand that this was simply two different ways of peaking of the same thing, but such is not the case, beause the products are different. Pine oil is produced by ne steam treatment of pine wood, cut up into small ieces, while pine-tar oil is obtained through the destrucive dry-heat treatment of the wood. According to the pecifications of the United States Navy Department, ine oil is defined as "a properly prepared light, strawolored oil, produced by redistillation of heavy, high-boilng-point fractions, resulting from the steam distillation f wood turpentine, and having a strong aromatic odor esembling turpentine." This oil should have a specific ravity of not less than 0.930 or more than 0.0945 at 60° ., and upon distillation should show at least 75% disilling between 200° and 220° C. The same authority, efining pine-tar oil, says: "A properly prepared distilate from straight pine tar, which latter has been obtained y destructive distillation of pine wood." It will be clear, hen, that the two products are different and are not necesarily interchangeable in use where experiments have een made upon only one.

Some tests have been made on pine oils, in one of which he oil was noted as orange in color and having a specific ravity of 0.945. In this experiment 2 lb. of the oil was sed per ton, and 2 lb. of acid was added to the pulp and gitated one minute before the oil was added. It was ound that by using the oil thus, a good product was obained, but by making two or more operations on the same ulp, adding 1 lb. of the pine oil first and then at the econd operation a pound of oleic acid, a high-grade prodct was also produced. In testing two or three kinds of pine oil in combination with oleic and other oils, it was found that a consistently good product was obtained each time, and that the percentage of extraction increased with the number of operations that were performed on the pulp, up to the point where practically all the sulphide had been removed from the oil.

In describing the flotation process at the Oneida Stag mill, at Idaho Springs, Colo., R. W. Smith[1] points out that oil at the rate of 2 1/2 lb. per ton of dry feed was added. The oil cost was materially reduced by mixing three different kinds—in this case consisting of one part of mixed crude wood tar, fairly cheap; one part of spirits of turpentine, more expensive; and four parts of a cheap, local mineral oil. The mineral oil constitutes a cheap base for carrying the other oils. It is not always possible to find a mixture that will give a clean, high recovery and at the same time make clean products. By mixing in this way, however, the cost per gallon for oil on the ground was reduced from 45c. to 23c. This reduces the cost of oil per ton of crude mill feed from 6c. to 3c.

OILS USED AT THE ANACONDA MILL

In the description of flotation at Anaconda, the kind of oil used for their flotation has been noted by Laist and Wiggin[2]. A product that has heretofore been little used in flotation, but has been the subject of some experimentation, is a sludge-acid kerosene that has been employed by Minerals Separation and is called M.S. 37. It was used practically all through the experimental work at Anaconda and gave highly satisfactory results. Although exposed to the weather in iron drums during the winter months, it gave no trouble by becoming too viscous. One barrel of oil from the Western Oil Co. was tested during February, but did not give as satisfactory results as the oils from Standard Oil Co. and the Union Oil Co. of San Francisco. One barrel of oil from the Midwest Refining Co. was tested during February, but did not give the results obtained on the other two. From the Producers Refining Co. came an oil that could not be tested, as it had solidified in the barrels and did not become liquid after standing for days at a temperature of 60° F. or better.

During the experimental work creosote oils were tested with varying results. The creosote from the Cleveland Cliffs Iron Co., of Marquette, Mich., is obtained as a byproduct in the manufacture of charcoal from hard pine. This is known as M.S. No. 33, the number given to it by the Minerals Separation Co. It was used practically throughout the entire work with highly satisfactory results. Creosote from Pensacola Tar and Turpentine Co., of Gull Point, Fla., was used in considerable quantity in experimental work. It gave fully as good results as the Cleveland Cliffs creosote. It is made from Georgia pine and is known as No. 400 by the Pensacola company. A barrel of creosote from the Crichton Pine Products Co., of Alabama, was tested and gave good results. A test was made using a barrel of tar creosote from the Butte Gas Works, and this gave fairly good results. The test was too short to be conclusive, but it was thought that the tar creosote would give satisfactory results.

In testing the Callow machines a mixture of oil containing tar creosote from the Barrett Manufacturing Co. was used with good results. In the laboratory experiments it was found that tar creosote gives good results. Creosote from the timber-treating plants at Rocker comes from the J. F. Lewis Co., of Moline, Ill. It did not give good results, although the test was too short to be absolutely conclusive.

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[5] H. Hardy Smith, "Eng. and Min. Journ.," Dec. 11, 1915.

[1] "Flotation Replaces Cyanide," "Eng. and Min. Journ.," Jan. 15, 1916.

[2] Bulletin A. I. M. E., March, 1916.

THE ACID-HYDROCARBON PRODUCTS

The reference to the sludge-acid kerosene introduces a new oil, or hydrocarbon product, that has not been spoken of before, the manufacture and production of which is not well known by flotation men. The product is one from the distillation of petroleum. The burning-oil stocks from the steam stills, consisting of from 65 to 75% of the crude oil charged, are treated at the rate of 5 to 10 lb. of 66° commercial sulphuric acid per bbl., in order to improve the color and odor and also to remove decomposition products which cause the flame to smoke when burned in lamps. The process is performed in agitators, using an air-blast for agitation. In order to get the full benefit of the acid, any water present must first be drawn off and a small amount of acid added in order to remove all the remaining water. This is agitated for from 20 to 40 min., allowed to settle from the oil and then drawn off. The remaining acid is then added and the mass agitated for from one-half to one hour, allowed to settle from 3 to 5 hr., and drawn off. The acid treatment removes the tarry matter formed during distillation, also a large percentage of the unsaturated hydrocarbons and sulphur compound. The acid is turned almost black after treatment, and is known as sludge acid. It is allowed to settle from the oil and is then drawn off into tanks and delivered to the acid-separating plant for the recovery of the acid. This sludge acid is the product that has been found useful in flotation. It will be observed that it comes from the treatment of light burning oils. A similar process is practiced upon the lubricating oils, but the sludge acid from these heavier oils is black, asphaltic in nature, and very viscous—almost a solid mass. It, with the sludge from the burning oils, is sometimes agitated with water in a lead-lined separator, the weak acid recovered is concentrated in lead pans, and finally in stills of cast iron to 66° Baumé, and then used over again. The residue from this treatment is usually used for fuel or worked up into pitch. It will be seen that the use of these sludge-acid oils may possibly combine the features of having the oils necessary for reducing surface tension together with the acid required in the treatment of some particular ores.

In a test made on some oleic and coal-tar oils, a cycle of four different operations was carried out on each. The test was performed at a dilution of 4:1 and at a temperature of 45° C., the ore being a typical blende combination with heads averaging 15½% Zn. The additions consisted of the oleic oil and 2 lb. of acid per ton. Clean concentrates of 45.6% zinc were produced, with clean tailings containing 1.3% zinc. In using the straight coal-tar oil the same feed produced clean concentrates of 49.5% and clean tailings of 1.2% zinc. In each case there were four operations performed.

There are several different kinds of pine oils, made by different manufacturers, and although the qualities are in general approximately the same, some difference may be found in particular products. Taking for example Spiritine and the Atlantic as two different examples of pine oils, it has been found that they both give good froth. It may be noted that when pine-tar oil is used, a long contact with an acid solution will be likely to cause the froth to break up and the concentrates to drop out of it. For this reason, where long contact is essential it is believed, at least in some cases, better to take an oil in which the pine-tar product does not exist. One of the two pine oils has been found to contain pine tar, and although it gives an excellent froth on short agitation, long contact with acid will, as has been said, cause the concentrates to drop out of the froth. Where acid is not used, however, pine-tar oils are particularly advantageous and make splendid froths.

A large number of tests have been made with acid petroleum products, some of which make good flotation oils. In tests on Texas crude oils, most of them have been found to give good results in combination with a frothing oil. The frothing oils used in combination in this case were oleic, stearic, pine and pine-tar oils. The Texas crudes are usually known as A, B, C, D, E and F. Combinations containing half of these Texas oils and half of one of those that have been mentioned as frothing agents were tried, and most of them gave very good results. The Texas crude "A," in proportion of one-half to one-half of stearic, however, requires considerable agitation. This agitation is more than is required when the other combinations of oils are used. The combination of the Texas crude "C" with oleic acid, in the proportion of half and half, froths pretty well, but the froth did not show much strength nor stand up well.

The Minerals Separation oils have already been referred to, but in some cases they are used in combination with pine and pine-tar oils, as well as with oleic and stearic acids. In a few cases, however, tests of a mixture with oleic and stearic acids did not give good results, but there was probably some local reason for such an outcome.

OTHER OILS TESTED

Thorough tests have also been made of such products as crude oil, fish oil and many others. Fish oil gives good results, and a combination of fish oil and oleic acid does too, although it shows some tendency to carry up siliceous matter with the mineral. Fish oil and pine oil in combination do not seem to do any good at all. In the experiments made on this combination, no results were secured. Stearic and oleic acids give good results, as also does stearic acid alone. Beaumont oil with tar oil and with oleic gives fairly good results, and some paint oils may also be successfully used. Coal-tar oils have already been mentioned, as has also their combination with pine oil and other frothing agents.

Pine oils and pine-tar oils have been tried in combination with cottonseed, lard, nitrobenzol, turpentine, oleic acid, stearic acid, corn oil and other hydrocarbons. The results seem to vary with the kind of ores treated. In many cases a good result can be obtained with blende ores, while the same oil combination will not work at all on copper. At the same time, if the oil mixture is changed and also its proportion to the dry ore itself, the same oils, alone and in combination, may be made to do good work on the copper ores. The same applies to the treatment of any other kind of ore where changes in oils seem to give different results. In spite of the efforts that have been made to discover some rule for the application of various oils to different kinds of ores and in spite of the careful study given to the matter, no general principles can be announced. At many times the experimenters have seemed to be on the track of a logical explanation, but with the formulation of rules, numerous variations and objections to it have cropped up, so that at the present time there is really nothing that can be laid down as specific.

Tests have been made on corn oils, and the corn oil in combination with pine, pine-tar, oleic and stearic acids has been tried. All of them give good results under some circumstances and poor results under others. It might be said in general that any oil will form a good flotation product if the proper combination with its complementary oil is used. By this is meant that if a carrying oil is used, it must be supplemented by a small quantity of a frothing oil. The frothing oils and the carrying oils are complementary to each other, one supplying the qualities that the other does not possess. There are some oils that combine the qualities of carrying and frothing agents, but as a rule they are so expensive that they cannot be used alone, and it is found cheaper to use a large quantity, comparatively speaking, of the cheaper carrying oil and a much smaller quantity of the more expensive frothing agents. Of the Texas crude oils there seems to be none so far tested that can be depended upon to give satisfactory results alone. They all have an asphalt base and bring forth a light, rich, unstable froth. In combination with either pine, oleic or pine-tar oils, they give good results. They are graded according to their specific gravity, the lightest oil being the Texas "A" and the heaviest the Texas "F." The latter, in combination with oleic and pine in a proportion of one-third each, gave remarkable results on some careful experiments.

Comparison of many different kinds of pine oils show that there is very little difference in the product of different manufacturers, most of them having about the same properties. Oleic oils have been tested in combination with corn, pine-tar, turpentine and other oils, and also straight. In proper quantities they seem to give good results in every case. Oleic oils of different manufacturers have been also compared, and there seems to be very little choice between them.

Miscellaneous Oils Tested

Tests on a lot of miscellaneous oils have given, in general, good results, although some will not work when economically possible quantities are used. Wood creosote works well and produces a good, thick froth, but has a tendency to carry silica into the froth. Spike oil was tried, but it usually does not seem to produce a froth that is tough enough for practical satisfaction. Rape oil produces a pretty good froth, fairly clean, although on continuous subsequent operations there appears to be a peculiar scum that interferes with satisfactory flotation. Nitrobenzol is too light for flotation, and no results can be had with it. Castor oil alone does not usually produce good results. In combination with turpentine it will work satisfactorily, but such large quantities of it have to be used (up to 8 or 10 lb. per ton) that it is not economically practicable. Cottonseed oil and coal oil (kerosene) alone did not produce any practical results. Coal oil and pine-tar produce pretty good results, but require a large quantity of the oil in proportion to the tonnage treated. Turpentine alone does not produce satisfactory results, according to experiments, nor does the variation called turpentine oil. All the turpentines work fairly well, however, when combined with a heavy oil. The use of fish oil in large quantities gives fairly good results, but its extremely disagreeable odor would be a drawback. The trouble experienced when stearic acid is used alone seems to be that stearic brings the congealing point down, and this oil also takes more heat to render it liquid enough for use. It seems probable that coal-tar oils and coal tars themselves will probably be the most generally useful oils in flotation processes, being used as carrying oils and forming the bulk of the oils added. They must, however, be combined with some oil having frothing qualities, such as pine, pine-tar or many of the other lighter oils already mentioned.

The peculiar result of a large number of oils tested seems to be that the only way to determine whether an oil is applicable for flotation of a certain kind of ore, is to try it on that ore. And, it will be noted, it is advisable to try an increasing number of oil combinations and quantities. Since, as has been mentioned, it is totally impossible to outline any rule for forecasting the results to be given by oils of certain classes on ores of particular kinds, a large number of experiments is absolutely necessary to accurately determine such oil or combination of oils that can be used, and the minimum quantity that can be used to secure the greatest economical quantity of flotation concentrates.

Testing Flotation Oils

Oils may be tested for their use in flotation plants and, in fact, no oil should be used until a thorough test has been made and its value for use in the plant proven. The great difficulty is that there is no standard way of making tests that will indicate the usefulness of an oil in flotation, so that the usual method is to choose a standard ore on which tests of all kinds are run and recorded, the effect of the oils being referred to this particular ore as a standard. This method has been brought out by J. Coutts.[3] He points out that the first thing to do with an oil is to measure its density for future calculation, as it will be measured by volume in the laboratory and there must be some method of transferring these volume units into weights.

Coutts classifies three different kinds of standard tests: First, one for mixed sulphides; second, one for differential separation; and third, one for the flotation of copper and iron sulphides. He believes that oils high in phlanderene are best for differential separation of zinc-lead sulphide ores. Phlanderene is an oily constituent that leaves a gummy residue on evaporation. It may be tested for by evaporating oils at moderate temperature and examining the residue, or it may be detected by the polariscope. An oil giving a deflection by the polariscope of 60 or over is considered to have a sufficient quantity of phlanderene for use in copper flotation.

For testing the number of drops of oil in each cubic centimeter a small burette is recommended, the discharge orifice of which has been made smaller by heating and dumping it up. About 80 or 90 drops per cubic centimeter should be given at normal temperatures. The number of pounds of oil per ton of ore can be found, when the specific gravity and number of drops in one cubic centimeter are known, from the accompanying formula:

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[3] "Aust. Min. Standard," Apr. 8, 1913. Reprinted in "Eng. and Min. Journ.," June 19, 1915.

$$\frac{2{,}240 \times sp.gr.}{453.6 \times drops\ per\ c.c.} = lb.\ of\ oil\ per\ ton$$

The great difficulty in testing oils for flotation is that it is not yet known what quality it is that makes oils of value for flotation. The only way to find out if an oil will do for this purpose is to try it on the ore to be tested. Some laboratories have under way series of tests looking toward the determination of the flotation quality of oils, and also the matter of changing the quality so that they may be used for flotation successfully. In this case reference is not had to the mere mixing of oils to secure good flotation froth, but the actual changing of the quality of the oil itself by such means as dissolving different materials in it, sulphonating it, or modifying it by heat or other treatment. Some progress is being made on the production of oils of good quality from cheap oils that can be obtained readily in particular localities.

The Classification of Oils

The New York Produce Exchange defines crude petroleum as follows: "Crude petroleum shall be understood to be a pure, natural oil, neither steamed nor treated, free from water, sediment or other adulteration, of the gravity of 43° to 48° Bé."

Since the production of the lower Baumé gravity oils, the limitations in regard to gravity have been relaxed. In order to ascertain whether or not the petroleum conforms to the foregoing rule, it is usually distilled in 10% fractions, and the Baumé gravity determined on each fraction. It is obvious that from the complexity of crude petroleum each succeeding fraction would show a somewhat regular graduation in specific gravity, whereas in cases of adulteration it would be more or less irregular. There are a number of tests that can be performed on oil to determine its constituents in oils of different gravities and also to determine the quantity of sulphur contained, the specific gravity of the oil, the water contained, and other tests. Burning oils are usually tested to show their flashing point. Lubricating oils are also tested in the same way to show their flashpoint, and in addition, their viscosity and their cold test—that is the temperature at which they become solid. All of these are set forth in detail in the textbooks on the subject of oils and are too complicated to be treated here, particularly in view of the fact that they have no relation whatever to flotation so far as we know at the present time.

Aside from the petroleums there are many liquid fats and fatty oils in addition to the solid fats. In the first class there are the vegetable oils, which may be divided into drying, semidrying and nondrying. In the second class are the animal oils, which are subdivided into marine animal oils, such as fish oils, liver oils and blubber oils; and the terrestrial animal oils.

The solid fats are divided into vegetable fats and animal fats, and the latter are subdivided into drying fats and nondrying fats. In these classes come a host of different kinds of oils, many of which have already been mentioned in this article and hundreds of which have not. It seems that almost every vegetable or plant will produce an oil having some different qualities from every other. There are also animal oils and fats of different qualities and having different effects. Only a few of the large number are of interest in flotation, because only those few occur in such abundance as to be commercially cheap enough to be used in commercial process of this kind.

*

Chile Mills

The superintendent of the New Homestake Mining Co. and the manager of the machinery company that makes the Rex chilean mill, united in giving us permission to publish the letter of Peter Garnnet, mill foreman, which he sent to the Rex company as a testimonial. Peter's report is crude but unalloyed gold. It is not only amusing, but also there is a certain amount of technical information to be derived from it. The first letter was addressed to the manager of the Rex company. The testimonial follows:

Mr. Jarvis Dear Sir:

after havin obtande the results that I hav from the Rex Chilian Mill I have desided to Give the Publick a few facts about what they can do. if you so desire you may hav the inclosed article publeshed in the minen *Journal* or Magazien, in fact eny where you so desire. you may correct statments by leeven out or aden to eny thing for your best ensterst. as I havent told half that I coad truthfuly tell if so amine too. I can more than Bere out every statment Made. I hav Som Pictures of the Mills fit up with new Steel and also Steel worn out. also shoin weight of New Steel and weight of old steel also showin how menny tons it Ground in waring a way more than ninty persent of the Steel. If you deside to hav the inclosed article poot in print please Send me a Copy of the Same. also if you at eny time desire eny infermation about the Mills Let me no what it is and it will Bee forth Comen.

Very Respkful yourse

PETER GARNNET.

Malin-ad. Independence, Idaho, General Delivery.

P.S. you Mite Send me a Celender for Crismess if youre Company Deels in Such Mashenry.

To Hoom it May Consern Set up and take notis and Gett a few facts about Chilian Mills and what they can doo. in the first place will say that I hav ben in the Mill Bisness for twenty od yiears and in five different States Namley, Montana— Idaho— Utah— Nevada & Colorado and in late yiears hav handeled twlve diferent Makes and impraved Makes, and hav allways Suceeded where others fald. Let me say rite here that there is more in the operatin of a Chilian Mill than the partickler Make, for they are all bilt to doo the same work. at the Present time I am at the New Homestake operatin fore Chilian Mills of the Rex Make that I installed more than eighteen months a go. to be asack they strted to grind ore on the 11 of May and hav run Constent ever cins. at present they are Grinden more than one hundred tons per Mill for every twenty fore hours running time. Under stand this is the hardest and tufest Rock to grind that I ever seen. I am Grinden it to thirty Mesh. it is crushed to about one inch before it Getts to the Mills.

Will now giv you a few facts that I beg you to note very Closley. after more than eighteen months Constent running under the Most Severe test that I ever Saw a mill poot thrue this is the Condishen they are in to day.

We will take the Mullar Barings and the Penion Barings which is the most important barings of the Mill, is just as perfect as the day they first started. all Bushens is in perfect order. Penians and Geer wheel, dosent sho ane particle of ware so far. in fact the Mills is just as Good in every way as they was the first day they ever run. Lost time for repare sofar Nothen. Cost of repars out side of Steel nothen. a few miner Changes made at a very small Cost. time Changen a full sett of steel from too hours and twenty five minits to fore hours. on Corse I hav a very simple proses of Keyen the Dy ring in plase that will hold it in plase and never moove eaven if it is worn ploom in too. on Corse that enables us to start the mill the moment the Steel is replased which I hav don in as Loe a time as too hours and twenty five m. a nother very important thing is the Geer Bolts in any make of a Mill they are allways loos. I hav a gear bolt that can not Lusen under eny Cercumstanses. in fact it is the little things that must be don and don in time. and there will be no big things to doo. You would not think of haven a miner repar youre watch pervided it cost a few hundred Dollars. A Mill is a Grate eal harder to repar and Keep in repar and needs more atenshen than eny other mashenry mad. for to obtaine the best results everything must be kep Just in as perfect order as the best wach ever Made. A Criple Cant doo the work.

Now for the Steel it is very important to no when youre steel is in the Shape to Giv the best results. youre steel should be run so as to Keep the out side of the Di ring and also the out side of youre muler tires the leest bit the thenest at all times. by so doin you will Gett the best results. you Should at lest Gett ninty persent ware out of youre steel. also remember that on some ores it is nesary to tun youre mills at a faster speede than others. Dependen on the hardness of the ore. a nother Good thing to remember is to find out how fine to crush the ore before it Goes to the mill. as in many cases they make it too fine to Gett the best results from the mill. I feel saft in sayen that I can under ordenry circemstanses Grinde too hundred tons of ore to a thirty mesh in twenty fore hours with a Six foot Rex Mill and with all the Experence I hav had with Chilian Mills and to take every thing in Consideration the Rex Chilian Mill is fully fifty persent better than eny mill I ever handeled. Still there is a few Miner improvements that no dout will be over com in the nere fucher.

I hav ben thinken of ofern to Giv som Manafactuer Compney the rite to patent a few of my ides about Chilian Mills such as Keyen the Di ring in also a geer bolt that Can not get loos and severl other small But very important things. that will all aply to eny make of Chilian Mill to Just see how nere wee can Gett one to perfection. Will say in coluden that this is no payed for advertestment, it is simply facts as I hav found them and I will invite eny one that this may interest if they dout eny Statment made to visit me at the New Homestake and be convinst that every word here riten is the truth, or adress me at Independence Idaho and I will Gladly answer all Comuniations. Respkful yours PETER GARNNET.

⁂

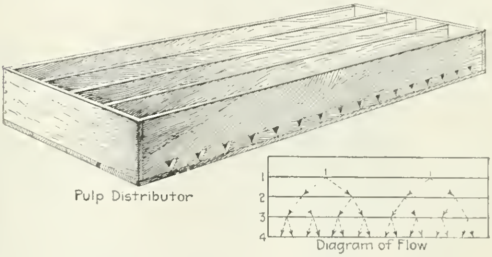
Tungsten Powder, in crystalline form obtained by the reduction of trioxide, if stirred into a solution of an alkali nitrite and heated at 127° for 3 or 4 hr., then thoroughly washed and dried, may, according to C. Trenzen, Brit., 14,381, June 15, 1914, be compressed into a bar, and consolidated by highly heating in vacuo or an inert gas. The product is stated to be ductile.

An Efficient Pulp Distributor

By ALEXANDER MCLAREN*

In plants where plate amalgamation is used for recovery of gold, it is important that the pulp be distributed evenly over the surface of the plates. With the splash from Chilean and Huntington mills this is not as easily accomplished as it is in the case of stamps. In amalgamating below such machines, I have used several forms of distributors, but have obtained by far the best results with the one shown in the accompanying sketch. It can be made in about two hours by anyone having any carpentering ability. For use at the head of the average-width plate the box will need to be 4 ft. long, 1 ft. wide and 4 in. deep, and made of 1-in. surfaced lumber.

Referring to the diagram, the partition marked 1 contains two triangular openings with the points down, the total area of the two openings being equal to the area of a 2-in. pipe. The next partition has 4 triangular openings the total area of which equals that of the preceding two. Partition 3 contains 8 triangular openings the total area of which is equal to the 4 in the preceding partition. Partition 4, the final discharge, contains 16 openings the total area equivalent to that of the 8 preceding ones.



A GOOD PULP DISTRIBUTOR

Each of the openings must be accurately spaced, so that the flow from it is evenly split and feeds two of the succeeding openings. If the mill pulp is delivered in the middle of the first partition, the box perfectly level lengthwise and tilted with the pitch of the plates, the tailings will "hutch" about each of the series of openings and an absolutely uniform flow will be obtained from each of the discharge openings. Round or square holes will not give the results obtainable from the triangular-shaped ones. I make no claim for the originality of this device, but have used it with success in a number of mills.

⁂

Cementation at Moonta

The satisfactory return of copper from the cementation process at the Moonta mines during the last four years is due principally to the provision for more expeditious treatment of the slime residues. Methods were introduced, according to the 1915 report of the Wallaroo & Moonta Mining and Smelting Co., Adelaide, South Australia, to accelerate the atmospheric oxidation. The whole of the slimes have been leached several times and the fine material must be given more rest. Without some plan to further increase oxidation the output from this source cannot be maintained and the production of cement copper will be more dependent on what can be secured from the tailings heaps.

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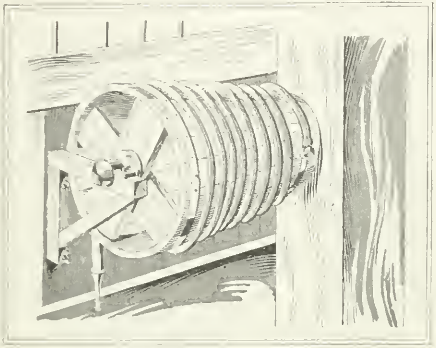
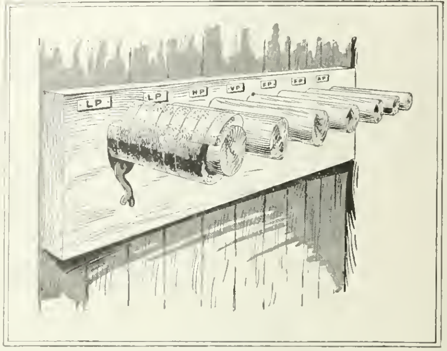
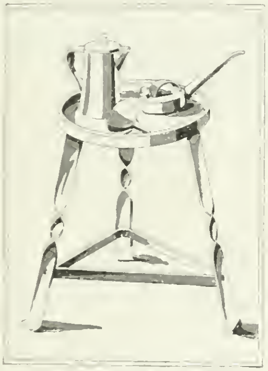
*Northwestern Mining Co., Bearmouth, Mont.

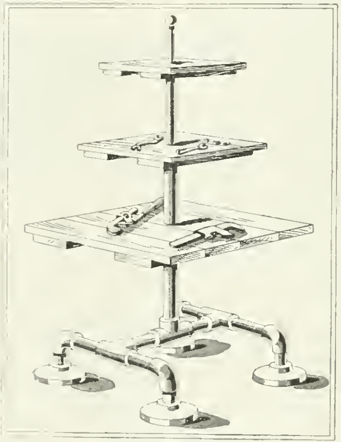
Handy Hints and Clever

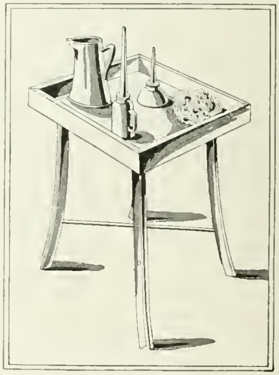

A HOME-MADE HOSE RACK

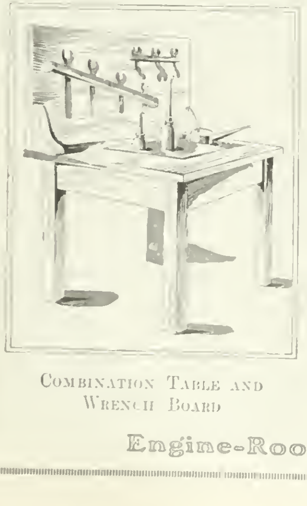


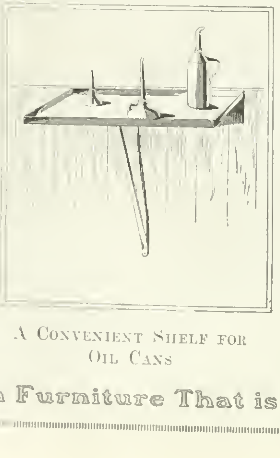
HANDY ROD-PACKING RACK

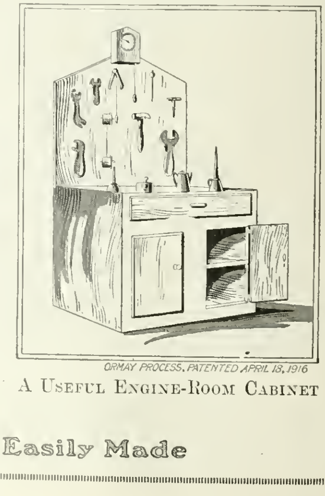

OIL-CAN STAND


PORTABLE TOOL STAND


OIL-CAN TABLE


COMBINATION TABLE AND
WRENCH BOARD

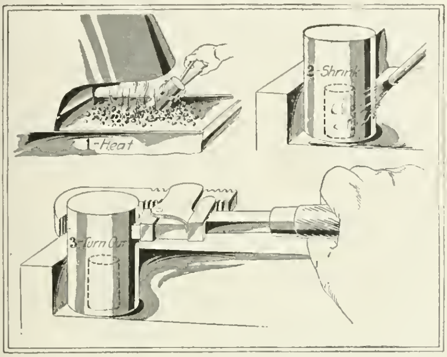

A CONVENIENT SHELF FOR
OIL CANS


ORMAY PROCESS, PATENTED APRIL 18, 1916

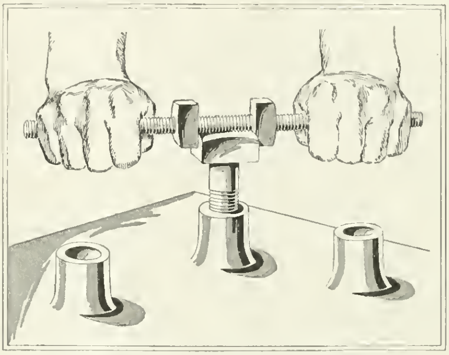
A USEFUL ENGINE-ROOM CABINET

Engine-Room Furniture That is Easily Made

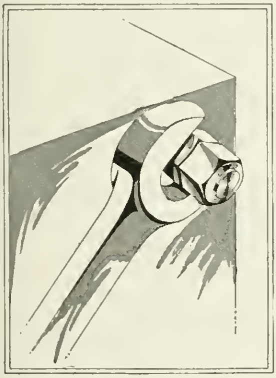
Kinks for the Power Plant



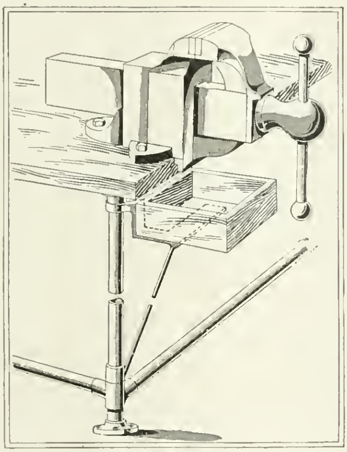
Getting a Grip on Tightly Driven Pin



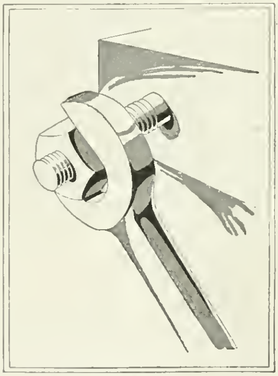
A Quickly Made Emergency Wrench



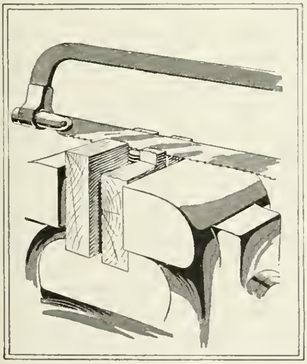
Pulling a Stud with Locknuts



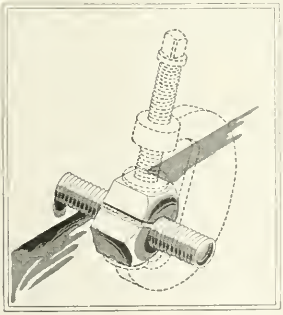
Swinging Drawer for Small Tools



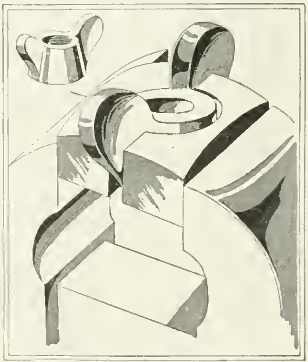
Pulling Stud with a Shrunk Nut



Holding a Screw for Slotting



Pulling a Stud with a Split Nut



ORMAY PROCESS, PATENTED APRIL 18, 1916

Wing Nut Held by Split Nut

Some Stunts That Work Out in Practice

Crushing and Grinding Machinery

SYNOPSIS—Crushing and grinding machinery shows a steady development, with but few machines of new types. The tube mill is the only novel appliance of recent years. Types are discussed and advantages of steel compositions are mentioned.

The changes in recent years in crushing and grinding machinery have been less, perhaps, than in any other line of metallurgical machinery. This is not to say that new devices are not being continually invented and placed upon the market, but operators seem slow to adopt these machines, preferring to wait until each new idea has been thoroughly tested out and has proved its efficiency beyond all doubt. As a matter of fact, few of them have been able to demonstrate superiority in sufficient degree to make them universally acceptable. The only grinding machine that has become standard in recent years is the tube mill, and that has been adopted from the cement-making industry, which has used it successfully for a number of years.

Primary Breaking Appliances

Primary breaking machines are reasonably divided into two classes, the first including the machines of the Blake type and the second the breakers of the gyratory type. In former years a third machine was considered a type of primary breaking device, this being the Dodge type of crusher, but this has fallen from its former position, first into the class of secondary crushers and finally into disuse almost together, since other kinds of machines have seemed able to do its work cheaper. The Blake and gyratory types, then, remain preëminent in the field of preliminary breaking.

A great many mills make use of the gyratory machine as the primary crusher, using it in large sizes to break down boulders and large pieces of ore coming direct from the mine. The gyratory crusher has been for years considered best suited to work of the kind, and most of the mills constructed previous to the last four or five years have used it for primary breaking. Recently, however, opinion has tended the other way, and some of the new installations are using breakers of the Blake type to do the work that was formerly given to gyratories—breaking down large oversized boulders and pieces of ore coming direct from the mines. Blake breakers are now made to receive pieces as large as 48x90 in. In this way they can be made to take the largest pieces of ore that ordinarily come from the mines.

Possibly the reason why the Blake-type crushers are replacing gyratories for large work is that the latter is a much more complex piece of machinery and the cost of repairing it is considerably greater than in machines of the Blake type. Should it come about that the Blake breakers displace gyratories for preliminary breaking, it is possible that the latter will have no place in the modern mill. Stage crushing may be done through Blake breakers of various sizes, until the ore is reduced to such size as is applicable to roll crushing.

Secondary crushing may be done, as has been pointed out, by Blake breakers, or it may be performed in any one of several other kinds of machines. The Symons disk crusher is a new aspirant for honors in this field and has succeeded in making a permanent place for itself in many mills. Rolls may also perform this work, and there are various other machines that have been applied to it. Breakers of the hammer type or the chain-and-hammer type have been used, but their application is so limited that they cannot be called, as yet, a universally applied type.

Another machine that has been used for secondary breaking, and one that is coming into more general use at the present time, is the ball mill. The ball mill is not new, but is of a type that has been used for many years, the Krupp machine being possibly the best known. These machines have been made for a number of years and have been used in some industries, but in mining they have never become very popular. The Krupp machine is unpopular because of its complex construction and the fact that it carries screens inside the drum, these screens wearing out rapidly and being unhandy to renew. The ball mills that are the most popular at the present time are the Hardinge conical style and the ordinary drum ball mill made by various manufacturers. The Marcy mill comes under this heading, since it is of the ball type. It also carries screens for sorting the ground material. In the latter mill, however, pains have been taken to make removal and renewal of the screens easy and rapid. These efforts may be said to have been successful, and the mill is in use in several of the large, modern plants.

The Marcy ball mill is practically a tube mill with length less than its diameter and is also fitted with lifters. It uses heavy steel balls to accomplish the breaking. This machine contains two compartments—one the grinding drum proper, where the useful work is accomplished, and another smaller one, divided from the main part of the mill by a perforated diaphragm. This diaphragm allows ground material to pass through into the smaller chamber, in which the screens perform a further separating service, the oversize being returned to the grinding chamber of the mill and the undersize discharged. The object of the diaphragm is to allow all material to pass quickly through to the end of the mill, while lifters are inserted that expedite circulation and discharge and eliminate the restricted flow that occurs with the center-overflow discharge.

The Status of the Stamp Mill

As secondary crushing machines, probably the stamp is the best known of all, since it has been in use for many years and has been employed for all kinds of crushing, much of it being of a kind for which it was not at all fitted. The characteristics of stamps are so well known as to require no elaboration here, but it is noteworthy that, while it has been acknowledged to be less efficient than many other machines, it has qualities that have enabled it to withstand many years of competition and still hold a place for itself in metallurgy. As a result of the attack made upon it within the last 10 years, however, the stamp is gradually retiring and, except in special cases where ores are of a peculiar character that seem to require it, the stamp will probably be very little used in mills that are to be constructed in the future. In corroboration of this view it may be noted that the new mills in the Alaska low-grade gold fields are being largely equipped with rolls instead of stamps.

These mills propose to beneficiate a low-grade gold ore by concentration, and the breaking and crushing scheme is to pass the ore in stages through breakers and rolls. Even in gold mills in which ore of good grade is to be beneficiated, the stamp will probably be displaced except in those instances where mortar and plate amalgamation are to be the only methods of gold recovery. The Nissen stamp, a variation of the ordinary gravity stamp in which each stamp works in a separate mortar and has a very large comparative area of discharge, has been successful in some instances and is still being used with good results in a number of cases.

It is of interest to note that at the Dome mill, at Porcupine, Ont., ball mills are replacing stamps as breakers. These mills are of the Hardinge type, 8 ft. in diameter, the cylindrical part being 30 in. long. Six of these mills are to be installed and are to take 3-in. feed, reducing it to about 10 mesh.

THE DEVELOPMENT OF STAGE CRUSHING

Probably the most important development in ore crushing in recent years is the growth of the idea that no machine in existence is capable of crushing ore efficiently from large pieces to the fine meshes necessary in preparing most ores for treatment. The idea is being recognized that each machine has its most appropriate field and that it should not be called upon to do anything else. It is possible, of course, to put 2-in. ore into a stamp mill and reduce it at one operation to minus 40-mesh, but the work is not efficient and can be done more cheaply by using more appropriate machines. Modern metallurgists recognize the advantages of stage crushing, and the mills designed at the present time are arranged to take advantage of it. In this connection it is interesting to quote from an article by Philip Argall, in the *Journal* of May 11, 1904.

> Those of us who have investigated the mechanical efficiency of a given machine, meaning thereby the pounds of ore crushed per horsepower-hour from and to stated maximum sizes, know that each machine of value has its economic limit at which it will give the maximum output in pounds per horsepower-hour, and also that there are fixed ratios of reduction that should not be exceeded. These limits, however are not in every case determined, yet I have no hesitation in stating that the machine which reduces a 2-in. cube to pass a $^1/_{50}$-in. screen aperture in one operation is a very inefficient apparatus, even if it should prove to be the most modern 1,350-lb. stamp.
>
> I have elsewhere shown that the efficiency of a rock breaker falls off rapidly when a reduction exceeding 4 to 1 is attempted, say 8-in. to 2-in. cubes, and that the same rule holds good for rolls; and that for reducing ores below 2 in., rolls are vastly superior to rock breakers, for the reason that while both machines work practically on the same principle, one is an unbalanced or imperfectly balanced intermittent-action reciprocating machine, and the other a perfectly balanced continuous-action rotary machine. Large rolls could be constructed that would compete favorably with rock breakers on sizes above 2 in., but they would be heavy, cumbersome and difficult to transport to the metal-mining regions, so I hold that the combination of breakers and rolls I have indicated best answers our present requirements in metal mines where the rock going to the breaker is never of unusual size—as quarry rock for example.

The idea elaborated in these paragraphs was true at the time it was written and holds good now. Perhaps the one change that may be considered justified in speaking of the matter now is that large rolls are being successfully used in many places.

In speaking of the question of rolls, it may be said that one of the principal objections to their use has been the fact that in ordinary work corrugations were almost sure to appear in the roll shells, and for this cause their crushing work was considerably reduced. To avoid excessive corrugations, it was believed necessary to have an expensive, highly skilled roll operator in charge of the work, and since individuals with this requirement were not easily to be had, it was considered an objection to the use of rolls. Improvements in the design of the machines, however, particularly the detail of successful fleeting, have brought them to the point where they can be used successfully without the peculiarly great amount of supervision that was at that time considered necessary.

CHILEAN MILLS AS GRINDERS

The grinding stage following rolls will depend entirely upon what is to be done with the ore. If it is to be treated by some metallurgical process that requires its passage through comparatively fine screens—say 20- to 80-mesh—the rolls may, and do in some cases, deliver direct to tube mills, while in other cases the grinding may be performed by some one of the chilean-mill type or even by finer rolls. Chilean mills are of two types—either the slow- or fast-running machines. In the first class is included mills of the older style such as were formerly used in Mexico—and of which many are still in use—in which there are usually two heavy rollers revolving slowly on a specially prepared die. The chilean mills as used at Angustias and in Pachuca have a die diameter of about 7 ft. and use rollers 7 ft. in diameter, 22 in. face, and weigh between 7 or 8 tons each. Revolutions are at the rate of 12 to 15 per minute, and capacity to 30-mesh screen is about 15 tons per day. These mills require about 15 hp. for operation. Mills of the type known as the Monadnock, the Akron, Evans-Waddell, Bryant and others, are of the high-speed type, usually having smaller die diameters (running up to 5 or 6 ft.), smaller rollers (from 3 to 4½ ft. in diameter) and operate at much higher speeds, usually in the neighborhood of 30 r.p.m. Examples of the use of such machines that are doing good work may be found at Stratton's Independence mill, near Victor, Colo., and at the Portland mill at the same place.

In referring to the use of stamp batteries, Julius I. Wile, in the *Journal* of Apr. 17, 1915, says:

> For tough ores it is probable that stamps will continue to be used on account of the high iron consumption of the ball mills on such ores, and it should be noted that on the Rand in South Africa the combination ball-and-pebble mill was tested against stamps and rejected, supposedly on account of the heavy iron consumption. The stamps generally used in America are the 5- and 10-stamp multiple batteries, the stamps being from 1,030 to 1,400 lb. falling weight. The 2,000-lb. Nissen stamp in tests on the Rand has demonstrated that it takes 25% less power and 10% less iron than the older type of the same weight, and this can be attributed to the quickness of discharge of the Nissen, due to the circular form of mortar surrounding the stamp shoe. Nissen stamps are also less costly to install when foundations and less space occupied are considered. It is well known that in the Lake Superior copper district, steam stamps have been used for years, and it would seem that here a heavy power-driven gravity stamp could be employed to advantage, as although the same power per stamp would be used for the same falling weight, it should use less fuel per horsepower than the direct steam stamp. In gold and silver milling, as cyaniding is now largely used there is no longer the objection to the use of heavy stamps on account of the slimes which would be made, and coarse screens are now used, as the finishing is done in pebble mills.

Tube mills were introduced into the metallurgical field as a direct result of the requirements of the cyanide process. When it became apparent that slimes could be treated more rapidly and with a higher extraction percentage than sands, some method of easily grinding so that a maximum of slimes would be produced was required. The tube mill, formerly used in the cement industry—where extreme fineness is required—was adopted and almost immediately became standard practice. The overflow type of tube mill is the one most generally used, the circulation through which depends on the amount of feed and the discharge on the amount of slimes that are displaced, come to the surface of the pulp and float out at the center. The discharge of tube mills of this kind may be protected by a grid or perforated plate that will permit the exit of ground material without the loss of pebbles, or the mill may be operated without any protection at all, which is often done. In place of the grid for retaining the pebbles of the mill, a device which consists of a funnel-shaped discharge casting that is fitted to the discharge end of the tube mill was originated by Walter Neal. On the inside of this casting was placed a spiral screw-like riffle, operating in the direction opposite to the mill rotation. Any pebbles tending to escape through the discharge orifice were caught in this screw and returned to the interior of the mill. In many cases the discharge orifice was used as the point at which fresh pebbles were fed, since it was easy enough to throw them into the opening where they would be caught by the screw and delivered in the interior of the mill. In view of the fact, however, that the discharge end of the tube mill is the wrong place to use new pebbles for grinding, that practice has not been continued, and pebbles are almost universally added now at the head end of the mill through the scoop feeder.

Tube mills are of many makes and specifications, but there are only two types that have universal attention. These are exemplified by the Hardinge conical mills and the ordinary cylindrical mills. The diameter of mills that have been used heretofore has varied mostly from 4 to 5 ft., and the length from 16 to 22 ft. The tendency now, however, is toward larger diameters, running sometimes to as much as 8 ft., and much shorter lengths, a 6-ft. length being not unknown. It is believed that with large diameters and short lengths and by dividing the grinding into stages, much more economical results are obtained.

Flint and Iron Pebbles for Grinding

Flint pebbles have been used almost entirely for tube-mill grinding heretofore, the best having been obtained in the Scandinavian countries—Norway, Sweden and Denmark offering a good supply. The flint-pebble industry has grown considerably in France, however, where it is confined almost wholly to the coast line between Havre and Dieppe. A report of the United States Department of Commerce states that the pebbles collected in and near Havre are selected for their spherical shape and are used exclusively for pulverizing. Another important use of flint pebbles is in the manufacture of porcelain, but for this purpose a pebble of purer flint is used than those found at Havre. The porcelain flint is found on the French coast in the region of Fécamp and Calais. These pebbles need not be spherical, since they are utilized by being crushed into a powder, which becomes an ingredient of the paste used in the manufacture of porcelain. To some extent, however, the round pebbles found at Havre are used for pulverizing in the porcelain industry.

The flint pebbles are gathered by women and children. Prior to the war the price to pickers was 15 francs ($2.89) per ton for the best flint pebbles, and 5 francs ($0.96) for ordinary. A leading shipper reports that the quantity shipped to the United States in 1915 was about 25% less than in the preceding year. He attributes this decrease to several reasons, including the scarcity of male labor, the lack of transportation facilities and the congestion of the port of Havre, which did not permit the usual temporary storage on the quays of the bags of pebbles intended for exportation. The cost of labor has also risen steadily, as has that of transportation, and the prices of bagging used as covering has also steadily risen, thereby necessitating an increase in the prices of pebbles.

The increase of price of pebbles, together with other factors which have seemed to make it necessary, have resulted in a change of opinion toward the use of steel or iron as a substitute. Many experiments have been made on the subject, and the result is that a number of mills are making actual use of pebbles of an iron or steel composition. Those known as "manganoid" have been experimented with successfully at Porcupine and Cobalt, and in some of the mills are in regular use.

Utility of Manganese and Chrome Steel

An interesting discussion has been taking place recently relative to the comparative advantages of manganese steel and chrome steel in crushing machinery. The discussion originated in an article by Douglas Lay, describing the grinding in the Slocan district of British Columbia. This was published in the *Journal* of Mar. 11, 1916. Mr. Lay called attention to the fact that the feed-roll shells were made of manganese steel, while middling-roll shells were made of chrome steel. At the St. John del Rey mill, at Morro Velho, Brazil, manganese steel, which gave such admirable results in rock breakers and tube mills, did not compare favorably with the chilled-iron shoes and dies for the stamp mill which were made at Morro Velho. In testing two types of liners for tube mills, it was found that the one with the deep channels had a much longer life than one with shallow channels. In the discussion of chrome verses manganese steel, Frank E. Johnson, of Salt Lake City, Utah, offers some figures in the *Journal* of May 20, 1916. He found that the cost per ton milled with chrome-steel jaw plates was $0.00138, while with manganese-steel jaw plates it was $0.00054. He calls attention to the fact that in another test, run at another property during the first part of 1914, chrome-steel plates crushed 48,736 tons of ore and manganese-steel plates crushed 99,451 tons of ore. In this case both plates were made from the same pattern. As to the use of balls, Mr. Johnson observes that there are practically no manganese-steel balls used at the present time, but that he is familiar with the test in which manganese-steel balls, specially made, gave slightly better service than chrome steel. He calls attention, however, to the fact that their manufacturing cost is greater than for chrome steel, making the latter more economical.

Mr. Lay adds the further comment that in the case of feed rolls crushing material roughly 1½ in. in size, his experience is that manganese-steel shells have at least double the life of those of chrome steel. In the case of finer material the difference is not so marked, and consequently the advantage lies with the cheaper chrome-steel shell.

In the 240-stamp mill of the Alaska Treadwell Gold Mining Co., in Alaska, 1 lb. of chrome steel in shoes crushed 2.7 tons of ore, and in the 300-stamp mill it crushed 2.44 tons. In the 240-stamp mill 1 lb. of iron in the dies crushed 5.83 tons of ore and in the 300-stamp mill, 4.09 tons. All dies used in the mills were cast at the Treadwell foundry. At the Alaska-Mexican, in Alaska, 1 lb. of chrome-steel shoes crushed 2.18 tons of ore, and 1 lb. of Treadwell dies crushed 5.34 tons of ore. At the mill of the Alaska United Gold Mining Co., 1 lb. of chrome-steel shoes crushed 2.59 tons of ore; and 1 lb. of Treadwell foundry dies crushed 6.12 tons of ore. The matter of manganese versus chrome steel for crushing machinery parts is still open, and there will undoubtedly be more discussion about it. It is apparent, also, that an effort is being made to replace flint pebbles by some metal composition, and this will probably be successful in time.

The feed to tube mills varies considerably and has usually been about 10-mesh, but the tendency at the present time seems to be toward coarser material. On regrinding work it has been found that where tube mills are fed with extremely fine material, their efficiency is considerably lessened. Attempts have been made to better this by adding a considerable proportion of coarse material along with the fine that is to be reground. For example, the Tonopah mills make a practice of adding a percentage of coarser material to their regrinding tube mills. It is claimed that a much higher duty is obtained from mills so fed. It is said that as high as ½ in. is fed to the tube mills at the Dome mill in Porcupine and a small portion of ¾-in. material is fed at the Nipissing in Cobalt. The reason is that it has been found that tube mills will handle coarser feeds, and enlarging the stamp-battery screens increases tonnage to such an extent that the per-ton costs are lowered. It is probable that this fact has been a reason for the change of crushing machines at the Dome that has already been chronicled. Here the stamps are to be replaced by ball mills, apparently the conclusion having been reached that the delivery from them is better fitted for tube milling than that from the stamps. Of course the impelling cause of any change of this sort is an ultimate saving of cost or the obtaining of better results or both. In this instance, however, it appears that the metallurgical results will be much the same, while the cost will be appreciably lowered.

It is worthy of notice that a good many of the grinding machines that were popular not so many years ago have been eliminated almost entirely from present-day metallurgical work, at least in this country. Among the machines that may be so classified are the Huntington mills, which were once standard equipment in concentrating and cyaniding plants. They have proved too expensive, however, and their maintenance cost was out of all proportion to the results obtained. The grinding pan is another machine that has dropped out of serious consideration and is now to be found very seldom in this country, although still largely used in Australia. There are one or two instances of its use lately in South America, but it has been considered here that ordinary grinding, finishing with tube mills, is preferable. Of course there always were many highly complicated machines that were designed to perform certain work, most of them peculiar in appearance and operation, but it is hardly worth while to go into details of machines of this class. One of them that did good work for a time and then was superseded by more efficient machinery, was known as the Kincaid mill. It is very seldom used at the present time. A common fault of the Huntington mill, which has just be mentioned, was the uneven wearing of the roller rings. Instead of wearing evenly to successively smaller concentric circles, they frequently assumed polygonal shapes and then pounded around the inside of the die ring instead of rolling in continuous contact with it. When this fault becomes aggravated the grinding falls rapidly.

The Marathon Mill

A new mill that is being tried for finishing grinding is known as the Marathon mill. It consists of a drum or tube, similar to the ordinary tube or ball mill in which pebbles or balls used for crushing are replaced by cylindrical steel rods, or shafting. The mill contains a charge of these rods sufficient to do grinding work, and the tube is revolved at a speed comparable with that of the tube mill. Grinding is performed by the falling of the pieces of cylindrical steel rods one upon the other, or by their attrition against each other. It is claimed that by the use of rods instead of pebbles or balls, the pulp is subjected to more grinding action, as in contradistinction to the mill charged with pebbles, the contact is over a long line instead of being limited to a point. A test of the Marathon mill has been carried out at the concentrator of the Detroit Copper Mining Co., of Arizona, at Morenci, in which the advantages of the mill have been pointed out. The diameter of the rods used varies from 2 in. to ⅜ in., these various diameters causing them to fit compactly and thus requiring a minimum falling distance to deliver a crushing blow. The center of gravity of the charge of rods is nearer the axis of the mill than in a mill of greater diameter whose crushing charge consists of steel balls or pebbles.

A characteristic of the Marathon mill that has been developed at the Detroit concentrator is that the discharge of the mill is uniform whatever the feed, or, in other words, if the feed to the mill is increased, the product is uniformly coarser, and if the feed is diminished, the product is uniformly finer. The result, according to this, indicates that the discharge from the Marathon mill is uniform, and does not consist of great differences of oversize and undersize, as is the case with most grinding machines of the type.

Two tests were made of the Marathon mill, and in the first test the most favorable results were obtained with a pulp which contained 36.7% solids. In test No. 2 the amount of water and slime in the feed was reduced to a minimum by shovel-wheels to secure a less volume of pulp and a consequent slower velocity of material through the mill. The tonnage in test No. 2 was greatly increased over that in test No. 1. The feed contained an average of 63.5% solid and only 2.92% minus 200-mesh slime. The speed in all of the tests of the Marathon mill was 30 r.p.m. In a diameter of 3 ft. at 30 r.p.m., there is no dead zone in the periphery of the mill, while excessive slipping of rods is prevented by having the liner plates thicker at each edge than in the middle. This results in a corrugated interior surface, and the lining is said to retain these corrugations until it is worn out. The rods are said to wear evenly from end to end, do not get crosswise in the mill, and are reduced to a diameter of ⅜ in. before they begin to crush, flatten out or break into pieces. When worn to this thinness, some rods roll up and are discharged; the short-length pieces retain their positions in the charge of rods without any serious result, but may reduce crushing efficiency to some extent. It is said to be good practice to take out the entire charge of rods every ten days, take out the small and disabled rods, and replace the loss in weight with 1¼-in. rods. As soon as the weight of rods consumed per day was determined, their loss in weight was replaced daily with fresh rods. The mill must be closed down to add the daily charge of rod. During the test the Marathon mill was tilted ¼ in. per ft., but later tests showed that it would produce equally as good results when run horizontally.

In No. 1 test the Marathon mill crushed 236.5 tons of dry feed in 24 hr., and in test No. 2 the mill crushed 440 tons of dry feed per 24 hr. The horsepower consumed per hour in test No. 1 was 18.6 and in test No. 2, 22.5. This makes 0.5316 tons of dry feed per horsepower-hour in test No. 1 and 0.8148 tons of dry feed per horsepower-hour in test No. 2.

MIAMI'S NEW POWER PLANT

Perhaps the most important improvement that the Miami Copper Co. has in hand is the new Diesel power plant. This new addition embodies some interesting equipment and an important saving in operating cost over the present unit. The equipment includes three Nordberg-Carels Freres Diesel engines of 1,250 hp. each, sea-level rating, direct-connected to General Electric 6,600-volt alternating-current generators. Allowing for altitude, the output of each generator is expected to be at least 720 kw. The new power installation, including buildings, will cost not far from $300,000, but there will be a saving of about $75,000 per year in operating cost over the present steam plant, which is today perhaps the most efficient in the Southwest, having an over-all thermal efficiency of 12.75%. The oil consumption of the Diesel plant is expected to be about one-half that of the present steam plant, which burns oil under the boilers. A thermal efficiency of approximately 30% is expected from the new Diesel plant.

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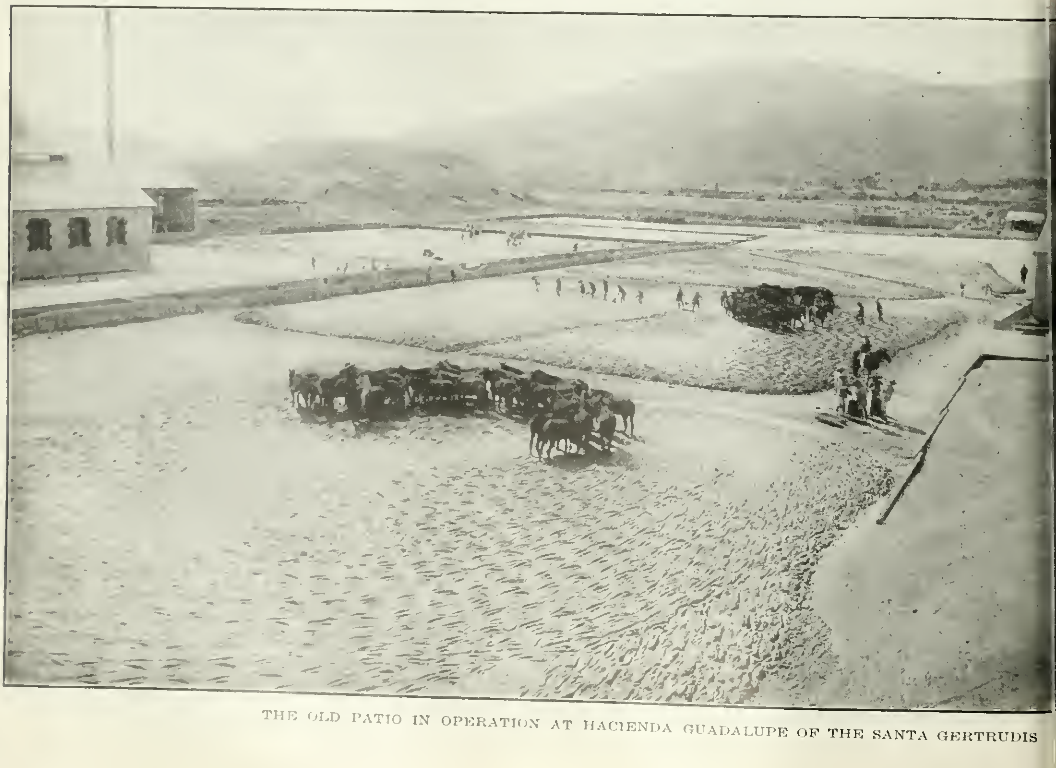
The Patio Process

The patio process is the great classic of silver metallurgy. Previous to its invention the recovery of silver was by slow, expensive and laborious methods that produced only small quantities at a time. The advent of the patio process marked the beginning of the enormous production of silver that came from the Spanish-American countries, a production that has grown gradually and continually up to the present time.

The patio process was invented by Bartolomé de Medina, at Pachuca, Mexico, in 1557. While it is still in use in a few isolated localities in Mexico and other Latin-American countries, it has practically disappeared from serious metallurgy and is only used as an alternative in highly specialized cases where a small amount of ore of a particular class is to be treated. The use of the system began to decline about the time of the invention of the Washoe process, which was applied to the silver ores of the Comstock lode in Nevada. It was still largely in use up to about 1900, but not far from that time the production of the pan process and the



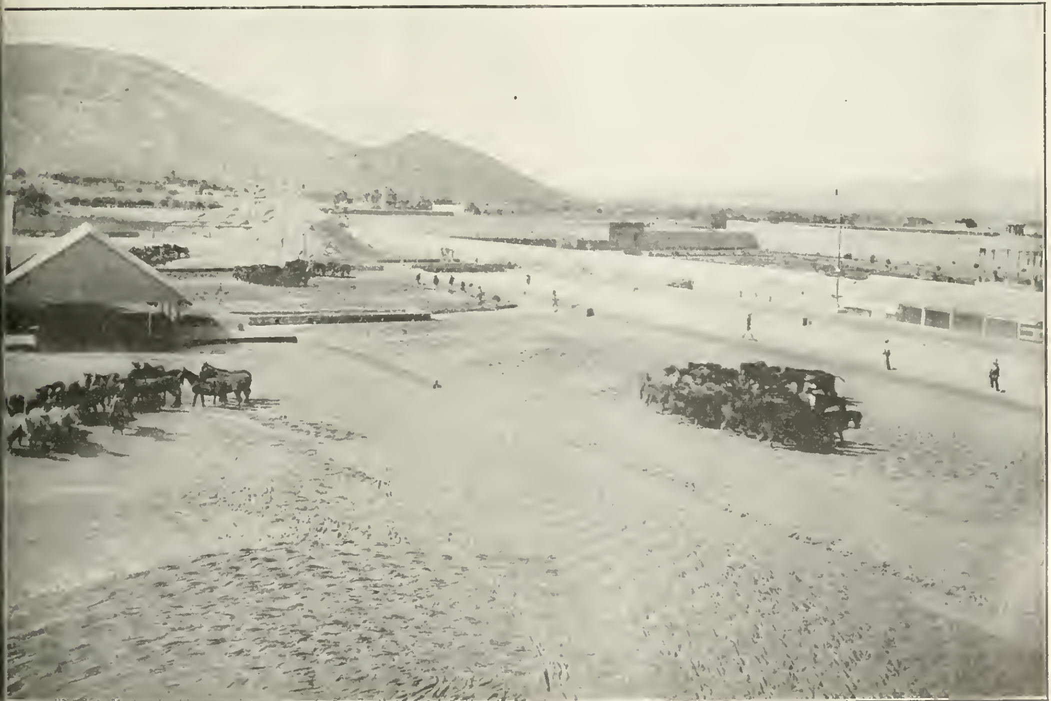
THE OLD PATIO IN OPERATION AT HACIENDA GUADALUPE OF THE SANTA GERTRUDIS advent of cyanide retired it rapidly into the class of those processes that have been famous but exist no more.

The institution of the process at Pachuca brought into production the famous mines of that camp, which continued to be worked profitably by the same process until about 1905 or 1906, although more modern processes had been instituted before that time. The patio process has also accounted for much of the immense volume of silver that was produced from the famous Mexican camps of Taxco, Guanajuato, Zacatecas, Chihuahua and all those other famous mining camps that gave Mexico its reputation as a silver producer and added immense wealth to the Spanish throne. It likewise accounted for immense productions of silver from the other Latin-American countries.

The patio process is adapted to treating ores in which silver occurs as a simple sulphide—argentite—or the complex antimonial and arsenical combinations that occur so often in the large North and South American silver deposits. In carrying out the process, the ore is first broken down by some means to a size such that it can be handled in the chilean mill, another invention of Latin-America for the metallurgy of precious-metal ores. The chilean mill, as everyone knows, consists of a heavy roller crushing ore on a die, which is a circular track in the ground. The original chilean-mill roller was cut from stone, and the size of the wheels varied from 5 to 8 or 10 ft. in diameter, the face running up to 20 or 25 in. in width. The die upon which this wheel rolled was also built of hard stone, the diameter of the track varying considerably in different instances and sometimes reaching as much as 15 ft. or more. A shaft was passed through the center of the roller, one shaft end being made fast to a vertical stake in the center of the mill, the other extending out beyond the track and being moved by mules or horses hitched to it.

In the chilean mill the ore was broken down to a size varying from very fine material up to pieces ¼ in. or ½ in. in diameter. This material was then taken to another grinding machine known as the arrastre. As was the case with the chilean mill, this machine was built in the ground and consisted of a stone-paved track of circular shape, having a central vertical stake and an arm reaching from that stake out across the track and being moved by mules or horses, just as the chilean mill was actuated. The grinding, however, was done by large, heavy, flat stones, as hard as could be secured, one end of which was attached by rawhide thongs or chains to the horizontal arm of the machine. The length of the connecting chains was made so that the front end of the flat stone was slightly lifted from the bed of the arrastre, the rear end dragging on it. With this machine water was added to the ore or not, as the case seemed to require, and the flat stones were dragged around, grinding the ore to a fine powder or paste between the heavy drag stones and the paved floor of the machine.

Having ground the ore to the required fineness, which was just as fine as could be secured and usually consisted of a pulp containing a large proportion of minus 200-mesh material and varying portions of granular material averaging perhaps about 40-mesh grade, it was then drawn from the arrastre and taken to the patio.



OMPANY AT PACHUCA, MEXICO, A TYPE OF ANCIENT SILVER-RECOVERING PROCESS

This was simply a large floor or yard paved with flagstones or some other smooth material. It was not covered, since the air and sun were required for the carrying out of the chemical part of the process. These patios often reached several acres in extent. The pulp on the patio contained enough water to make a pasty mass of it, but not enough to allow it to run.

The actual metallurgical process commenced by the addition of salt and copper sulphate to the mass, which was then thoroughly mixed by men with shovels, aided by a troop of mules or horses that were driven around in the mass. After the salt and copper sulphate had completed the chemical work required, quicksilver was added to the mass, or *torta*, as it was called, and the mixing and treading process began again. This was continued until thorough amalgamation of a great portion of the silver was secured.

In many cases common salt derived from evaporation of salt-lake waters or mined from rocks was used, and the copper sulphate employed in the early days was the *magistral*, or crude copper sulphate coming from the mines. The amalgamation of silver in the patio process was assisted by action of the air and sun, and frequently took thirty or more days to accomplish extraction of the maximum amount of silver from a single *torta*. Having reached the highest possible extraction, the *torta* was taken into large settling tanks, much like the mechanical cyanide agitator, in which the pulp was diluted with a large quantity of water, kept in slow motion and the quicksilver allowed to settle to the bottom, while the pulp containing the ground ore was allowed to float away. The quicksilver and amalgam recovered was retorted, and the silver was melted into bars.

Notwithstanding the crudeness of this process, a comparatively high percentage of extraction was obtained, often 90 to 93% of the silver being recovered. The disadvantages were that the cost was extremely high, a long time was required for operation, and very little of the gold was recovered. From silver ores containing small amounts of gold, which are common in Mexico and Latin-American countries, usually less than 30% of the gold was recovered. Great quantities of patio tailings have accumulated in Pachuca and Guanajuato, some of which is being worked over again.

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Aluminum Industry

E. Collett, in *Polyteknisk Forenings*, Christiania, Dec. 16, 1915 (through *Journ. Soc. Chem. Ind.*, Mar. 31, 1916) says that the world's production of aluminum in 1912 was 60,000 metric tons; for 1915 an output of 100,000 tons was anticipated, but owing to the war barely 80,000 tons was made. The present price of aluminum in Norway is 3 to 4 kr. per kg. (1s. 6d. to 2 s. per lb.). Crude bauxite is now freed from silicates and impurities for the European aluminum industry in the south of France. The conditions for the production of the metal by thermo-electrolysis are particularly favorable in Norway. For the production of 1 ton of aluminum 5 hp.-yr. is required. Outside Norway the cost of 1 hp.-yr. is estimated at about 50 kr. (£2 15s.), or 250 kr. (£13 15s.) for 1 ton of the metal (25% of the total cost). In Norway the horsepower-year costs only 20 kr. (£1 2s.), or 10% of the total cost of production, owing to the cheapness of water power.

Mercury from Zinc Blende

F. Juretzka, in *Metall u. Erz.* 1915, XII, 307, *Chem.-Zeit.*, 1915, XXXIX, Rep., 443, and *Journ. Soc. Chem. Ind.*, March 31, 1916, says that zinc blende from the Rhine district contains at times 0.005 to 0.01% of mercury, probably due to an admixture of fahl ore. When the blende is roasted the mercury vapor escapes with the gases, and when these are utilized for the manufacture of sulphuric acid, the mercury is deposited partly before reaching the Glover tower and partly in the Glover tower and in the lead chambers. Sludge from the Glover tower contains 5 to 8% and that from the chambers 3 to 5% Hg. The sludge is drained, mixed to a stiff paste with "lime-sand" (waste from lime burning) and then with just sufficient lime to neutralize the acid, and the mercury recovered by distillation at a dull-red heat.

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Reduction of Roasted Zinc Blende

V. Lindt, in *Metall u. Erz.* 1915, XII, 335 (through *Journ. Soc. Chem. Ind.*, Mar. 31, 1916), reports that in the reduction of roasted zinc blende of low sulphur content (2 to 3%) sulphide-sulphur acts injuriously when the ratio of zinc to sulphide-sulphur is less than 10 : 1 and favorably if this ratio is 18 : 1. Sulphate-sulphur is detrimental to the reduction of roasted blende containing 1 to 2% of sulphide-sulphur when the ratio of zinc to sulphate-sulphur is 4 : 1 and favorable when the ratio is 5 : 1. In the case of products with a relatively high content of sulphide- and sulphate-sulphur, the sulphur acts injuriously on the reduction if the ratio of zinc to sulphide-sulphur is less than 20 : 1 or of zinc to sulphate-sulphur less than 6 : 1. The loss of zinc on reduction is higher with products, free from lead, in which the sulphide-sulphur is present entirely as iron sulphide, and in those of very low iron content or in which the iron is present entirely as zinc ferrite, than in other cases.

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Lime-Iron Singulosilicates

The properties of the system $2FeO.SiO_2 + 2CaO.SiO_2$ have been recently examined by B. Selivanoff (*Rev. Soc. Russe Metall.*, November, 1915; abstr. *Journ*, Soc. Chem. Ind., Mar. 15, 1916), who melted silica, lime and iron peroxide in an iron crucible in an electric resistance furnace. Fe_2SiO_4 melts at about 1,260° C.; there is a maximum at about 1,260° C. corresponding to $2Fe_2SiO_4.4Ca_2SiO_2$, and between these two points is a eutectic at about 33% (molecular) Ca_2SiO_4 and about 1,160° C. Heated in a current of hydrogen, reduction begins at about the following temperatures:

Fe_2SiO_4	100%	85%	65%	50%	40%	30%
Temperature, deg. C...	225	210	205-210	170	180	250

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Improvements at Miami Mill

The May output of the Miami Copper Co. of 4,600,000 lb. of copper established a new high record for that company. The capacity of the mill at Miami, Ariz., will be gradually increased to permit a monthly production of 5,000.000 lb. of copper. The 100-ton experimental mill for the treatment of the low-grade ore has shown an extraction of over 80%. Among other improvements an Miami is the proposed $75,000 Y. M. C. A. building, plans for which have just been approved.

Editorials

The Ore-Milling Industry

This issue of the *Journal* is devoted especially to matters relating to the milling of ores, by which is understood chiefly the methods of mechanical concentration. Other branches of milling are cyanide lixiviation—with which mechanical concentration is frequently combined, copper lixiviation and zinc lixiviation. These processes merge into the metallurgical as distinct from the simply mechanical processes of separating valuable minerals from worthless gangue, which constitute the bulk of our milling.

The importance of the art of milling is nowadays but slightly subordinate to the art of mining, for except in the case of iron ore nearly all the ore that is mined has to be milled for the purpose of concentration. At the present time the United States is mining copper, lead, zinc, gold, silver and miscellaneous ores, exclusive of iron ores, at the rate of about 76,000,000 tons per annum and is milling about 70,000,000 tons thereof. The great bulk of this immense quantity is milled by purely mechanical methods—jigging and tabling in the most cases, jigging and tabling combined with flotation in many cases, and flotation alone in a few cases. The other mechanical processes—magnetic and electrostatic separation—are of subordinate importance, but in a few instances, as in the magnetic treatment of the mixed zinc ores of Franklin, N. J., are of the first order in consideration.

The great thing in milling in recent years has been the development of the flotation process, which has enabled a greatly increased extraction of mineral to be made at but slight, if any, increase in cost—either in plant or in operation—over the old-fashioned jig and table mills. In view of the supreme importance of the flotation process, a large part of this number of the *Journal* is devoted to it.

This issue is a special number for millmen, and its space is given almost entirely to their subject. It is not designated to be a compendium on the art of milling, but simply a collection of useful memoirs, articles and notes on matters of current interest. The large amount of space given to the flotation process is in line with the general interest in that process.

Two Notable Mining Reports

As a general thing annual reports of foreign mining companies do not impress us at all favorably when compared to the classics put out by our own large companies, but two foreign reports are in hand that challenge our interest and respect.

The Tharsis Sulphur and Copper Co., operating pyrite mines in Spain, has completed the 50th year of its existence, which it announces very unostentatiously as it does also that during this period a dividend has been paid each year, amounting to a grand total of over £10,250,000. The mines were actively worked by the Romans, but according to the chairman's statement at the annual meeting, it is doubtful if they have yet reached middle age. A dividend of 10% was paid for 1915, despite a considerable sum carried to surplus and despite increase of more than half a million dollars in freight rates and income tax.

The report of the British South Africa Co., controlling North and South Rhodesia, for the year ended Mar. 31, 1915, shows total assets of £16,741,773. There are many mining companies showing greater resources than this, but this report does not impress us as a company report; it is really the "gray book" of an empire. War, customs levies, ranches and crops, agricultural experiment stations, mining, railways, immigration and national health are some of the few problems of its directors that are unassumingly set forth.

Under mining a figure of general interest is the increase in the mineral production of Southern Rhodesia from £3,883,001 in 1914 to £4,399,070 in 1915. This includes £3,823,167 in gold, 185,233 oz. of silver, 409,763 tons of coal, and 60,581 tons of chrome-iron ore. The coal output was all by the Wanki colliery, the chrome output by the Rhodesia Chrome Mines, Ltd. In Northern Rhodesia, the gold output was £3,953; silver, 4,066 oz.; copper, 813 tons; and 5,740 tons of 60 to 70% bismuth ore. Claims have been registered for gold, silver, iron, lead, zinc, bismuth, graphite, mica, molybdenum, platinum, tin, coal, nitrate and lime.

It is to be imagined that the shareholder who receives this report must read it with the feeling that, however far off monetary dividends are, there is a certain return on this investment that no other company will ever give.

Gold and Silver Production in 1915

The revised and corrected statement of gold and silver production in the United States in 1915, prepared jointly by the Bureau of the Mint and the Geological Survey, has been issued, and shows that the preliminary statement made last January was conservative in its estimates. The revised figures give the total production of gold in 1915 at 4,887,604 ounces, fine, or $101,035,700, and the total silver was 74,961,075 ounces, fine. At the average price in New York, the commercial value of the silver was $37,397,300, making the total value of the precious metals last year $138,433,000. These figures are an increase over the preliminary estimate of $2,144,600 in gold and 7,475,475 oz. silver. The larger difference in silver was probably due to an underestimate of the quantity contained in copper bullion.

As compared with the report for 1914, the total gold production of 1915 showed an increase of $6,503,900, or 6.9%, while there was an increase in silver of 2,505,975 oz., or 3.9%, instead of the decrease indicated by the preliminary statement. The figures for both years, 1914 and 1915, are given in the accompanying table, gold in value and silver in fine ounces.

In gold production California came first in 1915, with an increase of $1,296,000. Colorado, with a much larger gain, took the second place, being only $16,600 behind California. Alaska was third, Nevada fourth and South Dakota fifth, all three with only small gains. Ten states produced over a million each, while the Philippine Islands reported a gain of 22%, to a total of $1,320,900, a considerable share coming from dredging operations largely financed from Australia and New Zealand.

In silver production Nevada was first and Montana second with a difference of less than 30,000 oz. Utah held the third place and Idaho fourth. Colorado and Arizona were next in order, the former showing a considerable loss from the previous year, while Arizona made a gain.

GOLD AND SILVER PRODUCTION OF THE UNITED STATES

(Gold, Value; Silver, Fine Ounces)

	Gold		Silver	
	1914	1915	1914	1915
Alabama	$12,300	$5,100	300	
Alaska	16,547,200	16,710,000	865,900	1,054,634
Arizona	4,568,900	4,555,900	4,439,500	5,665,672
California	21,251,900	22,547,400	2,020,800	1,689,924
Colorado	19,902,400	22,530,800	8,804,400	7,199,745
Georgia	16,800	34,800	100	141
Idaho	1,187,200	1,170,600	12,573,800	13,042,466
Illinois		.....	1,900	3,892
Maryland	200	.....	100	
Michigan		....	415,500	581,874
Missouri			60,000	55,534
Montana	4,143,600	4,978,300	12,536,700	14,423,173
Nevada	11,536,200	11,883,700	15,877,200	14,453,085
New Mexico	1,219,100	1,160,100	1,771,300	2,337,064
North Carolina	130,300	170,700	1,500	1,496
Oklahoma			6,200	.....
Oregon	1,589,400	1,867,100	147,400	125,499
South Carolina	3,200	3,600		
South Dakota	7,334,000	7,403,500	179,800	197,569
Tennessee	6,400	6,800	102,800	99,171
Texas	8,800	1,800	574,700	724,580
Utah	3,377,000	3,907,900	11,722,000	13,073,471
Vermont			....	150
Virginia	300	500	1,500	....
Washington	587,800	461,600	341,300	213,877
Wyoming	6,700	13,900	100	2,910
Continental U. S.	$93,429,700	$99,714,100	72,444,800	74,945,927
Philippines	1,099,300	1,320,900	10,300	15,148
Porto Rico	2,800	700		....
Total	$94,531,800	$101,035,700	72,455,100	74,961,075

Silver and Flotation

Silver producers have good reason for watching with extreme interest the development of the flotation process. Any metallurgical development that will enable silver ores of lower grade to be worked, or that will permit other ores carrying small percentages of silver to be beneficiated at a profit, will have an influence upon the total silver production. Since a large portion of the world's silver is produced in the United States and Mexico, the silver-producing mines of the latter unhappy country being largely under American direction, improvements in the metallurgy of that metal are particularly interesting to operators here. As flotation may allow the working of zinc and lead ores containing small quantities of silver such as were not economically profitable under previous conditions, the wide application of flotation is likely to bring an additional amount of silver into the market. It has already had that effect in some portions of the United States, and when Mexico reaches a condition such that her mines may be operated, a further amount will be produced. In addition to the silver that will be recovered from base-metal ores that carry silver incidentally, it may reasonably be expected that further quantities will be produced from low-grade ores carrying silver, together with possibly some gold, as the metal of principal importance. There has been some difference of opinion as to the extent to which flotation will be applicable to silver ores, but it may be expected that low-grade slimes containing silver in connection with iron sulphides will be brought within the range of flotation and that an additional amount of silver may be brought into production from that source. The Mexican silver ores consist largely of argentite that occurs with iron sulphide, and the bulk of the tailings losses in silver-treating mills may be reasonably said to consist of finely divided material of this kind that goes to waste with slimes. Some of it cannot be recovered economically on concentrating tables, and it is reasonable to believe that much of it may eventually be saved by flotation methods. In fact, it is not without the bounds of reason to say that the slimes from ores of this class may be treated more cheaply and with a higher percentage of recovery than by the cyanide process, and it is not impossible that flotation will be largely applied to that work. Just as the cyanide process brought within the range of economical beneficiation ores that formerly could not be handled at a profit, so flotation may be expected to lower still more the tailings, decrease treatment costs and so account for the production of a considerable quantity of silver that has heretofore not been available.

The Metal Markets

The metal markets have been dull and reactionary for about two months. Last week speculators in stocks awoke to this and the metal shares were hammered down severely. The Wall Street organs took up the talk that had already been rife in some producing districts and expressed opinions as if calamity had overtaken the metal industries. Now, in fact, copper at 26c., lead at 7c., spelter at 10c., antimony at 19c., quicksilver at $75 and tungsten ore at $30 are not low prices. With respect to most of them they are prices that are from 1½ to 2 times above the normal. They are low as compared with what they were when they were about five times above normal as they were in all cases except copper and lead. But what can people expect? Apparently having been given an unexepected treasure like Aladdin's, nothing would suit them but even bigger things. When the end was reached, there was a reaction in sentiment. This is one of the penalties of extravagance.

The consumption of metals is still continuing on an unprecedented scale and bids fair to keep on doing so. The trouble with prices is that too many people wanted naturally to share in the great profits that were being made and therefore increased the production. Conditions will be healthier in all ways if prices recede to lower but still profitable levels.

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Attention is to be called to the four pages of drawings of useful kinks for the mill and for the engine room that appear in this issue. These drawings are made by a new and ingenious method invented by Arthur Ormay, chief draftsman of the Hill Publishing Co., and show the introduction of a truly artistic spirit into the art of mechanical drawing. The plates that we reproduce appeared originally in our sister publication, *Power,* to which we are indebted for them, as we also are for the two instructive plates showing the thermal balance of the steam-power plant.

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The index for Vol. 101 of the *Engineering and Mining Journal* will be mailed with this issue. Any subscriber not receiving a copy of same should notify the subscription department at once.

PERSONALS

W. S. Grether, lately at Salmo, B. C., is now at Butte.

Karl F. Klein has gone from New York to Morococha, Peru.

James J. Dowd, lately at Rolla, Mo., is now at Houghton, Mich.

E. E. Reyer has gone from El Paso, Tex., to Colorado Springs.

D. W. Minler, lately at Goodsprings, Nev., is now at Los Angeles.

Dr. A. T. Roos, of Deadwood, S. D., is in New York for a short visit.

Fred G. Heckaer, late at Nevada City, Calif., is now at Osceola, Nev.

Rolla E. Clapp, recently at Salt Lake City, Utah, is now at Los Angeles.

J. E. Harcus, recently at Albany, N. Y., is now at Guane, Pinar del Rio, Cuba.

R. H. McHardy has gone from Minneapolis, Minn., to Cananea, Sonora, Mexico.

A. F. Duggleby, recently at Butte, Mont., is now with the Juragua Iron Co., at Santiago de Cuba.

Louis S. Cates, general manager of the Ray Consolidated, was a recent visitor in New York and Boston.

R. L. Lee has been appointed superintendent of the smelting plant of the Central Chili Copper Co. at Panulcillo, Chile.

W. E. Thorne has entered into a new contract for two years more with the Lenskoie Co., of Siberia, for selecting dredging and hydraulic ground and sampling same.

Prof. William Nicol, of Queens University, Kingston, Ont., has resigned as professor of mineralogy, a position which he has held since the School of Mining was founded, in 1893.

Fernando Cardenas and **Miguel M. Gomez,** of Havana, have been in New York recently in connection with the shipment of a cargo of ore from the Candida, a new copper mine in western Cuba.

M. A. Rowan, who has been engaged on valuation work for the People's Gas Light and Coke Co., of Chicago, has resigned to take charge of the mining-engineering department of the Chicago & Eastern Illinois R.R., with headquarters at Nokomis, Ill.

William H. Warren has been appointed general manager of works of the Brier Hill Steel Co. at Youngstown, Ohio, and George F. Alderdice has been made vice-president of the same company, succeeding Rollin C. Steese, who formerly held both positions.

W. C. Bulmer has been appointed to succeed L. M. McDonald as superintendent of the openhearth and bessemer departments of the Ohio works of the Carnegie Steel Co. at Youngstown, Ohio. **Jacob A. Reisinger** has been appointed assistant to Mr. Bulmer.

George A. Guess, professor of metallurgy at the University of Toronto, has been engaged by the Vermont Copper Co. to start up the copper smeltery at South Strafford, Orange County, Vt. The furnace has not been operated successfully and has been idle for several years.

Percy E. Barbour, mining engineer and managing editor of the "Engineering and Mining Journal" resigned his commission as 2nd Lieutenant in the Maine Coast Artillery in order to accept a commission as 1st Lieutenant in the 22nd Corps of Engineers, N. G. N. Y., and is now at Camp Whitman preparatory to going to the border with his battalion.

H. Kenyon Burch, chief engineer of the Inspiration Consolidated Copper Company, has completed his work pertaining to the design and construction of the plant, and will leave on July first for an extended vacation trip throughout the East. His forwarding address for the next few months will be, care of The Sierra Madre Club, L. A. Investment Bldg., Los Angeles, Calif.

OBITUARY

Lieut. Carleton C. Green, well known throughout northern Ontario as a mining journalist and formerly connected with the Cobalt "Nugget," has been killed in a recent engagement. His home was at Haileybury, Ont., and he leaves a widow and two children.

SOCIETIES

American Electrochemical Society—Second National Exposition of Chemical Industries will be held in New York all through the week of Sept. 25-Oct. 1. The American Electrochemical Society will be one of the important national societies which will meet in New York during the same week. Its meetings will be held on Sept. 28, 29 and 30, and the outline of the program has just been announced, showing a varied series of papers and discussion, besides visits to the Exposition, receptions, etc.

American Society for Testing Materials—The nineteenth annual meeting was held at the Hotel Traymore, Atlantic City, June 27 to 30. As usual, the program was unusually complete and this year contained a total of 53 topics. Nine sessions were held, the fourth on Wednesday morning, June 28, devoted to the discussion of steel and iron. The following committee reports were presented: On steel, by C. D. Young, chairman; on heat treatment of iron and steel, by Albert Sauveur, chairman; on corrosion of iron and steel, by S. S. Voorhees, chairman; on magnetic properties of iron and steel, by C. W. Burrows, chairman. Nonferrous metals were discussed at the eighth session on Friday morning.

American Society of Mechanical Engineers—Ira N. Hollis, president Worcester Polytechnic Institute, Worcester, Mass. has been nominated for president for the year beginning with the annual meeting in December. The nominations for the three vice-presidents, who serve for two years, are: Prof. Charles H. Benjamin, Purdue University, Lafayette, Ind.; Prof. Arthur M. Greene, Jr., Rensselaer Polytechnic Institute, Troy, N. Y., and Charles T. Plunkett, president Berkshire Cotton Manufacturing Co., Adams, Mass. The three nominations for managers are: Prof. Robert H. Fernald, University of Pennsylvania; Prof. William B. Gregory, Tulane University, New Orleans, and C. R. Weymouth, San Francisco. Major William H. Wiley, who has been treasurer since 1884, has been renominated.

INDUSTRIAL NEWS

Chalmers & Williams, of Chicago, have recently shipped four 48-in. Symons fine-reduction disk crushers for the mill of the Federal Lead Co., at Flat River, Mo.

Murex Co., Ltd., has moved its office and laboratory from San Francisco to Darwin, Inyo County, Calif., where a mill is being built to treat the lead-carbonate ores of the Darwin Development Co. by the Murex process.

The Marks Pulverizing, Mining and Milling Machinery Co., of Los Angeles, has moved into its new quarters at 712 North Main St., Los Angeles. A test mill is being operated at this address to demonstrate the Marks centrifugal impact pulverizer.

The General Naval Stores Co., of New York announce that it will hereafter carry stocks of G. N. S. flotation oils in Denver and will be in a position to fill orders from that point within the next 30 days. John D. Davis, with office at 1550 Glenarm St., Denver, is the Colorado representative.

Weston H. Lazear has recently assumed charge of the New York office, and adjacent territory for the Stephens-Adamson Manufacturing Co., Aurora, Ill. Mr. Lazear is already acquainted in this territory and has devoted the past seven years to the design of "S-A" conveying, elevating, screening and transmission machinery.

The Executive Departments of the Western Electric Co., Inc., at New York moved on June 5 from 463 West St. to new offices in the Telephone and Telegraph Building at 195 Broadway. The move was made necessary by the steady growth of the company's engineering departments which will occupy the space that has been vacated. The local New York distributing department and the engineering and patent departments remain at 463 West St.

The A. M. Byers Co., Inc., Pittsburgh, maker of wrought-iron pipe, which also owns and operates Mattie furnace at Girard, Ohio, has leased for three years the plant of the Susquehanna Iron Co. at Columbia, Penn. The plant consists of the Columbia works and the Susquehanna works, the two being a quarter of a mile apart. The lease was made from W. W. Griest and associates, who have controlled the mills for some years. D. F. Manice, now in the Pittsburgh mills, has been appointed manager of the Columbia works, L. M. Johnston being general manager.

Editorial Correspondence

SAN FRANCISCO—June 22

Three Large Oil Tankers, costing a total of approximately $4,000,000, are under contract for construction at the Union Iron Works Co. shipyards in San Francisco. The new tankers are for the Pan-American Petroleum Transport Co. They are similar in design to those constructed for the Standard Oil Co. and are to be 435 ft. long, 56 ft. wide, with a capacity of 70,000 bbl. of oil each. The Standard Oil Co. is also having 7 more new tankers built for delivery within 18 months.

Decision in the Smelter-Fume Suits against the Penn Mining Co. in the U. S. District Court at San Francisco was announced in the "Journal" of June 17 to be in favor of the defendant in the first six cases. Eleven more of these cases are set for trial on Sept. 5. The jury required but one-half hour on June 9 to bring in the verdict. In the first six cases, the farmers claimed that the fumes from the Campo Seco smeltery reduced the amount of crops and worked a permanent injury to the soil; also that some of the stock, cattle and hogs had died from arsenic poisoning; and that wire fences were rapidly destroyed, the life of the wire being reduced from 15 or 20 years to 3 or 4 years. The farms represented in the six cases are situated at from 5½ to 7½ mi. from the smeltery. The plaintiffs rested their case on the testimony of the owners of the land interested in these suits, without calling as witnesses the veterinary surgeons, Dr. Fox, Dr. Kreely and others as expert witnesses, as was expected would be done. The defendant presented evidence of Charles Bartels, chemical engineer, who was one of the experts of the Selby commission and C. E. Bigler, agricultural chemist of the West Scramento Co., and the Natomas Co. Evidence was adduced showing that careful examinations had been made of the vegetation and soil and determinations of the amount of sulphur dioxide by approved chemical processes, showing that the amount of sulphur trioxide was in every case less than 1 part per million. In a large number of experiments in which growing plants were submitted to sulphur dioxide and sulphuric acid in moving air, there was no injury whatsoever where the concentration was less than 8.1 parts per million. Other experiments and tests were made embracing the entire growing period and it was found that where concentration was less than 5 parts per million, there was no effect upon the growth of vegetation or upon the amount of the crop. The shallowness of the soil and the rotation of crops was alleged by the defendants to be the actual cause of the decrease in the amount of crops on these farms since 1910. These farmers do not plow deeply, which is so essential to the growing of good crops in the foothill farming regions of California. The attorneys for defendant contended that damage done to wire fences was due to electrolysis.

BUTTE—June 22

The Accident Record for April in Butte was one of the best in the history of the mines. The total number of accidents in the 27 mines of the Anaconda company in the 30 days was only 35, or an average of 1.15 to the 10,000 shifts. In 13 of the mines there was not a single accident.

North Butte Stockholders here have suspected a persistent effort on the part of interests with influence to make a special bear target of that stock. North Butte was for years a discredited mine because it was at that time managed with an eye to the stock market, rather than developing the property in the interest of the stockholders. The present management is making a sincere effort to rehabilitate the property. If reports from the mines can be believed there is a decided improvement in the property, much new ore having been disclosed by the recent development.

A First-Aid Contest has been carried on for many weeks between 12 teams, representing the mines of the Anaconda Copper Mining Co. in Butte. An increase in the amount of the prizes has just been announced. The first prize instead of being $150 in cash will be $200. Instead of only three cash prizes of $150, $100 and $50, there will be prizes for seven out of the 12 teams and keen interest is being taken in the final battle for positions. The cash-prize awards will be as follows: First team, $200; second, $150, third, $125; fourth, $100; fifth, $75; sixth, $50; seventh, $25. This makes a total cash distribution of prizes by the Anaconda company of $725 instead of $300 as at first planned. It had been expected to give silver medals also to the winners and bronze medals to the members of the second team. These medals were to be supplied by the National Safety Council with which the American Mine Safety has been merged. It now develops that its medals cannot be awarded for contests in which competition is limited to teams representing only one company. This was the reason for increasing the cash prizes. Apparently the Moonlight Mine team will win the $200 prize but the others are yet to be decided.

A New Mine-Taxing Movement has been inaugurated in Montana, with the special object of reaching the Anaconda Copper Mining Co. The latter, like most large and successful corporations, is constantly the subject of attack by would-be legislators, agitators and grafters of all grades. Under the present system of taxation, the mining companies pay only a small rate on their property, the big tax being collected on the personal property and the net earnings. Some years ago an attempt was made to tax the companies 3% additional on their gross earnings, but the movement was defeated. Now a law is being initiated to tax them 6% more, and is likely to obtain sufficient support to bring it before the voters of the state at the fall election. The charge is made that the movement was really inaugurated by antiprohibition forces to compel Anaconda to come out against prohibition or to put up money to fight the latter movement. For very good economic reasons the Anaconda company is not opposing the prohibition movement. It had an object lesson on the effect of prohibition during the military rule in Butte two years ago when the saloons were closed. During that period the efficiency of miners was increased 25% and accidents in the mines decreased about 90%. Against such a showing as that the big company could not declare itself opposed to prohibition by law. The hostility of the antiprohibitionists might therefore be expected.

DENVER—June 23

Alleged Claim-Jumping at Nederland was responsible for a recent disturbance in the tungsten field, in which gun plays and a hangman's noose figured. The sheriff has dispersed the "vigilance committees" that were organized in the district to discourage the practice.

American Smelting and Refining Co. has taken over the Green Mountain group in Cunningham Gulch, Silverton district. Under the superintendency of Charles Gardner, this property will be put into operating condition. The ore will be concentrated in the Silver Lake mill, and the products sent to the Durango smeltery. In the same district, the Hamlet mill, destroyed by fire last fall, is being replaced by a modern plant that will include flotation in its flowsheet.

Colorado School of Mines awarded scholarships this year to 34 graduates from high-schools within the state, these scholarships being acceptable by the school in lieu of all fees for four years. This is the first time the plan has been tried here. Prof. E. J. Dittus and H. W. Wright of the faculty are preparing a report for free distribution on the flotation research that has been conducted in the institution during the past year. The Denver branch of the U. S. Bureau of Mines is to move to the School of Mines, July 1, and thereafter will have its offices and laboratories in the Physics Building at Golden. The large testing plant will also be at the disposal of the Federal bureau.

Present Flow from Down-Town Mines at Leadville is about 1,700 gal. per min. at the bottom level; this is being easily handled by the electric-driven centrifugal sinking pump. Old reciprocating steam pumps are being removed and scrapped from this station to make room for the new electric pump of same design as the sinker but which will have a capacity of 2,000 gal. per min. After more than 13 months of steady pumping, the Down-Town Mines Co., of Leadville, has accomplished its purpose of draining the portion of the district lying within and adjoining the city limits. Through the efforts of Ex-Governor Jesse F. McDonald, an amalgamation of interests was effected between owners of more than 300 acres of valuable mining property and a magnificent pumping plant established at the Penrose mine. Several of the levels are being driven anew while old ones are being cleaned out and put into shape for renewed productions.

Reduced Freight Rates on ore not exceeding $12 per ton in value have been established between Breckenridge to Denver. In the suit of the Wellington Mines Co. against the Colorado & Southern Railway Co. for a reduction of rates on zinc concentrates from the company's mills at Breckenridge, Colo., to Bartlesville and Collinsville, Okla., the Interstate Commerce Commission has denied the mining company reparation for freight charged on previous shipments, but has found that the increase from $1.50 to $3 per ton applicable from Breckenridge to Denver was not justified and has ordered the restoration of the through rate based on $2.25 component to Denver. The commission in its report states that the distance from Denver to Bartlesville via the Santa Fe is 725 mi., and that the through rate from Denver to Bartlesville, which was not in dispute and is also $2.25, earns for the railroad only 3.1 mills per ton-mile. The Wellington company testified that one of its mills was closed by reason of the increase in the Breckenridge-Denver freight rate and not by reason of any of its other troubles.

SALT LAKE CITY—June 23

The Smelting Plants in Salt Lake valley and vicinity have been working at capacity for some time, and have recently notified some of their shippers to curtail the output of certain low-grade ores.

A State Assay Office will be established at the University of Utah through the efforts of the state conservation commission. The plans have been tentatively approved by the U. S. Bureau of Mines and by the Salt Lake Chapter of the American Mining Congress. The object is to encourage prospecting to develop the mineral resources of the state. It is not intended to compete with regular assayers, and qualitative determinations but not quantitative analyses are to be made. This will enable prospectors and others to determine whether their finds are worth further investigation. When the plans have been worked out and approved a bulletin will be issued.

Utah Copper's New Leaching Plant will be begun within the next two or three weeks. The site has been selected, and plans are nearly completed. The initial capacity of the plant is to be 2,500 tons daily; and it will treat a large accumulation —40,000,000 tons or over—of oxide and carbonate ores, which occurred as a capping over the sulphide orebodies. This capping carries 0.5 to 1% copper. The Utah Copper Co. has for some time had an experimental plant in operation, and the results obtained will furnish the necessary data. Sulphuric acid, employed in the leaching, will be made at the plant of the Garfield Chemical and Manufacturing Co., now being erected near the Garfield smeltery.

Encouraging Results are being obtained at the Tintic Milling Co.'s plant at Silver City, and the company is planning an increase in capacity. At present, low-grade siliceous ore amounting to 100 tons daily is being treated, and preparations are being made to treble this amount. Holt-Dern roasters chiefly are being used, and six more of this type will be added. Excavation for their installation is in progress. Three cleanups have been made thus far, each yielding about $24,000. The third lot amounted to about 20 tons of precipitates. The Iron Blossom and Dragon Consolidated are furnishing most of the ore at present, and the company has leases on a number of dumps in the district.

WALLACE, IDAHO—June 22

Dividends of Cœur d'Alene Mines for the first six months of 1916 established a new record, far in excess of the amount paid in any corresponding period in the history of the district. In the following detailed statement, except where stated as estimated, the figures are official. The estimates are conservative and it is probable that the actual figures are greater than here given: Federal, $240,000; Caledonia, $442,850; Bunker Hill & Sullivan, $797,500; Hecla, $650,000; Interstate-Callahan, $1,394,970; Success, $300,000; Hercules (estimated), $1,500,000; Green Hill-Cleveland (estimated), $400,000; Tamarack & Custer, $40,000; Hunter (estimated), $200,000; total, $5,965,320. The net earnings of Cœur d'Alene mines for the year 1915, as shown by sworn statements filed with the county assessor, amounted to $9,794,632. That is the highest record in the history of the district. Assuming that the same rate of production and profits will prevail during the last half of the year, 1916 will show an increase of at least one-third over the former high record.

JOPLIN—June 24

Cloudburst on June 19 flooded dozens of mines and curtailed production. Three miners were drowned at Coralbut mine at Chitwood. Galena camp was particularly hard hit, and some mines there will not be reopened for at least a month, unless special pumps are provided.

Calling Out of Militia has taken numerous men from local mines. Property hardest hit was the Coahuila at Duenweg. It's superintendent, C. D. Smith, is a major in the Missouri National Guard, and the assistant superintendent, Fred Nesbitt, is a captain. Both have gone with their regiment to the recruiting camp at Nevada.

Striking Hoistermen issued circular during week claiming 10 mines were paying scale of $5 per day demanded by Brotherhood of Hoisting Engineers. The following day all but one operator denied truth of this statement. No mines are now down through inability to get hoistermen. Average base price for blende during June will be about $78, or $10 less than May price, which will mean a 25c. reduction in wages for men, during coming month. Labor trouble not anticipated.

OATMAN, ARIZ.—June 22

The Stock-Market Slump is being felt in Oatman. Several prospects have been forced to shut down because of lack of funds to carry on development work. Unfortunately one or two of the best prospects in the district are included among the ones recently shut down. However, this condition will only be temporary as it is due entirely to the fact that many of the prospects depended upon Los Angeles "brokers" to raise the money for their development and it is a well-known fact that these brokers will haggle for an hour over a quarter of a cent a share on a 100-share lot of stock.

Revival of Mining in Cerbat Range is attracting considerable attention. The important developments at depth in the Tennessee and Golconda mines where commercial ore has been opened up at 1,400 ft. and 1,100 ft., is bringing this old mining country to the front again. The men who are coming into the district now realize that the day of shallow surface mining is past and only with the backing of large capital can successful mining be carried on. The complex sulphide ores, which were difficult to handle by other methods, have been brought into the commercial limelight by the development of the flotation process. It is interesting to note the entrance of the Guggenhein interests into this district through the optioning of the Elkhart mine, a famous old producer.

VIRGINIA, MINN.—June 23

Many Mines Are Closed on the Mesabi range as a result of the I. W. W. agitators continuing their campaign. At Eveleth the Oliver Iron Mining Co. has closed the underground operations at the Spruce, Fayal, Adams and Leonidas mines, though a few men are kept at work in the pit mines. Probably 800 men are affected at Eveleth. At Virginia, during a pitched battle a striking miner was shot and killed by a company guard. All saloons have been ordered closed. The closing of operations in the Virginia district affects at least 2,500 men. At Biwabik the business men have stopped credit to the striking miners. At Hibbing, on June 22, 1,500 striking miners paraded and at the meeting made the following demands: Abolishment of contract labor; minimum wage of $3 a day; 8-hr. shifts for every man; abolishment of Saturday night shift. The mines at Nashwauk and Buhl are operating as usual, no trouble having developed there to date. If miners do not return to work soon, the Oliver will probably close all its underground mines and only ship from openpits and stockpiles which can supply the furnace requirements.

IRON RIVER, MICH.—June 20.

Patriotic Spirit of Middle West has been generally misunderstood, having been misrepresented by the attitude of a few pacificists to whose views the daily press has given wide publicity. It is well, therefore, to note the attitude of a Michigan corporation here in connection with the Mexican crisis. The following notice was posted on June 19 at the four mines of the Munro Iron Mining Co. by G. L. Woodworth, manager of mines:

> Any employee of the Munro Iron Mining Co. who enlists in the army or navy or belongs to the militia of this nation, and is called to the service of this nation, will on his return receive his former position if he applies for same. Notify this office before leaving.

TORONTO—June 23

A Rush to Rice Lake Gold District is starting from Winnipeg and other points in Manitoba. Steamers will hereafter sail from Selkirk twice a week to accommodate miners and prospectors. A mining exchange will be opened in Winnipeg early in July to be known as the Manitoba Mining Exchange, at which Rice Lake and other stocks will be listed.

A Du Pont Powder Co. Subsidiary is being organized with $10,000,000 capital to operate exclusively in Canada. A water power and other properties on the Saguenay River in Quebec have been secured and the erection of a plant is expected to follow soon. It is stated that the plant will be utilized for the fixation of atmospheric nitrogen, which in due time will be applied to the manufacture of high explosives at the company's plants in the United States.

The Mining News

ALASKA

STRIKE reported in Innoko region on Boob and Mastodon creeks, tributaries of Ditna river, about 25 mi. from the gold discoveries.

NEW RUSH TO FOLEY CREEK, tributary of Notch Creek in Chisana district, resulted from work of McCallum brothers, Thomas McGeegin and Thomas McAllister. Find is about 20 mi from Shushana and 23 mi. from Nabesna.

ALASKA GOLD BELT (Juneau)—Arthur Riendeau, who drove 2,500-ft. tunnel last year, will probably be awarded contract for new lower tunnel, in which lateral diamond drilling will also be done. Contracts will not be awarded until claim litigation is settled; decision expected soon.

ARIZONA

Cochise County

BUNKER HILL (Tombstone)—Several carloads copper ore, sampling above 16%, shipped by leasers from upper levels in old bonanza workings.

MASCOT (Dos Cabezas)—Copper-gold vein on the Oregon 100 level drifted on for 100 ft. and averages about 3 ft. wide; gold assays up to $71.40. On same level north crosscut exposed Off Incline oreshoot; 10 ft. wide, commercial copper ore. Diamond-drill hole P. 86 encountered chalcopyrite ore at 188 ft. and continued in ore 60 ft.; hole was drilled easterly from Drift 35 on the Consolidated level and is about 700 ft. below surface; disclosure considered important. John W. Prout, Jr., superintendent.

Maricopa County

SWALLOW (Wickenburg)—Situated in Castle Creek district, sold to J. P. Hutchinson, of El Paso; old 10-stamp mill in good condition; may operate soon.

RUSSIAN (Congress)—Acquired by C. H. Kunselman and J. W. Stacy, of Phoenix, who will develop; shaft in 10-ft. silver-gold orebody; drifting will start on 300-ft. (bottom) level.

Mohave County

MINNESOTA (Chloride)—Reorganized; unwatering started; about 25,000 gal. being pumped daily.

PAYROLL (Chloride)—Development temporarily stopped by water; being held in check by baler.

MIDNIGHT (Chloride)—Gus Holmes, Jr., and associates of Salt Lake City, sinking shaft 4 ft. per day with hand drills.

NORTH GEORGIA (Chloride)—Gus Holmes, Jr., is installing headframe and hoist to explore 75-ft. outcrop carrying silver and lead.

ELKHART (Chloride)—Bonded by American Smelting and Refining Co. and is being unwatered. Nearly 2 miles of workings, famous old lead-silver-zinc producer.

SILVER KEYSTONE (Chloride)—Adjoining old Keystone in Mineral Park section; will resume sinking to 300 ft. and connect with Keystone shaft. Headframe and hoist being installed.

TELLURIDE CHIEF (Kingman)—Shaft, down 45 ft., will be sent to 150-ft. point, from which drifts and crosscuts will be extended to tap Garnier and Big Swede veins. Latter stripped on surface for 52 ft.

KEYSTONE (Chloride)—This old mine in Mineral Park district now unwatered; developing oreshoot on 200-ft. level by hand drilling. Sinking 280-ft. shaft will be resumed after arrival of compressor and drills.

GOLD ORE (Goldroad)—Steadily sending 25 to 30 tons $20 ore to Gold Road mill; estimated 75,000 tons blocked out above 530-ft. level; shaft to be deepened 100 ft. and laterals extended. Pres. Werden states 30-ton mill contemplated.

LONGFELLOW (Chloride)—W. T. Smith, of New York, W. B. Twitchell, of Phœnix, and W. H. Crowell of Four Metals Co., Nogales, purchased Longfellow group from Hugh Wilson. The 140-ft. shaft, bottom of which is in 5-ft. gold-silver-lead-copper vein, will be unwatered.

TOM REED (Oatman)—Supt. E. M. Rabb states, concerning recent strike on the 1100-ft. level, that large body of milling-grade ore was found; reports that ore ran as high as $100 a ton were exaggerated. In regard to Black Eagle strike, an orebody running from $6 to $17 a ton, was opened lengthwise for about 300 ft. with tunnel, but no crosscuts have been run. Will sink shaft on claim, entirely surrounded by United Eastern ground.

Pima County

CORNELIA EXTENSION (Ajo)—Machinery ordered for sinking 500 ft. shaft.

SOUTH CORNELIA (Ajo)—Camp being established and work will begin soon on 500-ft. shaft.

COPPER MOUNTAIN (Ajo)—Drilling will be undertaken at once on this property, 18 mi. south of Ajo. Bonded recently by Julius Kruttschmidt, Jr., of Tucson, for American Smelting and Refining Co. E. J. Longyear Co. will do the drilling.

NEW CORNELIA (Cornelia)—New 10-in. water line from wells practically completed; machine shops in use and structural steel for crushing plant rapidly being put into place. Contract for 25 bungalows on townsite reported awarded to Otto Gröger, of El Paso.

BISBEE-AJO COPPER DEVELOPMENT CO. (Ajo)—New company formed in Bisbee to develop 24 claims, 22 mi. south of the Cornelia. Country rock schist and monzonite, impregnated with copper sulphides. Officers: John Sweeney, president; John Perry, vice-president; C. A. Johnson, secretary-treasurer.

Pinal County

ASBESTOS is being produced now in Gila County and in the Grand Cañon; lately, H. B. Riggs, S. E. Douglass and Philip Connelly of Mesa have had their claims near Superior inspected and another operation may result.

RAY CONSOLIDATED (Ray)—To guard against floods such as those of last spring, steel-concrete bulkheading is being placed along Mineral Creek at cost of $45,000.

Santa Cruz County

HARDSHELL (Patagonia)—Shipping lead ore to El Paso.

TRENCH (Patagonia)—Crosscutting from bottom of 500-ft. shaft.

BLUE EAGLE (Patagonia)—This claim in Alum Gulch optioned. Recently opened ore running 10% Cu and 10 oz. Ag.

HARRISON-SANDERS (Patagonia)—Compressor and machine drills being installed. Plan to sink another 100 ft. Last car shipped ran 9.2% Cu.

R. R. R. MINE (Patagonia)—Shipping 30 tons daily of 8% copper ore. Shipments will be increased. Ground broken June 20 for 100-ton unit of flotation plant.

DUQUESNE MINING AND REDUCTION (Duquesne)—Electric power now available at this property. Flotation plant being doubled. Shipping about three cars per week of high-grade copper ore.

Yavapai County

ARKANSAS & ARIZONA (Jerome)—Merger with Mowles Copper Co. ratified on June 12, 2,000,000, shares being paid Goodrich-Lockhart interests for Mowles property. Active development at both properties.

VERDE COMBINATION COPPER CO. (Jerome)—Formed by James M. Layman to prospect the Richards and other groups—about 500 acres—between United Verde Extension and Pittsburgh-Jerome. Peter Boyd, of National Tube Co., Pittsburgh, is president. A. P. Thompson, Jerome, in charge of development.

CALIFORNIA

Calaveras County

POORMAN (Altaville)—Drifting to tap rich gravel found in McElroy mine. Erickson & Nelson are leasers.

OZARK (Angels Camp)—Superintendent's dwelling completed and arrangements made for extensive work in this gravel mine.

ECONOMIC (Esmeralda)—Electrical equipment including transformers, motors and compressor received. Louis Robin in charge of installation.

Eldorado County

CEDARBURG (Georgetown)—Mine near Spanish Dry Diggings, idle for 35 years, is to be reopened.

BUNKER HILL (Greenwood)—Installation of machinery in progress at this copper mine near Penobscot. A 5-ton motor truck is to be used for hauling ore to Auburn. D. L. Shepherd, manager, has also bonded Argonaut mine, between Georgetown and Greenwood.

Modoc County

EL ORO (Lake City)—Gravel mine being opened under direction of Fred L. Phelps. Property will be developed by sinking to tap the channel. Hoisting and pumping machinery at railroad.

Nevada County

LEDUC (Grass Valley)—Crosscut in about 2,000 ft. and several veins cut, but the looked-for oreshoot not yet disclosed.

BOSS (North San Juan)—Reported that this property near Sweetland is to be reopened; formerly worked for gold but later disclosed copper deposit, at that time unprofitable, and mine was closed after shafts had been sunk 400 ft.

Plumas County

TAFT (Quincy)—Reported that option has been taken on this quartz property at Crescent Hill, owned by John Taft.

OVERSIGHT (Quincy)—John Wilson and August Benner will start their mill soon. Heavy snowfall gives assurance of plenty of water for power and milling.

PLUMAS GRASS VALLEY MINES CO. (Laporte)—Permitted to issue 50,000 shares, par $1, to net 80c. for development and 50,000 shares to J. F. Buel in exchange for an option to purchase Quigley placer claims of 100 acres for $21,000; $17,000 expended in development and equipment.

Santa Clara County

CHROME DEPOSITS, near New Almaden, discovered 40 yr. ago, purchased by F. L. Sage and R. B. Harper.

San Bernardino County

BISMUTH-ANTIMONY (Nipton)—Carload of 50% antimony ore shipped from this property on Clark Mountain, 20 mi. east.

TREASURY (Atolia)—This property, owned by M. H. Elliott, C. W. Peterson and D. V. McBridge, divided into 40 blocks about 200 feet square and leased; shipments being made.

Shasta County

AFTERTHOUGHT (Ingot)—Reported that American Metal Co. has relinquished option.

YANKEE JOHN DEVELOPMENT CO. (Redding)—Reorganization to succeed Yankee John Gold Mining Co. Controlled by Pittsburgh men and has been developed during the last 5 years.

SYBIL (French Gulch)—High-grade ore reported in this old mine on French Gulch Creek near the Milkmaid and Washington. The 5-stamp mill running at capacity. Joseph Day, leaser, killed on June 11 by explosion of gas ignited by his candle in 70-ft. shaft.

Sierra County

TWENTY-ONE (Alleghany)—Grading for millsite and boarding house.

EL DORADO (Alleghany)—Old producer bonded to L. Wagner and J. O'Brien.

SOVEREIGN (Sierra City)—Bonded to Mitchell & Bodfish, who will begin immediate operations.

ROCK CREEK (Downieville)—Tunnel in ore. Quartz mill to be installed. Dolan & Bell, owners and operators.

KATE HARDY AND DIADEM (Forest City)—Two richest mines in district under examination. Both mines equipped.

GRAY EAGLE (Downieville)—Bonded to Sidney C. Love and associates. Winze being sunk on ledge; mill and power plant ready; 13 men employed. G. L. Thomas, superintendent.

Siskiyou County

GOLD RUN (Yreka)—This old property, operated 40 yr. ago, is again said to be producing at a profit

SISKIYOU SYNDICATE (Etna)—Operation resumed on Borden group, on Salmon River; 20-ton mill being installed. 1 J. Luce is manager.

COLORADO

Chaffee County

COPPER ORE has been opened on Badger Creek, a few miles east of Salida.

Ouray County

IN RED MOUNTAIN DISTRICT, it is reported that James M. Hyde has taken option on the Crawford properties including Yankee Girl, Guston, Genessee, Vanderbilt and Treasury Tunnel, and will resume development work; mill is to be remodeled and flotation equipment installed.

San Juan County

TELESCOPE (Chattanooga)—Hübnerite vein opened. H. C. Fisher, manager.

KUNZ-AKERS (Eureka)—Being developed by R. E. L. Townsend and associates.

DORA CONSOLIDATED (Silverton)—Being reopened under management of L. C. Gillette.

GOLD KING (Gladstone)—Development and production will be resumed. Compressor plant repaired and mill is ready.

FAIRVIEW (Silverton)—High-grade gray-copper ore opened in the third-level north heading. George Bibb is manager.

CASCADE TUNGSTEN MINING CO. (Silverton)—Recently organized by Frank C. Grimes, George Haskell, A. M. Spears, W. A. Way and others.

RUBY (Silverton)—Pockets of hübnerite opened along outcrop of this 4-ft. vein for distance of 300 ft. Excavations being made for compressor plant and other buildings. Crosscut on the Wolfram property, being developed by C. Johnson and associates, opened Ruby vein west of main Ruby workings. Ore shipped to Yukon mill.

Teller County

MARY McKINNEY (Anaconda)—Strike of 3-oz. gold ore on bottom level.

DEXTER (Victor) — C. C. George electrocuted June 19 while installing electric hoist.

ELKTON (Elkton)—Main shaft timbered to Roosevelt Tunnel level and station there nearly finished. Nearly 2,500 tons of milling ore produced in June.

IDAHO

Jefferson County

WILBERT (Wilbert)—Report just issued shows milling in last fiscal year of 15,204 tons, assaying 25% Pb and 3.86 oz. Ag; concentrates averaged 52% Pb and 8 oz. Ag; contained 6,025,600 lb. lead and 46,419 oz. silver. Milling cost, $2.07 per ton. Oxidized tailings being tested for further treatment. Exploration in progress on 600 level.

Owyhee County

DE LAMAR (De Lamar)—This old mine leased by a syndicate, including J. B. Duncan, of Jordan Valley, Oregon.

Shoshone County

REX (Wallace)—Will commence work on tram and begin milling as soon as possible. Inclined winze, 1,130 ft. below surface, in ore, will be sunk 300 ft.

HYPOTHEEK (Kingston)—Important strike in east drift of 1,100 level, 15 in. of 75% lead ore and from 4 to 5 ft. of milling ore. Shoot opened for 400 ft. on 900 level. May increase 125-ton mill to 200 tons; shipments being made to Northport.

DOUGLAS (Kellogg)—Under bond to Anaconda company. Large body of zinc-lead ore developed in two tunnels; oreshoot in lower tunnel 850 ft. long, 3 ft. wide. Will install compressor and hoist and explore ground from shaft sunk 150 ft. from lower tunnel.

VIENNA-INTERNATIONAL (Wallace)—F. C. Bailey, of Spokane, and associates optioned 51% of stock and will install compressor and hoist. Property on Placer Creek, 6 mi. from Wallace in section now receiving much attention, but without productive mines. Shaft, 175 ft.; vein, 17 ft. wide with 3 ft. milling lead-silver ore.

MICHIGAN

Copper

LAKE (Lake Mine)—Grade of rock best in history; 19 drills at work.

HANCOCK (Hancock)—Increased shipments expected after July. One stamphead at Point Mills plant operating on rock from No. 2 shaft.

MOHAWK (Mohawk)—Refined output for May, 983,413 lb.; "mineral" output, 1,343,500 lb. from 50,156 tons of ore; discrepancy between "mineral" and refined larger than usual. Ore now coming mainly from Shafts 5 and 6; repair work in progress in northerly shafts, though operations resumed at No. 1 shaft.

Iron

ANTOINE ORE CO. (Iron Mountain)—Another stripping contract for removal of 50,000 cu.yd. awarded to John Marsch. Will bring pit close to shore of Lake Antoine.

HOLMES (Ishpeming)—Shaft down to 490 ft. Will go to about 1,200 ft.; first level will be at 950 ft. Permanent brick-and-concrete buildings being erected and machinery assembled. Headframe will be of steel, 130 ft. high. Shovels stripping to make stockpile room.

MINNESOTA

Mesabi Range

LAMBERTON (Hibbing)—Stripping now in progress should permit mining to begin by July 1. Pit will be 800x400 ft. Two shovels being used.

DEAN (Buhl)—Great slide of overburden recently; bank was 150 ft. high in places. Fifteen houses and large hall were damaged. Heavy rains caused slide.

KERR (Hibbing)—Mine, formerly known as the Sheridan, being reopened by Oliver Iron Mining Co. Overburden being dumped into Carson lake. Will ship about 500,000 tons this year.

MISSOURI-ARKANSAS

Joplin District

GIBSON (Joplin)—Field shaft opened 200 ft. north of mill. Bin capacity increased to 750 tons. Will produce three carloads of concentrates weekly.

ICE PLANT (Webb City)—Mill No. 2 just started by this company, though not completed. Is to have capacity of 1,000 tons in 24 hr. Sheet ground will be mined at 190 ft.

A. W. C. (Joplin)—Fourth mill started on Hercules tract; electrically operated; modern sludge unit with Dorr thickener. Four plants expected to produce 225 tons concentrates weekly.

VOGEY (Porto Rico)—American Zinc, Lead and Smelting Co., has taken additional 20-acre lease. Will open up Union shaft, unworked for nine years. Will build 500-ton bin and tram to Vogey mill, recently increased from 800 to 1,200 tons. The 2,700-cu.ft. compressor, largest in district, will furnish air for eight machines in Union workings. Small flotation plant now operating at Vogey; results not disclosed.

North Arkansas

EDITH (Rush)—Starting of mill delayed by collapse of bins.

MARION (Kingdom Springs)—Mill being erected on 640-acre tract.

OLD CONFEDERATE (Pindall)—Williams & Truitt reopened this lead mine, worked by Confederates during war.

MYRTLE (Rush)—P. W. Harley, of Oklahoma, has organized Shamrock company to operate this property on large scale.

MONTANA

Broadwater County

KEATING (Radersburg)—Extensive investigations being carried on as to best method of treating ores. Two shifts working and regular shipments being made.

CUSTER (Winston)—Contract for 100-ton mill let to Seattle firm. Mine was gold producer but has been tied up in litigation, now settled in favor of State Senator Charles S. Muffly, of Helena.

Lewis and Clark County

FRANKLIN (Helena)—Sulphide ore carrying gold discovered at 550 ft.

MARYSVILLE GOLD MINING CO. (Marysville)—Spokane tunnel will be driven over a mile to cut Blue Bird and Hickey veins in claims adjacent to Shannon mine. M. L. Hewett in charge.

Lincoln County

PROSPECTING of Libby Creek placers to be undertaken by San Francisco syndicate; area includes holdings of Libby and Comet companies, according to E. G. Mellander, of Libby. Gravel about 20 ft. deep; upper 10 ft. will not be washed.

Silver Bow County

BULLWHACKER (Butte)—East Butte will treat 100 tons of this company's ore daily, eliminating necessity of shipping to Tacoma and Salt Lake. Three carloads just shipped to the East Butte plant, showed 4.08, 4.10 and 4.14% Cu.

TUOLUMNE (Butte)—At the Butte Main Range and Colusa-Leonard properties in eastern section of district, company is retimbering Sinbad shaft; when unwatering is completed, development will begin on 500, 600 and 700 levels. Shaft sinking at Colusa-Leonard Extension will be started as soon as agreement submitted to stockholders is ratified.

BUTTE & BACORN (Butte)—Reorganization plans are proceeding satisfactorily. $264,000 required nearly subscribed. After debts are paid, working capital of $180,000 will be available. Company owns 278 acres of patented ground and option on 47 acres more. There are two shafts on property, 860 and 1,000 ft. deep. Properties about 3 mi. north of Anaconda mines.

BUTTE & SUPERIOR (Butte)—Report filed in Federal court, June 21, shows 50,688 tons of ore treated in May in flotation plant of company's mill at cost of $3.22 a ton; yielded 11,658 tons of concentrates valued at $65.25 a ton, as against 50,112 tons of ore treated in April at cost of $2.84 per ton, to secure 12,080 tons of concentrates, valued at $83.79 per ton. This shows drop of $18.54 per ton in value of concentrates as well as drop in amount of concentrates secured and an increase in cost of treatment.

NORTH BUTTE (Butte)—Recent development between 600 and 800 levels near Speculator shaft, opened important orebodies in north and south branches of Sioux Chief vein. On 700 level vein was 7 to 11 ft. wide carrying 13% copper and 9 oz. silver per ton. On 800 level vein was over 6 ft. wide averaging 8% copper and 4.3 oz. silver per ton. In Berlin vein, 4 ft. of ore averaging 8.8% copper was opened. Granite Mountain shaft, now below 3,400 level, will be carried to 3,600 level, which will be deepest shaft in Butte. May output was 48,385 tons of ore, furnishing 2,000,000 lb. of copper and 89,000 oz. of silver. June output probably larger.

NEVADA

Esmeralda County

LONE STAR (Goldfield)—Controlling interest optioned to Eastern men who have resumed development.

GOLDFIELD ORO (Goldfield)—Shaft repairs completed to 700-ft. level. Will resume development on 800 level.

FLORENCE (Goldfield)—Enlargement of flotation plant from 150 to 300 tons per day delayed by nonarrival of machinery. Now expect increased capacity, middle of July.

LOUISIANA CONSOLIDATED (Tip Top)—Gold-silver property equipped with 10-stamp mill and cyanide plant. Reported that developments during winter exposed tonnage of $12 to $15 ore. Option taken on adjoining Brownie group. Plan to enlarge mill.

GOLDFIELD CONSOLIDATED (Goldfield)—New flotation equipment being rapidly assembled; should be in operation early in July with capacity of 1,000 tons per day; 48 Callow cells being installed. Will take run-of-mine feed; cyanide plant being utilized meanwhile for retreatment of old tailings. Tests covering several months in 50-ton flotation plant indicated 93% extraction, with reduction in present milling costs.

Humboldt County

ROCHESTER MINES CO. (Rochester)—Mill treating 115 tons per day; extraction about 92%. Costs first five months of 1916 were: Mining, $3.221; milling, $2.288; indirect, $0.827; total, $6.336. Ore reserves reported as "sufficient for several years' consumption" and "10,000 tons broken and stored in stopes."

Lincoln County

PIOCHE-BRISTOL (Pioche)—Three feet of high-grade silver-lead ore opened in Contact vein. Shipping will commence early in July. H. W. Parker, superintendent.

Nye County

TONOPAH ORE PRODUCTION for week ended June 17 was 8,937 tons, valued at $186,126, compared with 9,217 tons for week previous. Producers were: Tonopah Belmont, 2,748 tons; Tonopah Extension, 2,200; Tonopah Mining, 2,000; Jim Butler, 700; West End, 678; Halifax, 214; Rescue-Eula, 161; North Star, 58; miscellaneous, 178 tons.

TONOPAH MINING (Tonopah)—May profit was $26,330 from 9,239 dry tons, averaging $13.30 per ton.

JIM BUTLER (Tonopah)—In May, 3,153 tons were shipped to plant at Millers, yielding net operating profit of $23,360.

ROUND MOUNTAIN (Round Mountain)—From Mar. 9 to May 31, hydraulicked 106,600 yd. yielding about $40,000 in the sluices. Most of gold is on bedrock which has not been cleaned up.

WEST TONOPAH (Tonopah)—Idle since 1907; recently refinanced. Compressor and heavier hoist added to surface equipment; 850-ft. shaft repaired and will be sunk 400 ft. before undertaking lateral development.

TONOPAH BELMONT (Tonopah)—May profit amounted to $126,263, an increase of about $23,000 over April, due to high price of silver. During month 12,824 dry tons were treated, producing 2,363.75 oz. gold and 226,987 oz. silver.

TENNESSEE

STATE OF TENNESSEE has served notice on attorney general of Georgia of intention to file an intervention in U. S. Supreme Court in Georgia's case against Ducktown Copper Sulphur and Iron Co. Tennessee Copper Co.'s arrangement with State of Georgia expires in October.

UTAH

Beaver County

CROFT (Milford)—Shaft down 150 ft. and station will be cut and drifting started for ore opened above. R. R. Tanner, superintendent.

Juab County

PLUTUS (Eureka)—Reported operations will be resumed through the Chief.

D & B MINES (Eureka)—Incorporated to work 60 claims in north Tintic. Gold ore opened. Salt Lake and Tintic men interested.

MAMMOTH (Eureka)—One or two cars of 17% copper ore being shipped monthly from [illegible] level. Mine has been shipping about 4[illegible] tons monthly, but owing to lack of demand for certain kinds of ore, shipments will be cut to 2,500 tons.

GEMINI (Eureka)—Shipments resumed after two weeks' halt in underground work following accident to cage and cable. Loading station at new railroad spur completed and it is now possible to ship both via the Rio Grande and the Salt Lake route.

Salt Lake County

MICHIGAN-UTAH (Alta)—Further lead ore opened in Copper Prince tunnel.

SOUTH HECLA (Alta)—New strike [illegible] 800 ft. from surface, shows 10 to 12 ft. of shipping ore.

UTAH COPPER (Bingham)—About [illegible] shovels are in operation, handling about 30,[illegible] tons daily, exclusive of waste.

GREAT DIVIDE MINES (Bingham)—Special meeting July 8 to consider proposed bond issue to pay debts and furnish working capital. E. D. Haskins, secretary.

UTAH METAL AND TUNNEL (Bingham)—Much development being done. Orebody, opened on 850 level of New Haven, being followed easterly-westerly and on dip. Malloy bedding reached by a raise, giving 200 ft. of new stoping ground; ore is about 4 ft. thick. Mill capacity increased from 125 to over 225 tons.

Summit County

DALY (Park City)—Work being done on company account and by about 40 lessees.

BROADWATER MILLS, Big Four, Beggs and smaller mills are operating. Another mill to treat tailings just completed by Charles Moore on flat below Park City near Homer ranch; capacity, 75 tons a day.

Tooele County

O. K. SILVER (Indian Springs)—Second car of high-grade silver ore shipped.

VIRGINIA

Rockingham County

U. S. MANGANESE CORPORATION (Elkton)—This company has taken over the old Kendall & Flick manganese mines and additional property comprising about 1,000 acres; numerous old shafts on properties, and considerable good ore has been shipped in the past. Company reports 13 drill holes put down, showing good manganese orebodies. Three shafts being sunk, depths from 80 to 150 ft. Capt. C. J Bartels, superintendent; W. F. G. Berger, consulting engineer. It is expected that arrangements will be made with the newly formed Seaboard Steel and Manganese Corporation, for manufacture of ferro-manganese at old Reading furnace at Temple, Penn. This furnace has a pig-iron capacity of 175 to 200 tons per day. New York office, 74 Broadway.

CANADA

British Columbia

GRANBY (Vancouver)—May output, 4,727,929 lb. copper of which over 3,383,230 lb. was produced at Anyox where four furnaces are in operation.

Ontario

COBALT ORE SHIPMENTS over Temiskaming & Northern Ontario Ry., in May were: Beaver, 16.62 short tons; Buffalo, 31.28; Cobalt Comet, 54.75; Coniagas, 110.83; Crown Reserve 103.61; Kerr Lake, 113.50; La Rose, 96.02; McKinley Darragh, 333.34; Mining Corporation of Canada, Cobalt Lake, 117.93, Townsite-City, 41.14; Nipissing, 64.69; O'Brien, 42.99; Penn Canadian, 76.45; Peterson Lake, 41.77; Right-of-Way, 46.58; Temiskaming, 68.44; total, Cobalt proper, 1,359.94 tons; Casey-Cobalt (New Liskeard), 29.02; Miller Lake-O'Brien (Elk Lake), 20; total silver-ore shipments, 1,408.96 tons; Copper ore, Rand Syndicate (Temagami) 34 tons. Nickel ore, Alexo (Pourquois Junction) 959 tons.

DAVIDSON (Porcupine)—Mine being reopened.

TEMISKAMING (Cobalt)—Station cut at 1,100-ft. level.

NIPISSING (Cobalt)—Refinery damaged by fire, June 21; loss small.

FOLEY O'BRIEN (Porcupine)—Expected to resume about middle of July.

GENESSEE—Cut 2-in. vein at 150 ft. on claim adjoining the Chambers-Ferland.

SCHUMACHER (Porcupine)—May production was $20,908; total operating expenses, $15,128, or $3.58 a ton.

LAKE SHORE (Kirkland Lake)—High-grade ore struck on 300-ft. level, the vein extending into the Teck Hughes.

PETERSON LAKE (Cobalt)—A 2-in. vein carrying native silver opened on the Reliance claims on which company has option.

BOSTON CREEK GOLD MINES (Boston Creek)—New $2,500,000 company to take over Kenzie and about 50 claims owned by R. A. P. Syndicate.

NATIONAL (Cobalt)—This company, leasing on the King Edward, has sunk to 700-ft. level, and will continue shaft 350 ft. further to reach lower contact.

CROWN RESERVE (Cobalt)—A 12-in. shoot, recently found at 700-ft. level, carries leaf silver and will average 500 oz. per ton. Vein is in the Keewatin and 200 ft. below any ore previously found. Work on the Cochrane proceeding but option on McCrea group at Boston Creek has been dropped.

DOMINION RAND SYNDICATE (Temagami)—On these claims near Temagami Lake, large body of chalcopyrite ore, 60 ft. wide in one place, has been found. Three carloads shipped. Aërial tramway being installed to convey ore 1,000 ft. from mine to lake; then transported on scows to Temagami station.

MEXICO

IN EL ORO DISTRICT, Esperanza and Dos Estrellas companies resumed crushing in May at rate of 400 and 600 tons per day, respectively. Letter, dated June 7, stated El Oro and Mexico Mines of El Oro were to resume "in near future."

BOLIVIA

SINDICATO PETROLIFERO DEL ORIENTE BOLIVIANO is title of syndicate formed by Luis Lavadenz and other Chileans to explore 545,000 hectares of petroleum-bearing lands in Department of Santa Cruz, Province of Cordillera. Engineering party left Cordova for fields early in June.

SOUTH AMERICAN ELECTRIC SMELTING CO. (Pittsburgh, Penn., U. S. A.)—R. S. Wile and L. H. Lee of Wile Electric Furnace Co., sailed from New York June 14 to erect electric furnace for smelting Bolivian tin ore.

CHOSEN

ORIENTAL CONSOLIDATED (Unsan)—In April, 200 stamps ran 28¼ days; crushed 26,142 tons; yield $146,062; operating costs $77,720; construction $1,869; net profits $66,472.

The Market Report

Metal Markets

NEW YORK—June 28

Again we have to chronicle a week of dullness and reactionary tendencies, but as was the case at the time of our last report, lead was the exception. That metal has continued to exhibit a firmness and volume of business superior to any other metal.

Copper, Tin, Lead and Zinc

Copper—This market was again very dull and the volume of business reported was much less than in the previous week, small as it was then. The principal producers are entirely out of touch with the market, being thoroughly sold up for months to come, and indifferent to temporary recessions. The primary market at present, as during recent weeks, is in the hands of the smaller producers and the trading agencies, who being desirous of selling copper, accept what they can get. They are able to furnish plenty of July and July-August copper to meet the present small demand. In the early part of the week, July copper was reported sold at 26c., cash, New York, and in the latter part of the week, July at 25¾c., July-August at 25½c., while August-September was offered in round lots at 25¼c. During several days no transactions at all were reported, and quotations were but nominal.

Exports from Baltimore for the week included 168,242 lb. copper to Liverpool; 5,103,414 lb. copper to Havre, France; making 5,271,656 lb. in all.

Copper Sheets are unchanged at 37.5c. for hot rolled and 38.5c. for cold rolled. Copper wire is 31½@32c. per lb. for large lots at mill.

Tin—This market fluctuated in sympathy with the London market. It was dull, draggy and weak.

Lead—The same curious condition noted in several weeks lately, viz., some of the producers reporting good business and others reporting not much inquiry coming their way, continued to exist. Putting all reports together, the aggregate volume of business was larger than in the previous week. There was some export business done and there was substantial buying by domestic consumers. The nature of the orders of some of the latter indicated that they had allowed their stocks to run low. On the other hand, the statistical position from the standpoint of the producers is remarkably strong. There is no one of them who is carrying over from month to month any stock than is larger than ordinary business precaution requires to be on hand, and in some cases it is probably below the safety limit. Prices realized during the last week were rather irregular.

Spelter—Scarcely any sales of consequence were reported, and the market is quoted nominally on the offers to sell. Prices crumbled away almost from day to day, without there being any strong pressure to sell. The large producers apparently realize that it would be futile to attempt to sell any large quantities at present, but the smaller producers make offerings. There is now plenty of spelter available for early delivery, and there is no doubt that stocks are beginning to accumulate. At the close, prompt spelter was offered at 11¼c., July at 11c. and August at 10¾. July-August contracts were offered at 11c., and July-September at 10¾c. Spelter for delivery in the last quarter was offered at 10 cents.

Zinc Sheets are again easier. The base price was reduced on June 27 to $18 per 100 lb., f.o.b. Peru, Ill., less 8% discount.

Other Metals

NEW YORK—June 28

Aluminum—The market continues active, and there is not much metal offered outside of contract business. Quotations are 62@64c. per lb. for No. 1 ingots, New York.

Antimony—This market was extremely dull and hollow. We quote spot antimony nominally at 17½@18c., but if any orders should come in sight the competition for them would be so keen that without any doubt the price would be cut sharply. None of the important antimony interests was willing to quote on shipments from China.

Quicksilver—This market was more active, the turn in prices having brought in consumers as buyers. The New York market is quoted at $78 per flask, while San Francisco reports by telegraph $80 per flash, market strong. The London price is unchanged at £16 10s. per flask.

Nickel—The market continues steady with about the same amount of domestic business as usual and with some demand for export. Quotations are 45@50c. per lb. for ordinary forms, according to size and terms of order. Electrolytic nickel brings 5c. per lb. premium.

Minor Metals—Current quotations for **Bismuth** are $3.15@3.30 per lb., New York—**Cadmium** is quoted at $1.30@1.50 per lb.—**Cerium**, electrolytic, is sold at $8@9 per lb.

DAILY PRICES OF METALS IN NEW YORK

June	Sterling Exchange	Silver, Cts. per Oz.	Copper	Tin	Lead		Zinc
			Electrolytic, Cts. per Lb.	Spot, Cts. per Lb.	New York, Cts. per Lb.	St. Louis, Cts. per Lb.	St. Louis, Cts. per Lb.
22	4.7575	65	26 @26¼	39¾	6.85 @7.00	6.65 @6.75	11 00 @11 75
23	4.7575	65⅞	25⅞ @26⅛	40¾	6 80 @7.00	6.55 @6.75	11 00 @11 75
24	4.7575	66⅛	25¾ @26	40¼	6 75 @7.00	6 50 @6 75	11.00 @11 50
26	4.7575	65¾	25½ @25¾	39½	6 80 @7.00	6.62½ @6.75	11.00 @11.50
27	4.7575	66	25¼ @25½	39	6 80 @7.00	6.62½ @6.75	10 75 @11.25
28	4.7575	66¼	25¼ @25¼	39¼	6 80 @7.00	6.62½ @6.75	10.75 @11.25

The quotations herein are our appraisal of the average markets for copper, lead, spelter and tin based on wholesale contracts for the ordinary deliveries of the trade as made by producers and agencies; and represent, to the best of our judgment, the prevailing values of the metals, reduced to basis of New York, cash, except where St. Louis is given as the basing point. St. Louis and New York are normally quoted 0.17c. apart.

The quotations for electrolytic copper are for cakes, ingots and wirebars. Electrolytic copper is commonly sold at prices including delivery to the consumers and is subject to discounts, etc. The price quoted for copper on "regular terms" (r.t.) is the gross price including freight to the buyer's works and is subject to a discount for cash. The difference between the price delivered and the New York cash equivalent is at present about 0.25c. on domestic business. The price of electrolytic cathodes is 0.05 to 0.10c. below that of electrolytic. Quotations for lead represent wholesale transactions in the open market for good ordinary brands. Quotations for spelter are for ordinary Prime Western brands. Only the St. Louis price is herein quoted, St. Louis being the basing market. We quote the New York price at 17c. per 100 lb. above the St. Louis price.

Silver quotations are as reported by Handy & Harman and are in cents per troy ounce of silver bars 999 fine.

Some current freight rates on metals per 100 lb. are: St. Louis-New York 17c.; St. Louis-Chicago, 6.3c.; St. Louis-Pittsburgh, 13.1c.

LONDON

June	Silver	Copper				Tin		Lead		Zinc	
		Standard		Electrolytic							
		Spot	3 Mos.	£ per Ton	Cts. per Lb.	Spot	3 Mos.	£ per Ton	Cts. per Lb.	£ per Ton	Cts. per Lb.
22	31	97	95	133	28.32	172¼	172¾	30	6.38	67	14.27
23	31 3/16	98	96	130	27.68	175¾	176¼	29½	6.28	66	14 05
24	31 9/16	.....	......	.....	......			. .	. .		.
26	31⅜	102	99	130	27 68	173¼	173¾	29¾	6.33	65	13 83
27	31½	102	98	130	27 68	171½	172	29¾	6.33	65	13 83
28	31⅝	103	100	130	27 68	172	172½	29	6.17	63	13 41

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2,240 lb., except silver which is in pence per troy ounce of sterling silver, 0.925 fine. Copper quotations are for standard copper, spot and three months, and for electrolytic, price for the latter being subject to 3 per cent. discount. For convenience in comparison of London prices, in pounds sterling per 2,240 lb., with American prices in cents per pound the following approximate ratios are given, reckoning exchange at 4.80. £15 = 3.21c.; £20 = 4.29c.; £30 = 6.43c.; £40 = 8.57c.; £60 = 12.85c. Variations, £1 = 0.21⅜c.

Gold, Silver and Platinum

NEW YORK—June 28

Gold—More gold has come to New York from Canada. Some has also been received direct from London. The total amount is approaching $100,000,000 on this movement.

The Russian government has ordered a premium paid on all gold deposited at the official assay offices and banks. The object is to stop illegal exports from Siberia by merchants and traders.

Platinum—The market continues very slow. Transactions are necessarily limited by small supplies, and buyers are taking only what is necessary. Quotations are $75@78 per oz. for refined platinum.

Our Russian correspondent writes that there has been some revival in activity. The price has been kept down, notwithstanding a better demand, by government sales, the quantity requisitioned some time ago having proved greater than was needed. Moreover the high prices have stimulated production and more metal is offered. Producers are stiff, believing that prices will not fall below present level. Quotations for crude metal, 83% platinum, are 17 rubles per zolotnik—$63.92 per oz.—at Ekaterinburg, and 65,000 rubles per pood—$63.70 per oz.—at Petrograd.

Silver—The market has rested fairly steady the past week between 31 and 31⅝d. in London. The combination of buyers in London is tending toward steadiness in price. The possibility of war with Mexico is also a bullish factor but has had no effect on prices as yet. Mexican supply would undoubtedly be curtailed in case of hostilities. Coinage demand abroad still continues, with shipments from Shanghai to Bombay for the Indian Government.

On June 22 Mexican dollars in New York were quoted at 50@55c.; June 23 at 50¼@55¼c.; June 24, at 50⅞@53⅞c.; June 26, at 50⅝@53⅞c.; June 27, at 50⅞@54c.; June 28 at 51@54⅛c., closing.

Zinc and Lead Ore Markets

PLATTEVILLE, WIS.—June 24

The base price paid this week for zinc ore was $75@77 per ton 60% zinc for top grades down to $70 base for medium grades assaying down to 50% zinc. The base price paid for 80% lead was $78@80 per ton.

SHIPMENTS, WEEK ENDED JUNE 24

	Zinc Ore, Lb.	Lead Ore, Lb.	Sulphur Ore, Lb.
Week	5,316,000	225,780	610,800
Year	113,840,000	4,147,710	28,147,400

Shipped during week to separating plants, 7,520,000 lb. zinc ore.

JOPLIN, MO.—June 24

Blende, high price $92.90; premium ore, per ton 60% zinc, $90; medium $86@75; low $70; calamine, per ton 40% zinc, $60@50; average, all grades of zinc, $78.83 per ton. Lead, high price, $82.25; base $80@77.50 per ton 80% metal content; average selling price, $80.57 per ton; the bulk of ore selling on the lower base was purchased for next week's delivery.

SHIPMENTS WEEK ENDED JUNE 24

	Blende	Calamine	Lead	Values
Totals this week	11,454,930	940,930	2,721,710	$598,200
Totals this year	346,749,930	28,510,830	59,271,340	$21,785,340

Blende value, the week, $463,120, 25 weeks, $18,086,460.

Calamine value, the week, $25,460; 25 weeks, $1,025,000.

Lead value, the week, $109,620; 25 weeks, $2,673,880.

The portion of the mining district immediately surrounding Joplin was partly disabled a couple of days this week by a waterspout, or rainfall of over 5 in. in two hours, early Monday morning

OTHER ORES

Manganese Ore imports into the United States in April were 18,413 gross tons, against 218 tons in April, 1915. For the four months ended Apr 30 the total imports were, 10,492 tons in 1915, and 99,958 tons in 1916; increase, 89,466 tons.

Imports of manganese ore in Great Britain five months ended May 31 were 107,297 tons in 1915, and 174,666 in 1916; increase, 67,369 tons.

Imports at Baltimore for the week included 1,760 tons of manganese ore from Brazil.

Antimony Ore—There is not much demand. On the other hand there is very little for sale, imports being held back by high freight rates. Quotations are nominal at $2 per unit

Tungsten Ore—More inquiry is reported especially as buyers are getting ready to contract for their second-half requirements. No business is reported, however, except a few small sales at $30@32 per unit. Holders are asking $35@40 per unit, with no sales.

Iron Trade Review

PITTSBURGH—June 27

Prospects of war have not been affecting the steel market materially in the past few days, and for one reason because there was so very little to affect, the domestic steel market being extremely dull. Export demand from neutral countries continues particularly heavy, as it has been for more than a month.

The strike in the Pittsburgh coal district is practically over, many men having returned to work yesterday and today, and the coal market has become nominal.

Pig Iron—The low prices at which warrants for Southern iron have been dumped on the market by speculators has adversely affected sentiment. We continue to quote: Bessemer, $21; basic, foundry and malleable, $18.25@18.50; forge, $18, f.o.b. Valley furnaces, 95c. higher delivered Pittsburgh.

Steel—The open market is quiet and prices are hardly as firm, though they are not quotably lower, being about $40@42 for bessemer and $40@45 for openhearth, with rods $55@69 and forging billets $65@70 per ton.

FERROALLOYS

Spiegeleisen is quoted $50@55 per ton for 20% at mill. For higher grade, 25 to 30%, about $5 more is asked. Supplies are a little better.

Ferrosilicon is nominally held at $83@85 per ton at mill for 50%; but premiums are paid for early delivery. Bessemer ferrosilicon is from $33 per ton for 10% up to $43 for 16%, at mill.

Ferromanganese—The market is excessively dull. Prompt may still be quoted at $225@250 but there is little being done to establish the figures. Contract remains at $175, for next year's delivery.

Imports of Ferromanganese in May are reported by the Department of Commerce as follows: At Baltimore, 6,195; Philadelphia, 1,198; New Orleans, 1,073; total 8,466 gross tons.

Imports at Baltimore for the week included 2,280 tons ferromanganese from Liverpool.

IRON ORE

Imports and Exports of Iron Ore in the United States four months ended Apr. 30, in gross tons:

	1915	1916	Changes
Imports	334,022	353,254	I. 19,232
Exports	9,238	25,575	I 16,337

Of the imports this year 210,576 tons, or nearly 60%, were from Cuba. The exports are nearly all to Canada, from the Lake Superior ports

COKE

Coke production in the Connellsville region for the week is reported by the "Courier" at 433,476 net tons; shipments, 433,630 tons. Upper Connellsville and Greensburg district shipments, 32,781 tons.

Coal and Coke on Pennsylvania R.R. lines east of Pittsburgh and Erie five months ended May 31, short tons:

	1915	1916	Changes
Anthracite	4,580,414	4,952,149	I. 371,735
Bituminous	16,597,074	20,524,490	I. 3,927,416
Coke	4,008,443	6,162,191	I 2,153,748
Totals	25,185,931	31,638,830	I. 6,452,899

The total gain this year was 25.6%. The largest proportional gain—53.7%—was in coke. May tonnage was 6,112,581 tons, an increase of 874,077 tons, or 14.3% over May of last year.

Chemicals

NEW YORK—June 28

The general market is rather inclined to be quiet and business has been only on a moderate scale.

Arsenic—On a moderate business prices continue at $6@6.50 per 100 lb. for spot, and $6 for futures.

Copper Sulphate—The tendency of the market has been downward. Sales are reported at $10@12 per 100 lb. for carload lots.

Nitrate of Soda—The market has been depressed by reports of heavy production and shipments. Quotations are easier at $3.05@3.10 per 100 lb. for both spot and futures.

Pyrites—Imports at Baltimore for the past week included 7,645 tons pyrites from Huelva, Spain.

Assessments

Company	Delinq.	Sale	Amt.
Advance, Mont	June 15	July 15	$0.005
Algomah, Mich	May 18	....	1.00
Blue Bell, Ida	July 8	Aug. 5	0.002
Bullion, Ida	July 10	July 31	0.01
Cedar Creek, Ida	July 5	Aug. 5	0.01
Central Eureka, Calif.	June 16	July 14	0.05
Challenge, Nev.	June 12	July 7	0.05
Columbus Ext., Utah	July 13	Aug. 8	0.02
Confidence, Nev.	June 23	July 14	0.10
Cons. Imperial, Nev.	July 18	Aug. 10	0.01
Crackerjack, Nev.	July 3	Aug. 1	0.01
East Hercules Ext., Ida	May 1	July 3	0.0015
Emerald, Utah	June 15	July 8	0.0033
Fortuna, Utah	June 15	July 8	0.005
Friend, Ida	June 30	July 20	0.002
Giant, Ida	June 16	July 17	0.003
Goldstrike Bon., Utah	June 15	July 15	0.01
Gold Mt. Champion, Utah	July 20	Aug. 10	0.0025
Gould & Curry, Nev.	July 14	Aug. 3	0.03
Hope, Calif.	July 17	Aug. 14	0.01
Imperial, Ida	June 12	July 12	0.005
Independence, Ida	July 8	July 29	0.001
Laclede, Ida	July 3	July 25	0.003
Leonora, Utah	June 20	July 11	0.005
National, Ida	June 2	July 3	0.02
Nevada-Douglas, Nev.	July 15	Aug. 16	0.10
North Franklin, Ida	June 19	July 8	0.005
North Lake, Mich.	June 14	.....	1.00
Old Veteran, Ida	July 8	Aug. 5	0.002
Ophir, Nev.	June 13	July 6	0.05
Rio Grande, Nev.	June 22	July 22	0.002
Rob Roy, Ida	June 10	July 10	0.002
Rockford, Ida	June 30	July 21	0.002
Sierra Nevada, Nev	July 11	Aug. 3	0.10
Silver Moon, Ida	July 8	Aug. 3	0.005
Silver Pick, Nev.	July 5	Aug. 14	0.01
Spearhead Reor., Nev	July 3	Aug. 3	0.01
Swansea Ext., Utah	July 10	Aug. 1	0.0025
Ton. Gypsy Queen, Nev	July 11	Aug. 15	0.01
Uvada, Nev.	June 24	July 27	0.02
Wallace, Ida	June 29	July 29	0.0025
Wasatch-Utah, Utah	June 19	July 22	0.0025
Wisconsin North Fork, Calif.	June 12	July 10	0.01

Stock Quotations

SAN FRANCISCO June 27 Name of Comp.	Bid.
Alta	.05
Andes	.14
Best & Belcher	.05
Bullion	.03
Caledonia	.40
Challenge Con.	.09
Confidence	.23
Cons. Imperial	.01
Con. Virginia	.10
Gould & Curry	.02
Hale & Norcross	.08
Jacket-Cr. Pt.	.05
Mexican	.15
Occidental	.70
Ophir	.27
Overman	.08
Savage	.07
Seg Belcher	.02
Sierra Nevada	.23
Union Con.	.72
Utah Con.	.01
Belmont	4.00
Jim Butler	.87
MacNamara	.06
Midway	.21
Mont.-Tonopah	.26
North Star	.15
Rescue Eula	.31
West End Con.	.90
Atlanta	.10
Blue Bell	.01
Booth	.15
C.O.D. Con	.03
Comb. Frac	.07
D'field B.B.	.02
D'field Daisy	.02
Jumbo Extension	.77
Pitts.-Silver Peak	.09
Round Mountain	.60
Sandstorm Kendall	.04
Silver Pick	.09
Central Eureka	.11
Argo	.15
Big Jim	.87½
Lazy Boy	.15
Oatman Cres.	‡.42
Oatman No. Star	.20
Tom Reed	1.45
United Eastern	3.75
United Western	.13

SALT LAKE June 27 Name of Comp.	Bid.
Alta Con.	49
Black Jack	.05½
Colorado Minin.	10½
Crown Point	.04
Daly-Judge	7.40
Emma Cop.	.44
Gold Chain	25½
Grand Central	69
Iron Blossom	1.60
Lower Mammoth	.04
May Day	.12
Opohongo	.01½
Prince Con.	1.30
Seven Troughs	.02½
Silver King Coal'n.	2.60
Silver King Con.	3.07½
Sioux Con	.10½
Uncle Sam	.06
Yankee	.20½

COLO. SPRINGS June 27	
Acacia	.03¾
Doctor Jack Pot	.09
Elkton Con.	.15
El Paso	.77
Findlay	.03½
Gold Sovereign	.03½
Golden Cycle	2.12
Granite	.65
Isabella	.16¾
Jack Pot	.05
Jerry Johnson	.04
Mary McKinney	.35
Portland	1.65
Vindicator	2.25

TORONTO June 27	
Adanac	.80
Bailey	.07
Chambers Ferland	.22
Coniagas	5.00
La Rose	.61
Peterson Lake	.24
Right of Way	.05
Seneca Superior	.35
T. & Hudson Bay	50.00
Temiskaming	.62
Tretheway	.23
Wettlaufer-Lor.	.09
Dome Exten.	.35
Dome Lake	.33
Foley O'Brien	48
Hollinger	29.50
Imperial	‡.03
Jupiter	.32½
McIntyre	1.55
Porcu. Crown	.75
Preston E. D.	‡.03
Vipond	.55
West Dome	.35

LONDON June 14			
Alaska Tre'dwell	£6	7s	6d
Burma Corp.	2	13	1½
Cam & Motor	0	15	0
Camp Bird	0	9	9
El Oro	0	10	3
Esperanza	0	11	6
Mexico Mines	4	2	6
Nechi, pfd	0	13	6
Oroville	0	16	0
Santa Gert'dis.	0	14	9
Tomboy	1	3	3

N. Y. EXCH. June 27 Name of Comp.	Clg.
Alaska Gold M.	19¾
Alaska Juneau	8¾
Am.Sm.&Ref.,com	92½
Am. Sm. & Ref., pf	111
Am. Sm. Sec., pf. A	92
Am. Sm. Sec., pf. B.	84
Am. Zinc	40¼
Am. Zinc, pf.	65
Anaconda	79⅞
Butopilas Min.	1⅜
Bethlehem Steel	440
Bethlehem Steel, pf.	130
Butte & Superior	66½
Chile Cop.	20⅞
Chino	48½
Colo. Fuel & Iron	41
Crucible Steel	75½
Dome Mines	25⅝
Federal M. & S.	12½
Federal M. & S., pf.	35¼
Great Nor., ore ctf.	34
Greene Cananea	37
Homestake	130
Inspiration Con.	49
International Nickel	45½
Kennecott	47¾
Lackawanna Steel	66
Miami Copper	34½
Nat'l Lead, com	65
National Lead, pf.	113
Nev. Consol.	16½
Ontario Min.	6¾
Quicksilver	2¾
Quicksilver, pf	4¾
Ray Con.	21
Republic I&S, com.	43
Republic I&S, pf.	107
Sloss-Sheffield	47
Sloss-Sheffield, pf	93
Tennessee Copper	34
Utah Copper	76¼
U. S. Steel, com	83⅝
U. S. Steel, pf.	117½
Va. Iron C. & C.	48

N. Y. CURB June 27	
Beaver Con.	.40
Buffalo Mines	1
Butte & N. Y.	5¾
Butte C. & Z.	4½
Can. Cop. Corpn.	1$\frac{11}{16}$
Cashboy	.07
Cerro de Pasco	34½
Con. Ariz. Sm.	1⅝
Con. Coppermines	2⅜
Con. Nev.-Utah	28¾
Crystal Cop.	1
First Nat. Cop.	3⅜
Florence	.40
Goldfield Con.	.82
Goldfield Merger	.08
Granite	.38
Hecla Min.	5$\frac{3}{16}$
Howe Sound	4⅝
Jerome Verde	1½
Joplin Ore & Spel	2½
Kenefick Zinc	‡13½
Kerr Lake	4¾
Magma	14½
Majestic	.50
McKinley-Dar-Sa.	.50
Mines of Am.	2½
Mother Lode	.27
Nevada Hills	.18
N. Y. & Hond.	15¾
Nipissing Mines	7¼
Oro	.05
Ray Hercules	3¾
Rochester Mines	.57
St. Joseph Lead	16
Standard S. L.	1½
Stewart	.25
Success	.80
Tonopah	6
Tonopah Ex.	5½
Tribullion	$\frac{1}{16}$
White Knob, pf.	1½
Yukon Gold	2

BOSTON EXCH June 27 Name of Comp.	Bid
Adventure	2
Ahmeek	93½
Algomah	1½
Allouez	64½
Ariz. Com., ctfs.	8½
Bonanza	.25
Butte-Balaklava	2
Calumet & Ariz.	67
Calumet & Hecla	5[illegible]5
Centennial	15½
Copper Range	59
Daly West	2½
East Butte	11½
Franklin	6½
Granby	85
Hancock	10
Hedley	‡20
Helvetia	.25
Indiana	2¾
Island Cr'k, com.	47
Island Cr'k, pfd.	88½
Isle Royale	27½
Keweenaw	4
Lake	11
La Salle	3¼
Mason Valley	2½
Mass	11½
Mayflower	2
Michigan	2¾
Mohawk	97½
New Arcadian	6
New Idria	13
North Butte	21
North Lake	1½
Ojibway	1
Old Colony	1¼
Old Dominion	65
Osceola	90
Quincy	86
St. Mary's M. L.	73
Santa Fe	1¾
Shannon	8
Shattuck-Ariz.	28¼
So. Lake	6
So. Utah	.15
Superior	14
Superior & Bost.	3¾
Tamarack	44
Trinity	5¼
Tuolumne	.40
U. S. Smelting	65¾
U. S. Smelt'g, pf.	50½
Utah Apex	4$\frac{3}{16}$
Utah Con	12¾
Utah Metal	7¾
Victoria	2¾
Winona	5¼
Wolverine	54¼
Wyandot	1¼

BOSTON CURB June 27	
Bingham Mines	10⅝
Boston Ely	.60
Boston & Mont.	.85
Butte & Lon'n Dev.	.69
Calaveras	4¾
Calumet-Corbin	.04
Chief Con.	1$\frac{11}{16}$
Cortez	.40
Crown Reserve	.51
Davis-Daly	1¾
Eagle & Blue Bell	1$\frac{11}{16}$
Houghton Copper	1¾
Iron Cap Cop., pf	5¾
Mexican Metals	.26
Mojave Tungsten	5¾
Nat. Zinc & Lead	1½
Nevada-Douglas	90
New Baltic	2
New Cornelia	13
Ohio Copper	.14
Oneco	1
Raven Copper	‡.18
Rex Cons.	.14
Rilla	.35
United Verde Ext.	29¾

‡Last Quotations.

Monthly Average Prices of Metals

SILVER

Month	New York 1914	New York 1915	New York 1916	London 1914	London 1915	London 1916
January	56.572	48.855	56.775	26.553	22.731	26.960
February	57.506	48.477	56.755	26.573	22.753	26.975
March	58.067	50.241	57.935	26.788	23.708	27.597
April	58.519	50.250	64.415	26.958	23.709	30.662
May	58.175	49.915	74.269	26.704	23.570	35.477
June	56.471	49.034	......	25.948	23.267	.
July	54.678	47.519	....	25.219	22.597	..
August	54.344	47.163	....	25.979	22.780	
September	53.290	48.680	....	24.260	23.591	
October	50.654	49.385	......	23.199	23.925	..
November	49.082	51.714	.....	22.703	25.094	
December	49.375	54.971	......	22.900	26.373	.....
Year	54.811	49.684	.....	25.314	23.675	......

New York quotations cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

COPPER

Month	New York Electrolytic 1915	New York Electrolytic 1916	London Standard 1915	London Standard 1916	London Electrolytic 1915	London Electrolytic 1916
Jan.	13.641	24.008	60.756	88.083	65.719	116.167
Feb.	14.391	26.440	63.494	102.667	*	133.167
Mar.	14.787	26.310	66.152	107.714	*	136.000
April	16.811	27.895	75.096	124.319	*	137.389
May	18.506	28.625	77.600	135.457	*	152.522
June	19.477	......	82.574	....	95.333	.
July	18.796	......	76.011	.. .	91.409	
Aug.	16.941	.... ..	68.673	.. ....	82.333	.
Sept.	17.502	......	68.915	.. ...	85.250	..
Oct.	17.686	......	72.601	.. ....	88.000	
Nov.	18.627	......	77.744	.. ...	93.273	..
Dec.	20.133	... ..	80.773	.. .	100.43	
Year	17.275	......	72.532	. .		

TIN

Month	New York 1915	New York 1916	London 1915	London 1916
January	34.260	41.825	156.550	175.548
February	37.415	42.717	176.925	181.107
March	48.426	50.741	180.141	193.609
April	47.884	51.230	166.225	199.736
May	38.790	49.125	162.675	196.511
June	40.288		167.636	.
July	37.423		167.080	.
August	34.389		151.440	
September	33.125	.	152.625	
October	33.080	.	151.554	
November	39.224	.. .	167.670	
December	38.779	.	167.000	
Av. year	38.590	. .	163.960	

LEAD

Month	New York 1915	New York 1916	St. Louis 1915	St. Louis 1916	London 1915	London 1916
January	3.729	5.921	3.548	5.826	18.606	31.167
February	3.827	6.246	3.718	6.164	19.122	31.988
March	4.053	7.136	3.997	7.375	21.883	34.440
April	4.221	7.630	4.142	7.655	21.094	34.368
May	4.274	7.463	4.182	7.332	20.347	32.967
June	5.932	...	5.836	...	25.170	
July	5.659	.....	5.531		24.611	.
August	4.656	....	4.520	.	21.946	.
September	4.610	.....	4.490		23.151	..
October	4.600	......	4.499		23.994	
November	5.155	. . .	5.078	.	26.278	
December	5.355	.... .	5.266		28.807	
Year	4.673	.....	4.567	..	22.917	. ..

SPELTER

Month	New York 1915	New York 1916	St. Louis 1915	St. Louis 1916	London 1915	London 1916
Jan.	6.386	16.915	6.211	16.745	30.844	89.810
Feb.	8.436	18.420	8.255	18.260	39.819	97.762
Mar.	8.541	16.846	8.360	16.676	44.141	95.048
April	10.012	16.695	9.837	16.525	49.888	99.056
May	14.781	14.276	14.610	14.06	68.100	94.2[illegible]7
June	21.208		21.038	..	100.614	..
July	19.026		18.856	. . .	97.250	.
Aug.	12.781	.. ..	12.611		67.786	
Sept.	13.440	..	13.270		67.841	
Oct.	12.800	. .	12.596	. . .	66.536	
Nov.	15.962	...	15.792	. ....	88.409	
Dec.	15.391	. .	15.221	....	89.400	..
Year	13.230	.	13.054	...	67.553	. .

New York and St. Louis quotations, cents per pound, London, pounds sterling per long ton. * Not reported.

PIG IRON IN PITTSBURGH

Month	Bessemer‡ 1915	Bessemer‡ 1916	Basic‡ 1915	Basic‡ 1916	No. 2 Foundry 1915	No. 2 Foundry 1916
January	$14.59	$21.60	$13.45	$18.78	$13.90	$19.70
February	14.55	21.16	13.45	18.93	13.90	19.51
March	14.55	21.81	13.45	19.20	13.95	19.45
April	14.55	21.65	13.45	18.95	13.95	19.45
May	14.61	21.78	13.60	19.11	13.83	19.58
June	14.70		13.67		13.77	
July	14.94		13.91	.	13.68	
August	16.01	.	15.31		14.75	
September	16.86	.	15.95		15.70	
October	16.95	.	15.96		15.80	
November	17.57	...	16.47		17.20	..
December	19.97		18.44		18.95	
Year	$15.82	.....	$14.76	. ...	$14.95	.....

‡As reported by W. P. Snyder & Co.

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Engineering and Mining Journal

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Amenities of Bolivian Mining

By Mark R. Lamb[*]

SYNOPSIS—Tin mine at Llallagua at an altitude of 13,000 ft. pays its staff double salaries on account of the altitude. No one but native-born and trained can wield a single jack at this altitude. Native Bolivians are improvident, and the rising generation is absolutely neglected, primitive mining and milling methods slowly giving way to modern machinery. The tin produced has been shipped to England without cable quotations and has been sold there on the market. The miner has to take what he can get for his product when it arrives on the English market.

It is the small mines that are being worked in Chile and Bolivia by individuals or small companies that are attractive. Most of them are owned by Chilean capital, the foreigner rarely having any part.

LA PAZ, BOLIVIA, A CAPITAL CITY IN THE MOUNTAINS. IN THE BACKGROUND IS ILLIMANI, THE HIGHEST MOUNTAIN IN THE WESTERN HEMISPHERE

The Bolivian mine around which the most exciting stock-exchange battle has raged during the past few years is the Llallagua (pronounced yah-yah-guah). This is a tin mine. It has a consistent record of big production, excellent management and violent fluctuations in share values. Until recently the mine supported a very expensive lawsuit, but good counsel and a wise adjuster have succeeded in bringing the dispute to an end, with the result that it and its former antagonist, Sr. Simon Patiño, will be able to work for dividends instead of to provide for fees.

The mines are at an elevation of 13,000 ft. above sea level. This feature alone doubles the salaries of the staff. It is a long day's horseback ride from the railway station at Challapata, and the guide passes the time pleasantly by pointing out where the messenger carrying the pay was shot, where the Turk peddler was robbed and killed, and similar assuring incidents.

On the way out to the mine droves of llamas are passed carrying out supplies and machinery or bringing in cargoes of tin concentrates. The llamas are not fed, so they pick up what they can while traveling. Their rate of progress is thus quite limited. They are not much larger than goats and not as strong as burros, so a 100-lb. load is a maximum. Nevertheless they freight at a lower rate than carts or mules can do, owing to the feed problem. On the high plateau region of Bolivia it takes, speaking conservatively, one llama or two burros or five mules to find a blade of grass per hour.

The combination of llamas and Bolivian Indians is successful in transporting materials that are not easily injured, but it fails where brains are required of either. For example, cement is packed in suitable bags for llama transportation and arrives in good condition during the dry season. Of course it also arrives during the wet season, but as lumps of stone. Even the bags are useless. Llallagua has lately completed an ideal little hydro-electric power plant under the technical direction of Oscar von Chrismer. The site is about as far from civilization, measured by difficulties, as it could be. The dam site is ideal, and a minimum supply of 300 kw. is assured the year round, though the rainfall is very irregular. The power plant is German, the equipment is all that could be desired.

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[*] Allis-Chalmers Co., Santiago, Chile.

Before this plant was built, power was supplied by producer-gas engines with anthracite at a fabulous number of pounds sterling per ton. As anthracite must be transported on the llama, it is necessary to provide stock for several months, so that no advantage can be taken of a shortage to raise the freight rate. There is no interstate commerce commission in Bolivia. The hydro-plant supplies the same 50-cycle three-phase current, so that the gas-engine plant can now be held as a stand-by unit.

The superintendent at the mine is Sr. E. Diaz, a Chilean with home and foreign experience, including a long period in the States, and he has been wisely permitted by his management to surround himself with a corps of assistants of his own choosing.

The mine is several kilometers from the mill. Ore is brought down by an aërial tramway, the drop from the mine to the mill being sufficient for its operation. The buckets are small and the rope is light, but the combination serves admirably. Bolivia is marked up with these single-line tramways, and one is easily converted to their use. They give little trouble, and this trouble is easily remedied. The buckets are simply hung on the line, not gripping it in any way, friction alone keeping them in place. Where the line is steep, this friction sometimes becomes a minus quantity. The buckets that then accumulate at the foot of the towers remind one of the impression which the English cabled news gives of the poor German artillerymen, the only difference being that the buckets are soon again in working order.

NATIVE LABOR IMPROVIDENT

The miners in Bolivia are Bolivians. In the States the miners are of all nationalities, but no one can replace the Bolivian, as no one else can work at that altitude. The miner uses an 8-lb. single-jack in drilling, holding the handle close to the hammer-head and striking a very short shoulder-and-body blow. They seem to strike hard and to get results. I have tried the hammer. After a very few blows, it was necessary to stop and rest. With only 8 lb. atmospheric back pressure for the lungs, it is absolutely impossible for anyone not accustomed for years to the altitude to do hard labor. At one mine we rode up the hill on mules and walked down the trail upon returning, and though the walk was scarcely a mile, I was entirely done for. Then to think of anyone not Bolivian born really attempting to work at that altitude seems nothing short of foolhardiness. All the foregoing leads to the fact that the Bolivian Indian is the only possible laborer and that consequently he should be conserved carefully. Instead of that, he is encouraged in the use of pure alcohol, and no effort is made to protect him and his family in winter. Snow and ice are colder in Bolivia than elsewhere, and as the laborer is not of a saving disposition, he usually becomes resigned to going through the winter with his summer clothes. Far from having any savings, he is usually indebted to his employer well in advance of what he has earned. Some plant managers are so anxious to hold men and keep them in good humor that very liberal advances are countenanced, though this frequently results in the laborer going elsewhere rather than work out his debt. With all their lack of foresight, they are very independent, as the demand for labor is in excess of the supply. Holidays are as frequent as in the States, and 200 working days is the usual year's run. The companies include in their reports the explanation of time lost for feast days, with the names of the saints which are the cause.

The little children are neglected absolutely, from the American point of view, and one need not go far in Bolivia to find conditions that seem susceptible to improvement. If I were a mine owner in Bolivia, I think I should gather up the older children and take care of them, in the hope that my job would last long enough to make it worth while. Not much would have to be done to help them considerably. For example, I was caught in a snowstorm between Antequera and Totoral one day in June. Walking ahead of my horse was a band of Indians with packs and children. The snow was heavy and froze on my overcoat and overshoes as it struck. The wind was dead ahead, and my horse declined several times to face it. Some of the adults were fairly well protected so far as their bodies were concerned, but what annoyed me was the bare feet of the little fellows. The snowstorm did not last long—but I will see those little toeprints wherever there is cold, glistening snow.

Children, and especially girls, who are constantly exposed that way cannot grow up to be good laborers. To be sure, if they are not strong, they are still useful for hand breaking and sorting of ore, but what is most required is strong men and women that can do heavy work and carry heavy loads. It would not be very expensive to feed the children and keep them warm in winter, and doesn't it seem possible that they would be appreciative enough so that a worth-while percentage would stay right along? I have no doubt all this sounds Utopian to a real mine manager in Bolivia, but it would be fun to try it.

On a street car in La Paz, a lady of the upper class met a friend; she had a little Indian boy with her, dressed nicely and looking happy. The lady explained that his Spanish was not good yet, as she had bought him only a short time before. The sale is of course not legal, but the scheme is to get the parents to swear that the child is not theirs. Then the parents cannot make trouble. It is merely another method of adoption, as of course the child can leave whenever he decides to do it. Another instance of this occurred when a Spanish opera singer and his wife bought a little 9-year-old Indian girl while on a trip through Oruro. I met them on the steamer en route to Spain. The contrast between the fair Spaniards and the dark red girl was striking and caused much comment. I wonder what the outcome of that experiment will be.

HAND LABOR IS NOT MUCH USED IN THE BIG MINES

The big mines like Llallagua, Oruro, Oploca and Sr. Patiño's are gradually doing away with much of the requirement for hand labor by the introduction of modern machinery. Hand crushing is nearly gone. Hand sorting is gradually disappearing before the modern mill that can make a profit on very low-grade ores, though sorting is still worth while where it is possible to make a shipping grade, without further handling.

The old hand-rabbled furnaces are being replaced by McDougal or other similar mechanical roasters, even where silver is present and chloridizing roasting must be done. The hordes of contractors that formerly worked over the tailings, selling their product back to the companies, are slowly being driven to doing useful work, while what they formerly did is being done within the mills by tables, vanners and other similar and more or less successful substitutes for human effort. It is necessary to say "more or less successful" because, after seeing these people washing ore about 50 times by hand in order to raise the grade of the concentrates a few points, it seems impossible that a machine could be made that could take their place. At one mill (which I am afraid to name until the order is placed) I have actually seen, and you may now see, a woman feeding each table by hand from a little pile of sand, with another sitting at the foot of the table who from time to time shifts a little tin divider which separates concentrates from middling. This is not a temporary expedient, because both women have rigged up very comfortable chairs or thrones of candle boxes and ore bags.

TYPE OF TOWN AND PEOPLE OF THE BOLIVIAN MOUNTAIN COUNTRY

The hand-roaster men work 24-hr. shifts. They like it better, and apparently there is no reason for changing the system. The roasted ore, where no silver is treated, is concentrated on jigs, tables and vanners and then on canvas plants or automatic wooden slime tables. These latter raise the grade of the tailings from 1 or 2% to 6 or 8%, and the concentrate is either worked over in a confusing multitude of round buddles or on vanners. Sometimes the sand is returned to the mill for regrinding, the women packers being able to carry about 50 lb. up the sidehill and the ladders to the Huntington and Chilean mills. Only in the larger and more progressive mills has the grade of the mill tailings been reduced so low that there are no contractors working them over. Speaking of tables, vanners and machinery generally, let me give my competitors a hint. There is nothing that so successfully convinces your customer that you know how to supply his needs as the inclusion of a large list of spare parts with every machine sold. Some manufacturers go so far as to regularly quote a price that includes a liberal supply of spares—and it is a good practice for South America. Remember that though you ship from your factory today, the merchandise does not leave New York for two weeks, and if the customer is in Bolivia, the time required for the shipment to reach Mollendo, Arica or Antofagasta, be transported on the railway and finally reach the mine via llamas, has totalled around three months. Then perhaps some case or part will have been left at the wrong port or broken, and he will have to cable for a duplicate, which will be another three months on the way.

Many of the Bolivian mines have producer-gas engine plants, some using anthracite and others charcoal. The Diesel is now coming into its own, since it is possible at present to buy Peruvian crude oil in the mining region. The altitude decreases the rating of the engines at an alarming rate, but once having admitted that gas and oil engines lose half their capacity at 12,000 ft., the point is not discussed.

The Oruro company has been very successful, treating different grades and kinds of ore. Part of the ore can be concentrated directly, while some of it requires roasting and silver leaching with hypo previous to concentration for tin. Not long ago this company erected a complete modern tailings plant, which includes classifiers, thickners, grinding pans, Richards-Janney classifiers, tables and vanners. The report for the six months makes such a good showing that modesty alone prevents my quoting it in full. There are large deposits of tailings of bygone years, and the regrinding and reconcentration of these is proposed, using tube mills.

Until lately and for several years, tin has been at a very good price. The war has put an end to that, and the lack of interest on the part of the American consumer of tin is resulting in the storing of a large amount of Bolivian tin until such a time as it can again be shipped to England, smelted there and sold to the States.

The Oruro has a special McDougal equipment which has reached a capacity close to 45 tons of 20-mesh pyrite per 24 hr. Considering the altitude and the fact that chloridizing roasting is done after the product leaves the McDougal, this is a high capacity. When everything is going properly, it will be possible to dispense with the hand roasting furnaces and thus free a lot of men who are needed for other work.

One of the most successful of the tin-mining companies is the Oploca. This is one of the few that has had the courage to continue shipping tin concentrates to England in spite of not having a cabled market price to figure on. The tin is simply shipped to England and when it arrives, it is sold. It sounds simple, but heretofore the tin could be sold before it arrived and the shipper knew where he stood at all times. It really takes courage to continue shipping, but the results so far have proved that Oploca has done well. While the prices secured have not been as high as it would have been willing to accept, it has been able to go on working, and it could not have done this had it continued to store its tin. It is remodeling the plant and has reached a higher efficiency than ever before.

In nearly every tin mine, classification and ultimate fine-grinding is the pair of vital and all-important items. At times it is necessary to roast the first concentrates in order to eliminate sulphides of iron and other metals, followed by a second concentration. Near Potosí there is the further complication of much iron in the ore, part of which can be removed by magnetic separation, and I believe that if an additional 5% of waste material could be removed from the tin concentrates, it would be easy to sell a machine worth £1,000 to handle 20 tons daily. Each per cent. of waste in the concentrates increases the charges against the shipment to such an extent that the cost of removing is sure to be less than the amount saved.

The gentle reader will remember from his geography lessons that Potosí is the place where the silver came from. At present, however, very little silver is shipped from there, the mines now producing mainly tin. It is a fine camp for some enterprising Englishman or Frenchman to combine under one ownership and work properly and economically. There are many curious and confusing mining regulations which make such a project next to impossible, but it is a pleasant thing to contemplate.

These notes should have been written months ago—before the bad feeling broke out abroad—because what were interesting and active mines before are mere liabilities now. None of the mines are working with full forces, and all but a few are closed down. None is really large, it is true, a production of 100 tons per day being enough to place a mine in first rank, but all were making money and buying machinery. To mention buying now would be to invite disaster.

Production of Explosives in 1915

The production of explosives in the United States, excluding exports, during the calendar year 1915, according to figures that the Bureau of Mines[1] has received from manufacturers, was 460,900,796 lb. (230,450 short tons), as compared with 450,251,489 lb. (225,126 short tons) in 1914. The report covers only the explosives used in coal and metal mining, railroad construction and other industrial enterprises.

The production for 1915 is segregated as follows: Black powder, 197,722,300 lb.; high explosives, other than permissible explosives, 235,828,587 lb.; and permissible explosives, 27,349,909 lb. These figures represent a decrease of 8,377,400 lb. of black powder, and increases of 17,374,616 lb. of high explosives and 1,652,091 lb. of permissible explosives as compared with figures for 1914.

The returns received by the bureau show an increase in the production and sale of permissible explosives for use in coal mines. In 1902 only 11,300 lb. of permissible explosives were used in coal mining, whereas in 1915 the quantity so used was 21,841,659 lb. The quantity of permissible explosives used in the United States in 1912 represented about 5% of the total quantity of explosives produced and 5.9% in 1915. The total amount of explosives used for the production of coal in 1915 was 196,739,634 lb.

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Negligent Hoisting of Employee

By A. L. H. Street*

In an action against a mining company for injury to an employee while being hoisted up an inclined shaft, due to the ore bucket in which he was riding leaving the skids upon which it ran, it is held that the evidence warranted findings that the accident was caused by negligence of the hoisting engineer in hoisting the bucket at full speed, and not through a tamping stick carried by plaintiff; and that, through previous practice at the mine, signals given the engineer sufficiently indicated that a man was to be hoisted.

Negligence of the engineer in this respect cannot be excused on the ground that the hoisting signals given him did not conform to those prescribed by statute, it being sufficient that he should have understood from established custom in the mine that a man was to be hoisted. (California Supreme Court, Gibson vs. Kennedy Extension Gold Mining Co., 156 Pacific Reporter, 56.)

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The Trethewey Silver-Cobalt Mine, Ltd., Cobalt, Ont., reports for the year ended Dec. 31, 1915, that operations were suspended on Feb. 28, because of shortage of power, and that the mine then remained closed because of the low price of silver. At the end of the year ore reserves were estimated at 26,774 tons containing 507,339 oz. of silver. A total of 6,113 tons of ore were milled at a cost of $1.18 per ton, producing 76 tons of concentrates containing 85,004 oz. silver, the average recovery being 80%. In addition 40 tons of ore from 1914 containing 41,486 oz. was shipped. Of these shipments, 74,635 oz. of silver remained unsold in London on Dec. 31. Total expenditure amounted to $37,762 and total receipts to $44,214, leaving profits of $6,452. The work of pumping out the old Rochester mine at Cobalt was started July 26, 1915, and 352 ft. of exploratory work was done.

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[1] Technical Paper 159. "Production of Explosives in the United States During the Calendar Year 1915," by A. H. Fay. 1916.

*Attorney at law, 829 Security Building, Minneapolis, Minn.

The Labor Situation

High wages caused by a shortage of labor, making it impossible to get enough men for three 8-hr. shifts, are held responsible by the heads of more than a hundred manufacturing concerns in Pennsylvania and New Jersey for a condition of decreased production which has become so serious that it threatens to cause the closing of several plants. The opinions were expressed in response to letters of inquiry sent out by Federal Reserve Agent Richard L. Austin of the Philadelphia district.

Manufacturers unite in the assertion that increased wages have been directly responsible for lessened efficiency of labor. They have had trouble keeping men at work. One manufacturer wrote that the motion-picture houses are filled with workingmen every day in the towns near large factories and that there is plenty of evidence elsewhere that labor is not taking advantage of the present situation to benefit itself.

With wages at high figures the manufacturers say labor has become inefficient. Instead of taking advantage of the rates to save money or better their condition, a large proportion of the workingmen take holidays after they have earned a sum equal to their usual weekly wage. And even while at work, according to the employers, they are becoming lazy and independent.

This complaint of lack of discipline runs through nearly every letter received. The employers assert that all classes of workmen are seeking more money, despite increases of from 10 to 40% since the war started, and that they take the first excuse to walk out or strike. One manufacturer wrote that his men "simply disappear" without a word as to the cause of their dissatisfaction.

The Propensities of Labor

One manufactur wrote: "Labor as a whole, certainly east of the Mississippi and north of the Mason and Dixon line, is suffering from a species of insanity. It does not know what it wants, but it wants more. However, one cannot help, in studying cause and effect, realizing that this is effect. The cause does not lie altogether with labor. It lies with another element in our American life which is also suffering from a species of insanity. What would you think of a statement of a president of a very well-known concern, to the effect that ordinarily they would be satisfied with a $2,000,000 net profit annually, but which this year expects to make $25,000,000?—enough money in one year to shut its plant down and have sufficient profits to last eleven or twelve years and do nothing. Who could blame the employees of such a concern for demanding more? It is undoubtedly our judgment that a continuation for any considerable time of the present-day conditions will put a quietus on general business."

One manufacturer of metal products suggested that "a great deal could be accomplished in minimizing labor troubles if the local newspapers would agree not to publish so many news items on labor conditions, or instead, simply make small reference rather than devote columns to the subject, as they have been doing of late."

Another in the same line said: "The most serious difficulty with them (workmen) is that the more money they get the less work they do. They have become so independent that it is very difficult to keep discipline, and instead of attempting to earn more money at the high rates, they simply reduce the amount of work they turn out or else take time off when they have earned the weekly wage to which they are accustomed."

An iron and steel firm wrote that its increased labor cost is 37%; adding that "every increase in wages granted has been followed by a decrease in efficiency on the part of our employees, so that the actual increase in labor cost to us is much greater than stated. The matter is so serious that there is but one thing to do, and that is to close the plants until such time as labor conditions are more settled and we have a fair assurance that rates of wages will remain constant a few weeks."

Another steel company suggested that "instead of realizing that the present harvest is likely to be short and working steadily and saving money," the workmen "are inclined to be extravagant and wasteful of times." The same firm said that workmen are not willing to give a reasonable return for the present high wages, their production being far below what it was at the old and lower rates.

"It is evident from these letters," said Arthur E. Post, assistant agent of the Federal Reserve here, "that labor has failed to recognize the crisis which is confronting it. Labor has cut off its nose to spite its face. The result will be a deep reorganization of industry and a fundamental change in the relations between capital and labor at the close of the war."

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Mining in Australia

Sydney Correspondence

A peculiar state of affairs affecting mining in Australia has been brought about by the European War and other causes, which bids fair to create disaster to the mining industry of the commonwealth. That it has not created more comment is due largely to its being misunderstood or unknown to one faction, the operatives, and so eminently satisfactory under the present condition to the other, the operators.

At the time when electrolytic copper was selling at about £100 per ton and had apparently reached its highest point, several of the largest producers, among which were the Walaroo & Moonta, the Sulphide Corporation and the Mount Morgan company for themselves and for their (Port Kembla) refinery, entered into a contract to deliver to the Allies a tonnage equal to a year's product or more, at £100, the total so contracted amounting to 15,000 to 18,000 tons.

As the price of copper rose above £100 there was great danger of a "pinch," when, by order of the Attorney General, a Metals Exchange was formed. This exchange, to be composed entirely of British subjects, is to handle all metals produced in the commonwealth with the exception of gold, and only electrolytic copper or copper bars too low in gold and silver to warrant refining were to be exported even by members of the exchange. Members were to be responsible to the government for the delivery of the copper to the Allies only, and a nominal commission was to be charged for the handling of all metals to be exported. Each consignment of copper was to be shipped only on special permission granted by the Attorney General through the secretary of the exchange, the latter having no knowledge of the metals-selling business, but holding his position by virtue of the Attorney General and acting for him.

As the price of copper continued to rise, a maximum price of £100 was fixed by the Attorney General. The president of the Sydney Chamber of Commerce (Mr. Beale) states that this price was fixed by "patriotism," but as it was not made voluntarily by producers not in on the £100 contracts, nor has this "patriotism" extended to efficiency or contentment on the part of the operatives who still continue to strike for shorter hours and more pay with no possible thought of "speeding up" to help out the home government, it looks more like government aid to help out the "shorts." Inasmuch as it is known that the Port Kembla company offered 500 tons of copper produced from custom ores at market, then around £135 per ton, and through some blunder on the part of the sales agent offered it to the government in place of an outside consumer, the patriotic theory does not look right. At any rate the government demanded the consignment as a part of the contract, and got it.

Customs smelters are refusing to buy ores or else charging an exorbitant rate for treatment. Quotations on ores containing 30% Fe and 30% S were as follows: 18% Cu, $14.10; 20% Cu, $14.70; 25% Cu, $16.20; an increase of 30c. per unit of content. This rate was quoted by the English & Australian Smelting Co., which makes copper bars only and pays for no gold or silver content in the ore.

The steady increase in wages allowed by the court, the slacking-off process followed by the miners and the present fixing of prices by the government so as to protect the large operators who sold short bids fair to retard prospecting, close the few workable mines outside the "ring" and create the suspicion that there is "a nigger in the woodpile."

Meanwhile strikes are of daily occurrence. A 44-hr. week granted to the Broken Hill miners is the forerunner of a general 44-hr. week, and a good start toward a five-day week.

Poor Condition of Industry

There is some talk of government ownership of smelteries and refineries. This, while allowing the present owners to get out of a hole, will not help the industry unless there is a decided improvement in methods over those employed in the telephone service and the state-owned fisheries, brick works, railways, etc., all of which are run at a substantial loss. New South Wales, run on 75% borrowed money, has not curtailed expenses, and under the mask of "aiding" the idle, who might well be employed in remunerative work, is spending millions in Sydney. Wheat commandeered by the government has not been paid for and it is reported that the banks, which advanced the money for the primary payment to producers, have refused to make further advances. Thousands of bags of wheat lie along the railways, much of which has been ruined by the rain. It's nice to divide up some other fellow's property.

We have just been having an "investigation" on an "oil monopoly" whereby a member of the State Cabinet has been tried for conspiracy. Most of the responsible business men say "whitewash." Copper would stand an investigation, to say nothing of Dalgety's monopoly on tungsten and molybdenite (this last for the benefit of Australian metal buyers).

Were it not so realistic to some of us, the whole government might be considered as a huge joke. The Labor party has dug a hole which it has left for the Liberals when it loses power, and with a national debt greater than that of the United States, without taking into consideration the increase caused directly by the war, even with the enormous resources of the country the outlook is not promising.

Commodity prices have all been fixed by proclamation, wages temporarily fixed with every prospect for a generally shorter week at an increased wage, and the candle now burning at both ends must soon "do su'th'n."

Impurities in Sulphuric Acid from Blende Roasting

A. Hoffmann, in *Metall u. Erz,* XII, 290, 310 (through *Journ. Soc. Chem. Ind.,* Mar. 31, 1916), states that the gases from blende-roasting furnaces contain suspended dust and this forms the chief source of the impurities in the chamber acid. The incrustations which form in the chambers, etc., are as hard as stone and cannot be removed by washing with water. They are probably composed of acid ferric sulphates. A microcrystalline, grayish-white, very hygroscopic sludge from a settling tank for the 60° B. (sp.gr. 1.71) acid had the composition, $Fe_2(SO_4)_3,3H_2SO_4,8H_2O$; on exposure to air it absorbed moisture and yielded sulphuric acid and $Fe_2(SO_4)_3,H_2SO_4$. The incrustations contain a crystalline sulphate of the composition, $Fe_2(SO_4)_3,H_2SO_4,7H_2O$, and sometimes, when they are of a greenish-yellow color, $Fe_2(SO_4)_3,H_2SO_4,11H_2O$ or $8H_2O$.

The lead sulphate present in the chamber sludge is the normal sulphate. When aluminum sulphate is found in large quantities, it is present as acid sulphate, which can be obtained in the form of snow-white glistening leaflets, $Al_2(SO_4)_3,H_2SO_4,14H_2O$, easily soluble in water. Zinc sulphate mostly remains in solution in the Glover tower acid, but is present in the incrustation formed in the Gay-Lussac towers, which contains 63.7% $ZnSO_4,H_2O$, 9.7% $PbSO_4$, and 21.1% $Fe_2(SO_4)_3,H_2SO_4,8H_2O$. In the concentration of the acid porous yellowish-white amorphous crusts of $Fe_2(SO_4)_3,H_2SO_4$, and hard white crusts are formed; the latter probably consist of a pyrosulphate, $Fe_2(SO_4)_2(S_2O_7)$. A very hygroscopic acid zinc sulphate, $ZnSO_4,3H_2SO_4$, may also separate during concentration.

Mining in Alaska

The Alaska mining industry will have a very prosperous year in 1916, according to a statement by Alfred H. Brooks, of the United States Geological Survey, covering the operations during the first six months of the year.

Copper mining will probably show the greatest advances. About 15 copper mines are now shipping ore, and developments are being pushed on others, indicating that they may become producers before the end of the year. There is every reason to believe, therefore, that the Alaska copper output for 1916 will be greater than that for any previous year. The gold lode mines of Alaska will also make a larger production this year than last, but it is not now expected that the placer-mining industry will show any marked increase. The shipment of antimony is continuing, and some tungsten ores have already been shipped from the Fairbanks district.

Drilling and Analysis of Copper Ores

By A. J. Sale*

SYNOPSIS—Discussion of the errors that may occur from the usual methods of figuring averages from churn-drill hole samples and the application of the law of compensating errors. Comments on assaying of churn-drill samples and a plea for wider use of the sulpho-cyanide method for copper assay. Examination of effect of mineralogical analysis of ores on determination of mining and milling practice, with concrete example.

Within the past few years a new term has crept into mining phraseology, usually expressed as "ore blocked out by churn drills." While this expression is freely used, particularly with respect to copper mines, it is safe to say that a great many investors, together with a few engineers, do not really understand what it is intended to cover. Of course all mining men know what a churn drill is and know that the pulp from the holes discovers the ore and that the ore so discovered is estimated from the samples taken. Only a few, however, have stopped to consider what is assumed in these calculations.

Some companies—probably most companies in local zones—have used holes placed at random over a given territory. Such samples will give fairly accurate but more complicated figures than the so-called "systematic blocks" to which I will confine this discussion. These blocks are surveyed squares, usually either 100 or 200 ft. on a side, covering the orebody. The holes are drilled at the corners of the blocks and samples taken of every 5 ft. of drilling. Leaving the sampling for future discussion, I will attempt to show what fundamental principles are involved in making the calculations for tonnage and grade of ore.

Different Methods of Combining Samples

Different engineers have different ideas concerning the method of combining the holes in the calculations. Most of them take four holes as the corners of a block and assume imaginary lines connecting the top of ore in one hole with the top of ore in the adjacent hole, and so on for each of the four sides. The bottom of the ore is outlined in a similar fashion. Corresponding pairs of lines and the drill holes themselves form planes that make the bounding sides of a solid theoretically containing all the ore in the block. The assay value of each hole is assumed to continue halfway to the next boring. This introduces another set of imaginary vertical lines midway between each pair of holes. If a plane is assumed between each opposite pair of these lines, we shall have two new planes which cut the original block into four sub-blocks, the volume (tonnage) of each of which is calculated while the grade is taken as identical with that of the drill hole at its corner. The tonnage and grade of a main block is the composite of its four sub-blocks, and a composite of all of the main blocks gives the tonnage and grade of the orebody.

In this method of estimation each interior drill hole is used for its four contiguous sub-blocks, thereby entering four times into the general calculations. From a practical standpoint, where large areas are involved, this is equivalent to assuming the vertical planes so shifted that each drill hole lies in the center of a block the volume of which is equal to the thickness of ore times the horizontal area of the block and the grade the same as that of the drill hole. Where active work is progressing some engineers use this direct and simple method of calculating at the start. In any case, neglecting minute variations by the first method, each 5-ft. sample represents a volume five times the horizontal area of a block. If 200-ft. blocks are used, each sample represents 200,000 cu.ft., or 16,000 tons of ore, assuming 12½ cu.ft. per ton. If 100-ft. blocks are used, each sample represents 50,000 cu.ft., or 4,000 tons of ore.

In a vague way a few skeptics appreciate these figures and condemn any method of blocking out by churn drills, as they claim that for one sample to represent from 4,000 to 16,000 tons of ore in an area of from 10,000 to 40,000 sq.ft., is an assumption that is too far-fetched to be practical. But if these men will investigate the law of compensating errors, they may take a broader view of the subject.

The sampling of the pulp from churn-drill holes is a field open to improvement. The mechanical features may be worked to perfection, but the human element yet remains. If an investigator will take the trouble to put on a pair of overalls and make friends of some of the men who are doing the actual work, he may discover some serious flaws in sampling that is supposed to be perfect. I know that some engineers will affirm that with automatic samplers they have obtained from drill holes assays which checked to perfection with those from a raise put up alongside of the hole from the mine level below. But this close checking is due more to the uniformity of the ore than to the method of sampling. I have seen the same check obtained from grab sampling.

Grab Sampling Gives Better Results Than Generally Supposed

Where grab sampling is followed, the pulp is thoroughly mixed by churning with the bailer, and one bailerful of pulp is taken out and kept as representative of the whole. While I do not recommend this system I am convinced that, where applied honestly, it will give good results. Its underground equivalent consists in taking samples in a crosscut at spacings of every 5 ft. instead of taking a sample over the entire 5 ft. Any engineer who has sampled large bodies of fairly uniform ore knows that these results will check closely. Certain engineers make a practice of condemning other people's churn-drill samples, just as they condemn any other work which they do not receive a high salary to supervise. Sometimes it so happens that these same engineers supervise drilling in the neighborhood of holes that they have condemned, with the result that their work is more open to criticism than that which they refused to accept. While

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*Battle Mountain, Nev.

I repeat that I do not recommend this system, I have seen it check up with the result obtained from underground sampling in a given block of ground, within 0.2% copper.

The theory of automatic sampling is perfect; its practice needs much watching. The automatic sampler usually consists of a wooden box in which are placed riffles similar to those used in the assay office. These riffles are set at an angle of about 45° to allow the pulp to flow freely through the troughs. The spaces between the troughs are equal to the width of a trough, so that when the pulp strikes it will be equally divided. Underneath the set of riffles is placed a similar set to divide again the pulp that comes through. If sufficient vertical height is available, a third set is used, which will take out one-eighth of the original pulp. If the amount of original pulp is not so large that the sample obtained requires further subdivision, the action of this sampler is practically perfect. But it usually happens that the sample as taken is too large to dry, and here is where the human element comes in. If the laborers can be depended upon to pick up the sample tubs and empty them back through the sampler the resultant sample will still have its original accuracy. But the only way to insure that this is properly done is to seal all possible exits for pulp except through the riffles and "fire" any drilling crew which has any misplaced pulp. I know of one company that drilled two large bodies of ore and sampled with an automatic sampler. During this drilling it was a prevalent custom, especially on night shift, for the laborer employed to "slop-out" any excess samples from the tubs, instead of pouring them back through the sampler. It so happened that one of these orebodies was characterized by chalcocite, while the other was chalcopyrite accompanied by nearly barren pyrite. In this "slopping-out" process it is probable that the chalcocite would concentrate and give assays too high while the pyrite would crowd out the chalcopyrite and give assays too low. It is safe to say that this company could have obtained better information if they had trusted to systematic and careful grab sampling.

It is not out of the realm of extreme possibility to put down a hundred drill holes and have each one of them strike a chimney of waste or ore, as the case may be. But it is very much within the laws of probability that one hundred drill holes will represent a fair average of the territory covered by them. Modern mining does not pay much attention to freak possibilities; it is governed by the laws of probabilities.

Application of Law of Compensating Errors

One of the branches of probabilities is the law of compensating errors, which, practically stated, is "that in a series of determinations whose errors are compensating, the probable mean error will be the probable error of any one determination divided by the square root of the number of determinations." To apply this law to churn-drill sampling we will assume an orebody containing 10,000,000 tons of ore which was blocked out by churn-drill holes of 100-ft. spacing. As previously explained, for practical considerations each 5-ft. sample will represent 4,000 tons of ore. Therefore this orebody is determined by 2,500 samples. Assume that these samples have been crude yet perfectly compensating "grabs," and to be on the safe side we will assume that all of these samples are in error by an amount of 1% copper. We now enter our "law of compensating errors" with 2,500 determinations, the probable error of any one of which is 1% copper. The square root of 2,500 is 50, therefore the probable error of the orebody average will be $^{1}/_{50}$ of 1%, or 0.02% copper. It is almost a certainty that if this orebody is worked out, it will produce ore that will not vary by more than 0.02% copper from that predicted by the churn drills, although any individual sample was in error. Of course, in these calculations, it is assumed that perfect compensation has taken place, that any one sample was just as liable to be 1% too high as 1% too low, or vice versa. On the other hand, if more accurate sampling was used, so that the probable error of any one sample was reduced to 0.1% copper, the final error of the orebody average would be reduced to 0.002% copper.

It is evident that the more nearly a condition of perfect compensation of errors is introduced, the better will be the results, therefore it is probable that better results will be obtained by using a systematic block system than by random drilling.

Any manager who trusts his copper assaying to any one man, without any kind of a check, is courting commercial suicide. In clean chalcocite ores any assayer with a reasonable amount of experience can obtain fairly accurate returns, but in refractory ores containing chalcopyrite and other complex sulphides it requires extreme care to dissolve all of the copper. If the ore is very refractory and the assay carelessly manipulated, with insufficient acids, it is probable that a large amount, sometimes nearly all, of the copper may remain undissolved. The most serious errors that I have seen in this connection were in one drill hole where over a hundred feet of nearly 2% ore was reported as 0.5%, and in another hole where the same grade of material was reported as 0.1%. As it happened that these holes were in important positions, these results were a serious misfortune to the company that drilled them.

Inaccurate Assaying Responsible for Poor Results

A large amount of error that is charged to poor sampling is really due to inaccurate assaying. If every copper company would preserve a sample from all its drill holes, no matter how crude the sampling methods, it is safe to say that they would profit by it. Such samples are valuable from a geological standpoint, even if they do not contain a trace of copper. A company may drill a thousand feet through leached formation before reaching sulphides; if the only records kept were the assays, it would be impossible to tell, in a later study, whether to deepen the hole or not. I know of one case where a company, taking over a new property, destroyed the records of a vast amount of drill pulps, representing a cost of several hundred thousand dollars, as they asserted that their manager had a "nose for ore," which would lead him into "values" undreamed of. It unfortunately happened later that this manager inaugurated his drilling campaign during an epidemic of hay fever, and his innovation of olfactory prospecting led him into serious disaster.

For control work and composites, where high accuracy is required, I consider that by far the most satisfactory method of assay is the sulpho-cyanide. Strange to say, little mention is made of this method in books on assaying and in general technical literature. I first heard of it from Mr. Nielson, chief chemist of the Nevada Consolidated and was given the essential details of its manipulation by Mr. Morgan, assayer for the Veteran mine at Kimberley, Nev. Both of these men made statements in regard to the accuracy of this process that I could not comprehend until I had tried it. After a week of careful work any assayer can easily master this process so that duplicate assays on low-grade ores will check by an amount not greater than 0.005% copper.

For ordinary drill samples the cyanide assay will give practically perfect results if the pulp that is being assayed is used to standardize the cyanide solution. The sulpho-cyanide assay, being both rapid and efficient, is very handy for this purpose. The assayer makes a composite of his day's work and runs a sulpho-cyanide assay on this composite, after which he uses it as a standard for his day's work. As a final check, the average of the assays for the day should be within a very few hundredths of 1% of the direct composite assay. This gives an idea of the value of the method for the usual estimating work.

Mineralogical Analysis Important to Large and Small Operator Alike

With large companies owning their own smelteries, mineralogical analysis of their ores is a matter of considerable assistance; with smaller ones, which have to ship their concentrates to a foreign smeltery, it is a matter of vital importance—almost as important as the copper assays themselves. By mineralogical analysis I mean the determining of the actual minerals in the ore by chemical analysis and calculation. The amounts of heavy minerals are of especial importance, as they determine the concentrating ratio, which means the direct index of the smelting cost. Even large companies can profit by this information, for if their smelting capacity should become crowded, it would be of great advantage for them to direct their mining to ores with high concentrating ratios.

The determination of the separate silicates in the insoluble is important to companies owning their own smelting plants, as certain feldspars are more liable to go into the concentrate than quartz. But for smaller companies the ordinary insoluble determination will probably be sufficient unless the rock contains silicate of copper. Clay, when properly treated, can be dissolved in hydrochloric acid and should be determined separately. This analysis should be made on both oxidized and sulphide ores. The most valuable way to composite drill pulp for this type of work is to predict the method of mining and composite along these lines. If the steam shovel is to be used, make the composites conform to the shovel benches; if underground mining is contemplated, make them conform to the stopes.

I will not attempt to enter into the details of the analyses, but will show a few characteristic types:

OXIDIZED ORE

Ore	Copper, as native	Trace	
	Copper, as sulphate	0.20%	
	Copper, as oxides	0.79%	
	Copper, as carbonates	1.65%	
		2.64%	total Cu
Acid consumers	Limestone	4.50%	
	Clay	5.50%	
	Ferric oxide	6.30%	
Neutral	Magnetite	1.20%	
	Insoluble	69.20%	
	Gypsum	2.20%	

The acid consumers are important where leaching is contemplated.

PORPHYRY ORE

Heavy minerals	Ore			Gold, 0.015 oz.
		Chalcocite	2.50%	Silver, 0.03 oz.
		Chalcopyrite	0.85%	Copper, 2.29%
		Magnetite	1.20%	
		Pyrite	4.50%	
			9.05%	
Fairly heavy minerals		Ferric oxide. (Garnet)	0.45%	
Light minerals		Insoluble	81.20%	
		Clay	4.40%	
		Limestone	1.10%	
		Gypsum	0.50%	

Assuming that the small amount of ferric oxide will go into the gangue, we have 9.05% of this rock as heavy minerals, which will go into the concentrate under ideal concentration. Therefore, theoretically the ore will concentrate 11:1 and the concentrates would carry: Copper, 25.19%; gold, 0.165 oz.; silver, 0.33 oz.

SILICIFIED LIME ORE

Heavy minerals	Ore			Gold, 0.02 oz.
		Chalcocite	0.48%	Silver, 0.05 oz.
		Chalcopyrite	3.67%	Copper, 1.65%
		Magnetite	2.10%	
		Pyrite	6.25%	
			12.50%	
Fairly heavy minerals		Ferric oxide (Garnet)	0.35%	
Light minerals		Insoluble	68.00%	
		Clay	5.50%	
		Limestone	6.30%	
		Gypsum	2.80%	

As 12.50% of this rock is heavy mineral, a theoretical concentrating ratio of 8:1 is indicated, which would produce concentrates carrying: Copper, 13.20%; gold, 0.16 oz.; silver, 0.40 oz. The garnet, being usually a small factor hard to determine, can probably be neglected, allowing that which is magnetic to go with the magnetite. The determination of clay and limestone will prove valuable information in connection with the milling, especially where oil flotation is used. But by far the most important features are the heavy minerals.

For example, let us assume that a company is operating its own mine and mill, but is forced to have its concentrates smelted by another company at a charge of $7.50 per ton, a recovery at the smeltery of 95% and a charge of 1¼c. per lb. for bullion freight and refining. Also let us assume that the company's local costs are: Mining, 40c. per ton; transportation, 15c. per ton; milling, 50c. per ton; and that the company saves 70% of its copper and 20c. per ton in precious metals. Also, if the mill saves 70% of the heavy minerals in a concentrate which carries 30% insoluble, let x pounds represent the amount of heavy minerals in a ton of original ore. Then there will be 70% of x pounds of heavy minerals produced in a concentrate which is 70% heavy

Conditions:	Ore A	Ore B
Analysis	2% Cu	1% Cu
Heavy minerals	33%	5%
Concentration ratio	3 : 1	20 : 1
Copper content	40 lb.	20 lb.
Mill saving (Cu)	28 lb.	14 lb.
Smelter recovery	26.6 lb.	13.3 lb.
Costs of Production:		
Mining	$0.40	$0.40
Transportation	.15	.15
Milling	.50	.50
Smelting $\frac{1}{3}$ ton @ $7.50	2.50	...
Smelting $\frac{1}{20}$ ton @ $7.50	....	.375
Refining 26.6 lb. @ 1.25c.	.332	....
Refining 13.3 lb. @ 1.25c.	....	.166
Total production cost per ton	$3.882	$1.591
Value of Product:		
Copper 26.6 lb. @ 14c.	$3.724	
Copper 13.3 lb. @ 14c.	...	$1.862
Precious metals (95% of 20c.)	.19	.19
Total value recovered	$3.914	$2.052
	$0.032	$0.461

minerals (30% insoluble, the rest heavy). Therefore the actual weight of the concentrate produced will be 0.7x divided by 0.7, or x pounds, from which it is seen that in this case the actual concentrating ratio will be identical with the theoretical. We will now compare the profits from two ores, one having double the copper content of the other.

From which it is seen that a profit of only 3.2c. is made from the 2% ore, while a profit of 16.1c. is made from the 1% ore. Of course, these ratios are an exaggerated case, but this table serves to bring out my point that "mineralogical analysis" comes very close in importance to the actual copper assays, especially where a company is dependent upon an outside smeltery.

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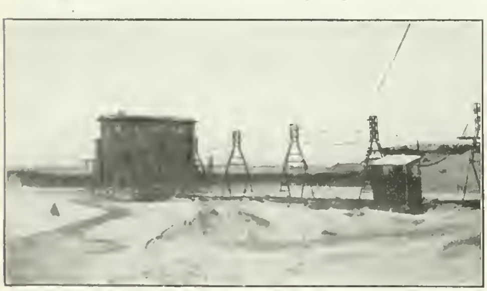
C. & H. Suction Dredge in Winter

By C. H. Benedict*

The Calumet & Hecla Mining Co. is reclaiming its conglomerate tailings by dredging.[1] Last winter being the first during which the dredge operated, there were presented some unusual problems due to the severe weather conditions. The tailings lie in Torch Lake, a body of water about four miles long and three-quarters of a mile wide, and they extend to a depth of 100 ft.

The tailings are picked up by a 20-in. Bucyrus hydraulic dredge and are conveyed through a ponton line to a central reservoir near the original shore line. A centrally pivoted bridge, carrying a pump-suction pipe, swings over this reservoir and a 12-in. Morris pump lifts the sands and delivers them to a classifying house and regrinding plant for further treatment.



STERN VIEW, C & H. SUCTION DREDGE, AND PONTON LINE, TORCH LAKE, MICH.

The problem was to keep the suction dredge operating throughout the winter, which was a particularly severe one. Freezing temperature set in by Dec. 1, and from Jan. 1 to Feb. 15 there was almost continuous storm, some snow falling every day for 45 days. Much of the time the temperature was below zero, and as late as Mar. 17 a temperature of 25° below was recorded. Ice conditions began to get bad about Jan. 1; before that time it was easy to cope with the ice by simple means. It was necessary to keep the 600-ft. ponton line free to swing at all times, but the dredge itself with its powerful suction ladder and steel hull managed to break the ice fairly well. In January, the ice having reached a thickness of 8 in., dynamite was resorted to in order to keep the pontons clear. This worked admirably for a few days, but trouble multiplied fast, for the ice broken up one day would form hummocks and make the next day's work all the more difficult. It soon became evident that the ice would have to be removed as fast as formed in order to keep the pontons clear. On account of the depth of sand, the dredge moved but little from day to day, so that the area to be kept clear was not great.. The ice was sawed every morning along the pontons and a channel about 10 ft. wide was kept open between the dredge and shore. On the shore was a boom used for stacking logs, and the cakes of ice as sawed were floated through the channel and stacked on shore. It was possible to keep open water about the dredge itself by using an auxiliary water pump and playing large streams along the hull, the agitation both preventing freezing and breaking up ice already formed. There was no serious trouble experienced from freezing either on the suction or discharge lines, and fortunately not a single rubble sleeve wore out during the winter. The interior of the dredge was kept comfortable by a boiler and heating pipes, and as the suction ladder worked between sliding doors, there was but little exposure from that source.

Since the beginning of operations there have been but two days on which the regrinding plant had to shut down for lack of sand, and the time lost then was due to a broken pipe, the repair of which was complicated by severe weather. The cost of the extra work during January, February and March, due to climatic conditions, was about $40 per day, or 2c. per ton of sand handled and less than ¼c. per pound copper produced. Considering the condition of the copper market, this was no hardship. It is probable that the copper obtained from reclaiming these tailings was as low-cost as any copper put on the market last year.

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*Metallurgist, Calumet & Hecla Mining Co., Calumet, Mich.

[1] "Eng. and Min. Journ.," Nov. 7, 1914.

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Mining Machinery as Part of Real Estate

Mining machinery installed by a lessee of mineral lands does not become a part of the real estate, if at the time of installation it is agreed between the parties that it shall remain personalty and may be removed by the lessee, although it be affixed to the soil.

In applying this rule in the case of Cogwill vs. Little Persimmon Mining Co., 183 Southwestern Reporter, 346, the Springfield, Mo., Court of Appeals decided that, under a lease giving the lessee a reasonable time within which to remove a mill and machinery on termination of the lease, there was no forfeiture of the property to the lessor through failure to remove it within sixty days after the lessor forfeited the lease, although the lessor gave notice to remove within that time, the removal being effected shortly afterward and the lessor not having been prejudiced through the machinery remaining on the land in the meantime.

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Domestic Asbestos Was Marketed in the United States in 1915 to the amount of 1,731 short tons, valued at $76,952, according to the United States Geological Survey. Compared with the production of 1914 this represents a gain of 484 tons, or 39%, in quantity and 306% in value. The asbestos of the world is supplied chiefly by Canada. Most of it is exported free of duty to the United States, the greatest manufacturer and user of asbestos products.

Zinc Distillation After Prereduction

C. A. H. de Saulles, in U. S. Pat. No. 1,183,172, issued May 16, 1916, describes an improvement in the metallurgy of zinc comprising the addition of carbon to the nearly finished charge in the roasting furnace and the regulation of the combustion thereof for the purpose of effecting a reduction of impurities that are prejudicial in the distillation in the retorts. The principal purpose is the reduction of sulphates, especially the sulphates of zinc, lead, barium, calcium and magnesium, the retorts being thereby relieved of the burden of reducing them and there being a correspondingly less production of gases and consequently a less velocity of the gases making exit from the retorts. Magnesium sulphate present in the charge is reduced in the retorts to magnesium sulphide, and the latter, in being further changed to magnesium oxide, gives up its sulphide to the zinc, producing zinc sulphide and thus increasing the loss of zinc. In the prereduced charge the magnesium goes to the retort as oxide, which is harmless in the retort and is even beneficial in that it tends to stiffen the slag therein. Furthermore, ferric oxide is reduced in part to metallic iron, in which form it is of less injurious effect upon the retort than is ferrous oxide.

The Process in Practice

The net result of this procedure is to relieve the retort of a considerable proportion of the burden usually imposed upon it. The process has been in use at the works of the United States Zinc Co. at Blende, Colo., for about two years. It has been found there that the zinc begins to distill from one to two hours earlier than in usual practice and the extraction of zinc in distillation is increased. There is reduction of zinc loss, owing in part to the production of a less quantity of blue powder, which is caused by oxidation of zinc by carbon dioxide and by the reaction of zinc vapor and sulphur dioxide, leading to the formation of a coating of zinc sulphide around the minute droplets of zinc that are being precipitated in the condenser.

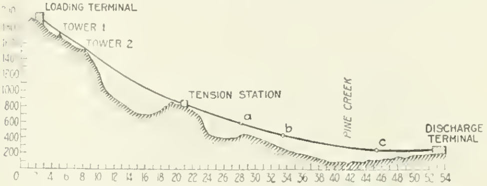
Loss of zinc is also avoided by increasing the life of the retort, which has been raised about six days. The addition of carbon to the roasting ore has thus resulted in an increased recovery of zinc of approximately 6%—that is, an extraction of 80% has been raised to 86%. The consumption of retorts has in some periods been reduced from 1.6 per ton of ore to only 1 retort per ton of ore. No increased loss of zinc in the roasting furnace has been experienced. In carrying out the process, carbon (preferably in the form of fine anthracite) is added to an amount equal to about 8% of the weight of the charge of zinc ore. The temperature due to the combustion of the added carbon must not exceed 1,000° C., and preferably is limited to a maximum of about 880° C.

This process is similar to one that is described by Alex Roitzheim in U. S. Pat. No. 1,100,490, but Roitzheim has a slightly different idea as to the effective and permissible temperature. He advises the preheating at 600° C. and says that at 700° C. a strong reduction of zinc oxide takes place. Roitzheim and de Saulles are in direct conflict on this point, their difference being possibly due to errors in pyrometric determinations.

Aerial Tramway Locked by Windstorm

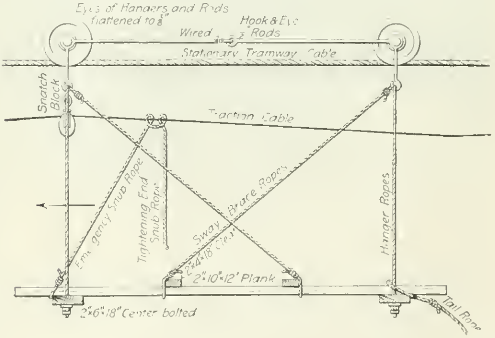
By Hamilton W. Baker*

An accident of interest to tramway operators recently occurred on the line of the Baker Mines Co., of Cornucopia, Ore. This company operates a Bleichert tramway of 15 ton per hr. capacity installed by the American Steel and Wire Co. The tramway is 5,500 ft. long and rises 1,675 ft. in this distance. The surface contonr necessitated a span of 3,200 ft. from the mill to the first point of support, a tension and anchorage station. I think the span is probably the longest in America.



THE BAKER MINES CO.'S AERIAL TRAMWAY

On Mar. 6 an unusual windstorm arose, necessitating a shutdown for safety. When the storm abated, releasing the band brakes on the bull-wheel at the loading terminal failed to start the tramway. An inspection of the line showed that at a point (*a* on profile sketch) 700 ft. below the tension station two buckets, a loaded and an empty, had collided and were apparently locked. From this point to the next empty bucket the traction on the empty side had blown over the loaded stationary cable. At the next empty (*b* on the profile sketch) the loaded stationary cable had blown across the line of the empty and had passed beneath an empty bucket, raised up and was resting on the outside of the bail. From this point to the next span the empty traction had blown over the loaded stationary cable. The next span was clear. At the next, marked *c*, the empty traction had blown across and was resting on the grip lever of a loaded bucket. There was no other apparent trouble, but its correction was accompanied by danger through the necessity of working in snowslide territory where the draws were particularly threatening after a 40-ft. snowfall.



REPAIR RIG FOR THE AERIAL TRAMWAY

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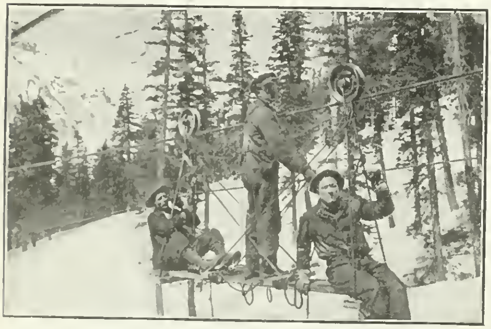
*Mine superintendent, Baker Mines Co., Cornucopia, Ore.

An effort was made to go up from the mill on a raft, but the ascent was too steep. To clear the line it was necessary to make a raft that could be carried by men on snowshoes to the tension station and lowered from there down the line. The tramway foreman rigged up a platform, shown in the accompanying drawing, that met the requirements satisfactorily. Two trolleys were used, and hangers of ½-in. iron were made and fastened to the trolley bearings. A 2x12-in. plank was used for a platform to which rope hangers were dropped from the trolleys. The traction cable was carried from a snatch block fastened to the front trolley, throwing its weight on the iron hangers so as not to increase the strain on the ropes.

This equipment, a bale of ¾-in. tail rope and extra slings were made into individual packs and carried to the tension station. The rig was there put on the line and the tail-rope snubbed to timbers. The foreman and two helpers mounted the platform and were lowered down the line. To pass the first bucket the following procedure was necessary: A, B and C represent the men, counting from front to back of the rig. As the rig approaches the bucket, the traction cable rises and is thrown out of the snatch block; A steps to the back of the bail of the bucket; B raises his weight from platform by hanging to stationary cable so that C's weight raises front end to pass above the bucket bail until the front trolley meets the bucket trolley; B then steps to the front of the bail and with A grasps the front trolley of the rig, passing it overhead and placing it ahead of the bucket trolley; A holds it in position while B advances and attaches the guy ropes; B and C advance the platform until the back trolley meets the bucket trolley; A mounts the platform and takes a position out of the way; B and C transpose the trolley and attach the hanger ropes; B and C then mount the platform and are ready to be lowered along the line. This operation requires about three minutes. An emergency rope is fastened to the front end of platform and two half-hitches are taken around the traction cable. By grasping the loose end of this rope the speed may be controlled at will.



THE TRAVELING PLATFORM FOR REPAIRING THE TRAMWAY

At the point of collision of the loaded and empty buckets, they were lashed firmly together and the grip levers of both buckets were lashed down. A hand rope was fastened to the grip lever of the empty and thrown over the stationary cable to the ground. The men were lowered and the lever thrown. The buckets separated sufficiently to allow the empty, on the removal of the lashes, to be slacked to a lower position and gripped. From this point the tail-rope was dropped from the tension station, one end passed through a pulley attached to the bucket and the main rope fastened to a tree on the ground. From this point surface men paid out the rope. From *a* to *b*, shown on the profile drawing, the jar from the separating buckets had thrown the traction away from the stationary cable. At *b*, both stationary cables were lashed together by tying one end of a rope to the lower, or loaded, stationary cable and looping it around the cables several times. The long end was lowered to the ground and handled by two surface men. Tightening on the rope tightened the loops, raising the lower cable above the bucket bail. The bail was dumped and the rope slacked to a point where the cable passed beneath the bucket and back to place.

The remainder of the cable was cleared as the men were lowered by prying the traction cable from the stationary, using a hardwood stick. The time required was 27 working hours, using 6 men. A better idea of the strength of the wind may be given by saying that the traction cable rubbed a tree 40 ft. to one side of the line of travel. An analysis of the accident demonstrated conclusively that the 5 to 6 ft. difference in elevation of the stationary cables made this accident possible. It was evident that the accident at *b* shortened the 8-ft. span between the cable lines to such an extent that the collision at *a* and overlaps between *a* and *b*, and *b* and *c*, were made possible. In closing down, a precaution followed is to give the stop signal when loaded and empty buckets are opposite on the line. A severe wind on a tramway so handled might, in an extreme case, wrap a span of traction over the stationary cable, but it is highly probable that the vibration and strains of operation would jar the cable loose.

VIEW OF THE BAKER MINES CO.'S CABLEWAY

Cost of Coal and Oil as Fuel

The chart herewith shown, from *Power* of May 30, 1916, should prove valuable to determine the relative value of coal and oil as boiler fuels. The fuel consumer must first have available data to determine the cost for producing a unit quantity of steam in his plant both with coal and with oil. The cost of steam includes fuel, labor, fixed charges and supplies.

The first factor in this comparison is the respective heating value of the two fuels. On account of the variations in heating value of both coal and oil, no definite calorific standards can be stated. In general, fuel oil will contain about 30% more heat units per pound than coal. As the prices for fuel oil are quoted on the basis of a barrel of 42 gal., it is necessary to know the heating value per gallon or barrel. This figure may be determined from the calorific value per pound and the gravity, the latter indicating the number of pounds per gallon.

In comparing the fuel costs of coal and oil, the heating value per unit of price is not the only determining

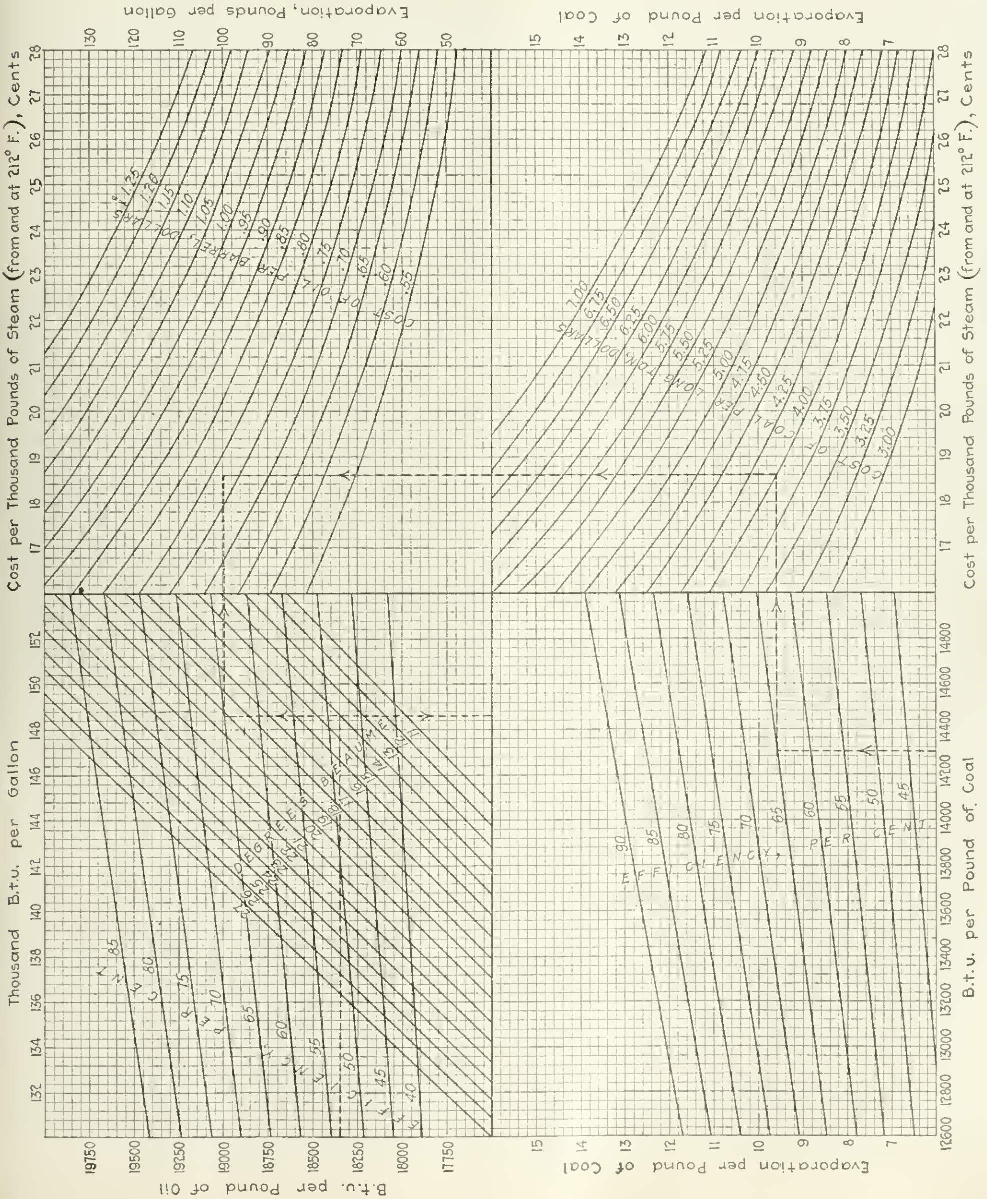


CHART FOR DETERMINING THE COMPARATIVE COST OF COAL AND OIL AS FUEL factor. The percentage of this heat that can be usefully employed in the generation of steam or the boiler and furnace efficiency is of equal or greater importance. The heat so utilized will vary from 45 to 85% of the calorific value of the fuel, or the losses will total from 15 to 55%.

An excellent graphic representation of the relative costs of fuel for generating steam with coal and oil was presented in the *Engineering and Mining Journal* of Mar. 25, 1916. An extension of these calculations based on comparatively small variations in the gravity of fuel oil is shown in the chart, the use of which may be understood from the dotted lines, assuming the following values:

Coal at $4 per long ton, having a heating value of 14,300 B.t.u. per pound as fired and burned with a boiler and furnace efficiency of 65%; to determine the maximum price per barrel that should be paid for fuel oil with a gravity of 14° Bé (8.10 lb. per gal.), having a heating value of 18,350 B.t.u. per pound and burned with an efficiency of 65%.

The B.t.u. per lb. of coal is found in the lower left-hand section of the chart. This point is projected upward to the intersection with the 65% efficiency line. From this point, in a horizontal line through the evaporation of 9.6 lb., of water from and at 212° F. per pound of coal, the intersection with the curve for coal at $4 per long ton is found. Passing vertically upward from this point, the cost per 1,000 lb. of steam is found at 18.6c. The chart is to be used with the right side as base.

The B.t.u. per pound of oil is in the upper left-hand section of the chart. This is followed horizontally to the intersection with the 14° Bé. line. Passing downward, or upward, the B.t.u. per gallon is 148,600. Projecting this point upward to the intersection with the 65% efficiency line and horizontally through the evaporation per gallon, 99.8 lb., it is found that the intersection with the price of steam as determined for coal, 18.6c. per 1,000 lb., comes at 78c. per bbl of oil, which will represent the equivalent value of this fuel.

LESS LABOR WITH FUEL OIL

In most steam plants the amount of labor required will be less with fuel oil than with coal. The saving in labor when oil is used in a plant that formerly burned coal will depend upon the method of handling coal into storage and from storage to the boiler room, the boiler-load conditions, the type of equipment and the efficiency of the men in the fireroom. It is reported that a saving of 80% in labor was effected in the largest oil-burning power plant in New England when this fuel was substituted. [A saving of 64% was effected on a freight steamer by the substitution of oil fuel.—Editor.]

In a hand-fired [illegible] boiler plant of average size, with coal at $4 per long ton, the cost of steam will be about $0.25 per 1,000 lb. This charge is based on an average boiler efficiency of 65%, allowing 12% of the coal fired during the operation for banking and heating at night. The distribution of the total cost will be about as follows, per 1,000 lb. of steam: Fuel, $0.20; labor, $0.03; fixed charges, $0.02; total $0.25.

The reduction in labor in hand-fired plants of less than 2,000-boiler-horsepower capacity will not be much greater than 50%, or $0.015 per 1,000 lb. of steam. It will be noted that this is [illegible] of the total or 7.5% of the fuel cost. Therefore, with [illegible] at $[illegible] per bbl., an increase in price of 7.5% [illegible] labor saving.

The investment for equipping a coal-fired plant to burn fuel oil depends upon the size and layout of the apparatus in the boiler room. The situation of the plant with respect to the source of fuel-oil supply will have a material effect upon the cost of the installation, since storage tanks constitute a large percentage of the investment. It is estimated that complete equipment will cost $5 to $10 per boiler horsepower. [$10 in the case of the freight steamer.—Editor.] If the cost of this equipment is taken care of in the fixed charges during the life of the fuel-oil contract, which is usually five years, it will represent an addition of 0.7 to 1.4c. to the charge per 1,000 lb. of steam or 3 to 6% of the cost of steam generation.

In considering the relative merits of coal and oil, each boiler plant should carefully determine the efficiency and labor cost while burning coal with the existing equipment and operating conditions. If a change to oil seems advantageous, similar data should be obtained with that fuel before any definite statement can be made regarding the saving to be effected. The figures and conclusions may be based upon fuel costs, labor saving, increased boiler capacity and convenience, but the future prices of oil will in most cases determine the advisability of its use.

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Activity in Manganese Mines

There has been increased activity among the manganese mines of the United States during the first six months of 1916. This activity is shown by the operation of new mines, the reopening of old ones and more regular production from those already active. According to D. F. Hewett, of the United States Geological Survey, there is a prospect that the production for the entire year will greatly exceed that for 1915, which was 9,651 tons, the largest since 1901. Several discoveries are reported from Arizona, California, Oregon, Utah and Virginia, and there are new operators in Arkansas, California, New Mexico, Utah and Virginia.

During the first quarter of 1916 the prices of all grades of manganese ore rose rapidly to the highest figures recorded in 30 years. Prices of 60c. to 65c. per unit for ore containing 45 to 50% of manganese and more than 1% of iron were freely offered about Apr. 1, and it is reported that 70c. per unit, or $35 per ton, was paid for several lots. During the second quarter prices remained constant at these figures. Large quantities of Brazilian ore continue to be received, and there is a prospect that the imports will exceed those for 1915, which were the largest on record with the exception of one previous year.

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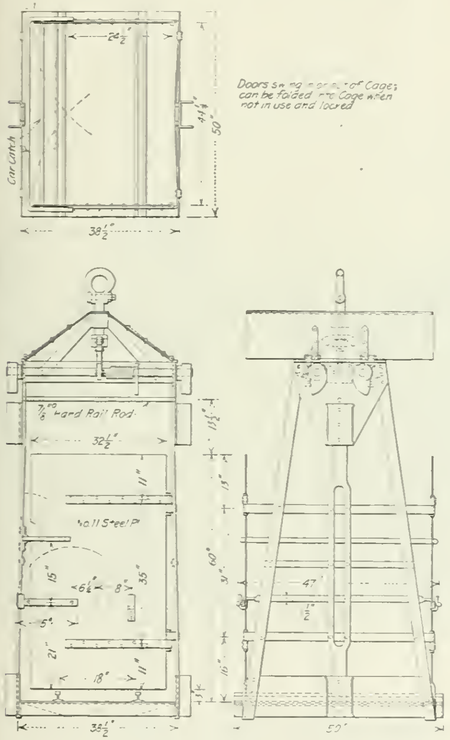
The New York & Honduras Rosario Mining Co., operating at San Juancito, Honduras, shows operating income for the year 1915, of $353,466, from which $54,187 was set aside for depreciation, $59,583 for depletion of ore reserves and $3,600 for fire insurance, leaving a net for dividends of $236,142. From this and the surplus dividends of $240,000 or 12% were paid. There were 117,790 tons of ore treated, which produced 1,749,861 oz. silver and 15,232 oz. gold, which sold for $1,191,761. Other receipts were $8,982. Ore reserves are estimated on Dec. 31, 1915, at 343,716 tons carrying $9.76 per ton, against an estimate of 418,978 tons at $10.45 per ton at the close of 1914. New properties are being looked for in a district about 20 mi. east of the present property, where the government has granted the company prospecting rights covering about 400 sq.mi. This is known as the Chile Mountain concession. The mill extracted 87.45% of the silver and 92.52% of the gold present in the ore. Materials consumed per ton were: Sodium cyanide, 3.93 lb.; lead acetate, 0.211 lb.; lime, 35.5 lb.; tube-mill pebbles, 3.58 lb. and zinc dust, 0.98 lb. Operations are continuing as usual.

Details of Practical Mining

Safety Cage Gates

By Roy F. Smith*

A Colorado law that became effective Apr. 13, 1915, requires that all mine cages shall be equipped with gates. The ones shown in the sketch were designed to be installed on two light cages in use at Leadville, in order to comply with that law. They are constructed of No. 11 steel plate and are hung on hinges made of $^3/_8$x2-in. steel. A $^3/_8$x$1^1/_2$x15-in. latch, which drops into a hook at the side of the cage, holds the gates when in use from swinging in or out of the cage. The car catch may also be lowered when the latch is in place, thus giving additional security in holding the gates from swinging out.



SAFETY-GAGE CAGE

When the cage is to be used for hoisting cars, the gates can be folded one over the other, into the cage, and locked in that position by engaging the latch on one gate in the door hook on the other. With this arrangement the gates in no way interfere with the operation of the car catch or the hoisting of cars and can be quickly swung into place and latched when hoisting or lowering men.

For lowering timber into the mine these doors were found to be safe, convenient and quite a saver of time over the old method of using ropes to hold the timber in the cage. Gates or doors of this type may be readily added to almost any cage, with very few alterations.

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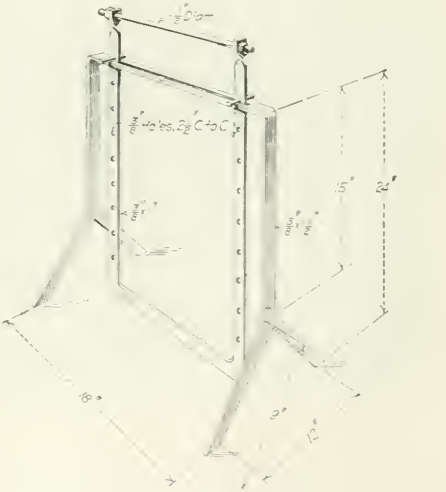
Steel Rest for Blacksmith Shop

In the accompanying illustration is shown a stand for supporting long steel, rods, etc., in the blacksmith shop when working with them at the forge or anvil. This stand has the advantages over the many "one-legged" forms used, of being more stable and considerably wider, and yet it is simple to construct. The supporting piece is made of $^3/_8$x$1^1/_2$-in. flat iron, the yoke of $^3/_8$x1-in. flat iron. The latter is passed through two slots in the horizontal part of the supporting piece before the ends of the yoke are twisted at right angles, as shown, and the rod passed through these ends. By means of the holes in the vertical members of the yoke and two nails, the support can be held at any desired height.



STEEL REST FOR BLACKSMITH SHOP

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When Going Up or Down Ladders in poorly lighted workings it is advisable to hold onto the sides of the ladders rather than the rungs. This will prevent mashed fingers due to the man above stepping on your hands and may prevent a bad fall

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*Mining engineer, 1845 Grant St., Denver, Colo.

Stockpiling at Pettit Mine

By L. A. Rossman*

One of the problems in connection with the mining of iron ore is its proper storage in stockpiles. Where several kinds are hoisted from a single shaft, this is especially important, not only from the standpoint of quality, but also of efficiency in the disposition of hoisted ore.

Several methods are in use on the Mesabi Range, all of which have interesting features, but one of especial interest is in use at the Pettit mine of the Republic Iron and Steel Co., at Gilbert. The Pettit is an underground property, modern in all details, possessing a steel shafthouse and other good mechanical features. Stockpiling is accomplished essentially as follows:

There are 12 bents of permanent trestle on each side of the headframe, this being necessary to cross the loading tracks and wagon roads. These are of the ordinary three-leg bent type, all floored with two thicknesses of 2-in. plank laid close and equipped with railing and toe-boards. The temporary joins the permanent trestle and consists of two-leg bents, caps, corbels and stringers. The legs are 10 ft. in length, stringers 18 ft., and caps 8 ft. The total height of trestle including caps, corbels, stringers and rail is about 14 ft. The tracks are 36-in. gage without grade, with 30-lb. rails and 3-in. plank ties. In order that two locomotives may operate on the same trestle, a siding is placed on the permanent trestle, this being equipped with automatic-spring switches at either end, allowing the locomotive on the return trip to pass onto the siding without the operator leaving the motor.

STOCKPILE AND TRESTLE AT PETTIT MINE

The ore is dumped from the skip into a 6-ton gable-bottomed car which is propelled by a 6-ton electric locomotive. The car is dumped by a tripping lever passing over a block set between the two rails and is closed again by returning over the block. With this arrangement two men and one motor have handled an average of 700 tons on each 8-hr. shift with no delay during the winter season.

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*Grand Rapids, Minn.

* * *

A Simple Method of Timber Preservation

By L. B. Reifsneider*

It is a well-known fact that climatic conditions in the tropics are deleterious to all classes of timber structures except those built of native hardwoods. In many places the latter cannot be procured or are obtainable only at prohibitive prices. Imported pine is most commonly used for all construction. In recent years nearly all the ordinary grades imported have been cut from timber that has previously been treated for the extraction of pine-tar products, and this class of timber has been found especially liable to decay.

At very few places are treatment plants available, and a variety of methods of surface treatment have been tried with limited success. About three years ago the following method of treatment was inaugurated at a plant in Cuba, and it has been found to be successful. A tank of 3-in. plank, long enough to contain the longest pieces generally used in the mine structures and large enough to take 6 pieces of 10x10-in. timber, was constructed, and the seams were calked with oakum and tar to make the tank water-tight. A ½-in. pipe line for live steam was run from a shop boiler and connected to the center of the bottom of the tank. A water line was run to the tank for convenience in filling. The timber to be treated was placed in the tank and enough water run in to cover it, the timber being kept from floating by wedging it down under a removable tie-rod. The amount of water in the tank was then computed and chloride of zinc in the ratio of ½ lb. per gallon of water was dumped into the tank directly over the outlet of the steam line. Live steam was then turned on by opening the ½-in. valve, and the water was allowed to come to the boiling point. The solution was kept at that temperature for from 3½ to 4 hr., and the steam was then turned off and the solution allowed to cool for 7 to 8 hr. for each lot treated. When fresh timber was put in, the solution was strengthened by adding chloride at the rate of about ¼ lb. per gallon of solution to replace that absorbed by the previous treatment. It has been found that it rarely all dissolves at once, but is taken up slowly.

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*33 South Third St., Camden, N. J.

A small derrick and timber dogs are used to remove the timbers from the solution, as the latter, even when cool, is very irritating to the skin, although when dry there are no ill effects from handling the timber. All timber is framed and cut to length before being placed in the tank, so that no untreated surface is left exposed by framing later. Careful observation showed a penetration of the chloride in sapwood and fiber of ¼ to ½ in. and in heart from $\frac{1}{16}$ to ⅛ in., and even after long exposure to torrential tropical rains, the fibers under the surface skin are found intact.

As a test, when the treatment was first started, several sticks of timber were cut and framed into sets for underground work and the parts of the same sticks were carefully marked. Half of the pieces were treated and the rest left untreated, and all were installed on 4-ft. centers in a drive where conditions in respect to moisture and ventilation were particularly bad. Six months after being placed fungus and rot began to appear on the untreated sets, and at the end of 18 months all had been changed and found to be rotten almost throughout. The treated timber is still in place and apparently sound after 38 months, with no signs of fungus. On the surface the results have been equally satisfactory, and all new timber used in any permanent structure is treated after framing.

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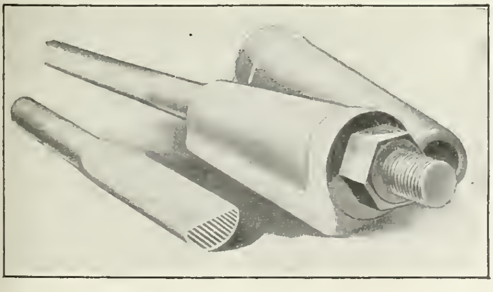
Half-Round Tank Hoops

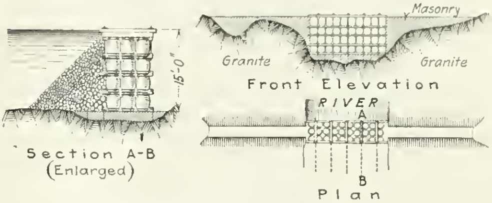
Tank hoops of half-round section brought out recently by the United States Wind Engine and Tank Co., of Batavia, Ill., are shown herewith. This section has a smaller exposed surface than the ordinary wide flat band, and it does not crush the wood or form a dust-collecting gutter (to start corrosion) like a round rod. The lugs keep the ends of the hoops clear of the tank, so that they will not injure the wood. Hoops of this design seem to have advantages that recommend their use.



HALF-ROUND HOOPS FOR TANKS

An Oil-Barrel Dam

A dam made of oil barrels built in northern Nigeria to help form a flotation pool for dredging operations, is described in a paper before the Institution of Mining and Metallurgy, by H. E. Nicholls and in *Engineering News*, June 3. The dam is 15 ft. high and is formed of 120 of the steel barrels in which oil fuel is brought to the site. Other suitable dam materials are very scarce. The barrels are arranged as shown in the sketch and are filled with sand to give weight. They are tied together with timber plates, filled in between with broken granite and tied back upstream with slanting steel tie-rods. The upstream side of the dam is backed with broken rock, the filling being graduated in size from coarse rock next to the barrels to fine rock and finally sand and earth.



STEEL OIL BARRELS FORM CORE OF DAM

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Drainage-Ditch Design Tables

Hydraulic tables for use in designing systems of drainage ditches have been prepared by John C. Burke, civil engineer, of Bemidji, Minn., and published in *Engineering News*, June 8. The tables have been found very convenient in the rapid checking of ditch dimensions and the control of velocity. Quantities for Elliott's formula and for two coefficients of Kutter's formula are given to afford ready comparison with other designs.

HYDRAULIC TABLES FOR DRAINAGE-DITCH WORK

Base	Depth	Top	Area	Wet. Perimeter	Hyd. Radius	Grade, %	Velocity, Kutter's 0.025	Velocity, Kutter's 0.030	Discharge, Sec.-Ft. Ell.	Discharge, Sec.-Ft. 0.025	Discharge, Sec.-Ft. 0.030	Cu.Yd per Mi.
4	3	10	21	12.5	1.7	0.02	1.2	1.0	34	25	21	4,107
..	..	..	..	....	...	0.04	1.7	1.3	46	36	27	.
..	..	..	..	....	...	0.06	2.1	1.7	54	44	36	.
..	..	..	..	....	...	0.08	2.4	1.9	64	50	40	.
..	..	..	..	....	...	0.10	2.7	2.2	77	57	46	
4	4	12	32	15.3	2.1	0.02	1.4	1.1	58	45	35	6,258
..	..	..	..	....	...	0.04	1.9	1.6	82	61	51	
..	..	..	..	....	...	0.06	2.4	1.9	98	77	61	
..	..	..	..	....	...	0.08	2.8	2.2	114	90	70	.
..	..	..	..	....	...	0.10	3.2	2.5	130	102	80	
4	5	14	45	18.2	2.5	0.02	1.5	1.3	90	68	59	8,800
..	..	..	..	....	...	0.04	2.2	1.8	130	99	81	.
..	..	..	..	....	...	0.06	2.8	2.2	160	126	99	..
..	..	..	..	....	...	0.08	3.2	2.5	180	144	113	.
..	..	..	..	....	...	0.10	3.5	2.8	200	156	126	
4	6	16	60	21.0	2.9	0.02	1.7	1.4	130	102	84	11,740
..	..	..	..	....	...	0.04	2.4	2.0	180	144	120	.
..	..	..	..	....	...	0.06	3.0	2.5	220	180	150	.
..	..	..	..	....	...	0.08	3.4	2.8	255	204	168	.
..	..	..	..	....	...	0.10	3.9	3.2	285	234	192	
4	7	18	77	23.0	3.2	0.02	1.8	1.5	175	139	115	15,060
..	..	..	..	....	...	0.04	2.6	2.2	240	200	169	.
..	..	..	..	....	...	0.06	3.2	2.6	300	246	200	....
..	..	..	..	....	...	0.08	3.7	3.0	350	285	231	....
..	..	..	..	....	...	0.10	4.1	3.3	390	316	254	....
4	8	20	96	26.6	3.6	0.02	2.0	1.7	225	192	163	18,780
..	..	..	..	....	...	0.04	2.8	2.4	320	269	230	....
..	..	..	..	....	...	0.06	3.5	2.9	390	336	278	....
..	..	..	..	....	...	0.08	4.0	3.3	450	384	317	....
..	..	..	..	....	...	0.10	4.5	3.7	508	432	355	....
4	9	22	117	29.4	4.0	0.02	2.2	1.8	293	257	211	22,890
..	..	..	..	....	...	0.04	3.1	2.5	415	363	292	....
..	..	..	..	....	...	0.06	3.8	3.1	510	444	363	....
..	..	..	..	....	...	0.08	4.4	3.5	590	514	409	....
..	..	..	..	....	...	0.10	4.9	4.0	660	573	468	....

The figures at the right, giving the cubic yards of excavation per mile of ditch of given size, serve as a useful check on selected sizes and grades with regard to economy in first cost of system.

Details of Milling and Smelting

New Process for Copper Concentrating

A United States Patent 1,175,331, dated Mar. 14, 1916, has been granted to Richard M. Atwater, Jr., of Scarsdale, N. Y., on a process for concentrating copper.

According to this invention the sulphuric acid is applied to the tailings as they lie on the ground, sprinkling the acid, in a suitable state of dilution and in a limited volume, over their surfaces at intervals of time dependent upon the depth, the consistency, the metal contents and especially upon the state of the weather. The exact amount of acid for any given case is best determined by experiment. The dryness of the climate and consequent strong evaporation of moisture from the earth's surface causes the copper sulphate formed from the diluted sulphuric acid to rise to the surface by capillary attraction and to form, by a sort of efflorescent attraction, a crust of impure copper sulphate, which is removed by any suitable mechanical means, such as scrapers, and carried to a central point, where it may be further washed or treated or refined before selling.

A practical manner of carrying out this method of copper concentration consists in leveling and blocking out the tailings heaps by means of a plow and scraper, in much the same way as truck farms are laid out and then running a light industrial-railway track around the blocks thus produced, to facilitate the transport of the acid and of the concentrated product formed by the treatment. The acid is carried in suitable containers run alongside the plot to be sprinkled and is conveniently applied with a hose, care being taken not to disturb the plane surface more than is necessary. As soon as the crust has formed sufficiently, which may take from, say, one to ten days according to the weather, it is removed by hand, preferably using scrapers. The heaps of concentrates, after being scraped together, are loaded on cars and run to the central plant. Here the concentrates can be placed in tanks when desired and redissolved, the residue being chiefly sand. The copper may then be extracted by suitable reagents, by electrolysis, or by evaporation.

⁂

Acid-Proof Mortar should be used in the construction of dust flues where the gases are liable to contain much SO_3. J. Moore Samuel, in the June "Bulletin" of the American Institute of Mining Engineers, says that the dust-chamber walls of the roaster department of the Copper Queen works at Douglas, Ariz., were constructed of hollow tile laid in cement mortar. The conversion of the calcium carbonate in the mortar into calcium sulphate by the sulphur trioxide in the gases caused a volume change that shattered the tile. This resulted in a large leakage of air through the walls of the chamber, this "false air" constituting approximately one-third of the total volume of flue gases. The walls are being repaired, the damaged sections being replaced by new tile laid with a fire- and acid-proof mortar. A considerable reduction in the dust loss is anticipated from the decreased volume moving through the chamber at a proportionately reduced velocity; it is found in practice that the roaster draft has a great effect on the capacity of the furnaces, but tests also show that increase of draft, or increase of tonnage treated, result in prohibitive dust losses, so that now the roaster draft is kept at the absolute minimum required to carry away the gases.

Difficult Chimney Foundation Tested After Completion*

A load test was recently made on a new chimney foundation of unusual design in Pittsburgh. The test confirmed the engineers' judgment by showing that the foundation is amply safe under the intended loading.

In modernizing the boiler plant at the Brilliant pumping station, the city's Bureau of Water encountered a difficult problem in the design of foundations for two new steel chimneys 10x200 ft., since the soil is filled ground along the bank of the Allegheny River. Test borings showed that the subsoil fill consisted of well-compacted broken stone and shale mixed with red clay and a small quantity of gravel.

A test pit sunk to the level of the contemplated base of the foundation was loaded with a concentrated test load of 5,500 lb. per sq.ft. Immediately upon the complete application of this load a settlement of 0.028 ft. occurred in 20 min., at the end of which time movement ceased; the total settlement was 0.145. The soil at the elevation loaded consisted of well compacted soft shale, clay and small broken sandstone. It was concluded that a maximum load of 2½ tons per sq.ft. could be applied with safety.

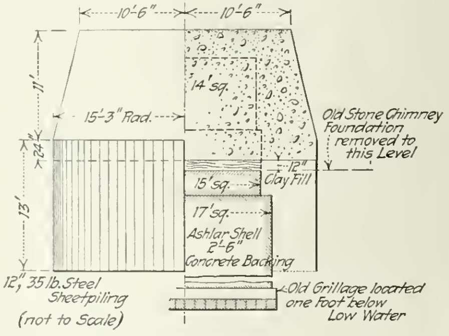
10'-6"
10'-6"
11'
14'sq.
15'-3" Rad.
Old Stone Chimney Foundation removed to this Level
24"
12"
Clay Fill
15'sq.
13'
17'sq.
Ashlar Shell 2'-6"
Concrete Backing
12", 35 lb. Steel Sheetpiling
(not to Scale)
Old Grillage located one Foot below Low Water

FIG. 1. SKETCH OF NEW STACK FOUNDATION AT BRILLIANT PUMPING STATION, PITTSBURGH

Accordingly a mass-concrete spread footing unsupported by grillage was determined upon (Fig. 1). It is conical, with base area 730 sq.ft. and top area 346 sq.ft., the height being 13 ft. and the weight approximately 500 tons. The new stack comes directly over the site of the old stack, which was built with an ashlar foundation supported on timber grillage. The old base was removed to a point 1 ft. below the level of the bottom of the new foundation block, and clay placed between the top of the old base and the bottom of the new, to prevent unequal distribution of the load over the bottom of the new block. As the elevation of the bottom of the foundation is below flood stage in the river a ring of steel sheetpiling was driven around the footing to a point 11 ft. below the base, to prevent scour due to fluctuation of water level.

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*"Eng. News," June 15, 1916.

The foundation block was poured as a monolith, without interruption of the work from start to finish. The completed base was subjected to a loading of 1.6 tons per sq.ft. (including weight of base). This is about equal to the dead-load of the structure. A platform was built up, using four 15-in. I-beams 25 ft. long directly on the top of the foundation, crossing these with six 15-in. I-beams and three 12x14-in. timbers, and laying on this a floor about 25 ft. square. The materials used for loading consisted of 340 tons of dressed sandstone, available on the ground, and sufficient sacked gravel and cement to make the total load, together with 8 tons in grillage and platform, 680 tons, making a liveload of about 0.9 tons per sq.ft.

The load was applied uniformly over the entire platform. Levels were taken from time to time on the tops of four $\frac{3}{4}$-in. steel pins, one at each end of two 20-ft. diameters, 90° apart, whose elevation had been determined prior to the application of the load. They showed that an average settlement of 0.0055 ft. occurred during a lapse of five days, due to the weight of the completed foundation alone, which gave a pressure of 0.7 tons per sq.ft. By the time the test load was placed an average settlement of 0.028 ft. had occurred. An additional settlement of 0.004 ft. took place during the ensuing two days, making a total average settlement of 0.032 ft. under the full loading of 1.6 tons per sq.ft. Levels taken as loading was removed showed no reaction. Work is done under supervision of C. A. Finley, managing engineer, and C. O. Daughaday, mechanical superintendent.

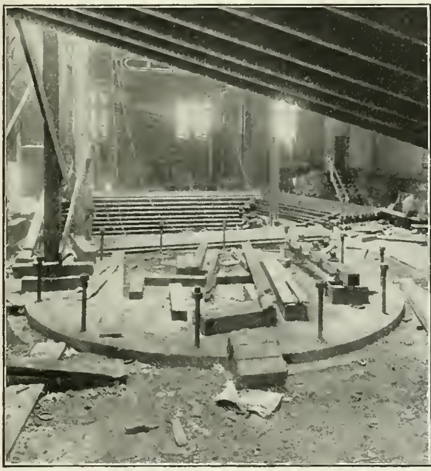

FIG. 2. ONE OF THE NEW CHIMNEY BASES AT BRILLIANT STATION

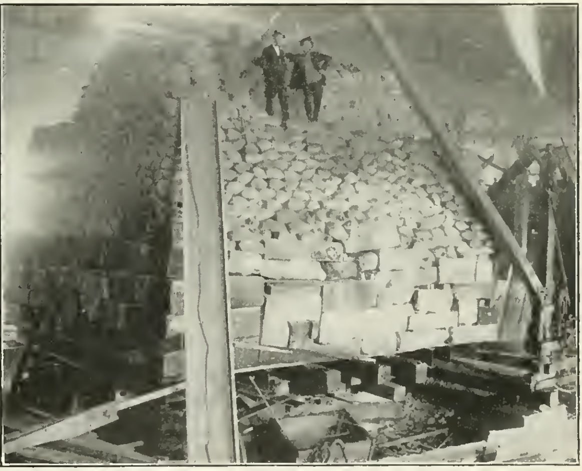

FIG. 3. TEST LOAD OF 680 TONS ON CHIMNEY BASE; $\frac{3}{8}$-IN. SETTLEMENT

* * *

Improving the Physical Properties of Zinc—E. H. Schultz, Chem. Ztg. 39, 547 (1915), in a lecture before the Ges. deut. Metallhütten-u. Bergleute states that the addition of about 6% Cu and 3% Al increases markedly the hardness and toughness of cast Zn. It also produces a more homogenous metal which contracts but slightly on cooling. Pressing or rolling improves the qualities of Zn.

Recovering Elemental Sulphur from Sulphur Dioxide

The recovery of elemental sulphur from furnace gases containing sulphur dioxide has been patented by William F. Lamoreaux of Isabella, Tenn., in U. S. Pat. 1,182,915, supplementing the Lamoreaux and Renwick patent of May 18, 1915, (U. S. Pat. 1,140,310) and the Lamoreaux application of Feb. 9, 1915, (Serial No. 6909). These prior applications covered a method of reducing sulphur dioxide from furnace gases by keeping the gases in contact with incandescent carbon for a predetermined period and supplying the additional heat necessary to secure practically complete reduction to elemental sulphur from a source independent of the oxidation of said carbon; this increment of heat might be supplied by passing an electric current through the carbon bed, or by initially preheating the gas to a sufficiently high degree to compensate for the deficiency of temperature resulting from dissipation of heat from endothermic reactions, radiation and other losses in the reaction zone; preheating was also provided by utilizing the heat otherwise wasted in the gases issuing from the furnace and eventually the sulphur was precipitated in suitable condensers. The coke or charcoal bed was consumed and had to be repaced according to the amount of oxygen contained in the furnace gases.

The present patent provides for the introduction of a suitable reducing gas or vapor, such as atomized oil, and effecting the practically complete reduction of the sulphur dioxide without any appreciable consumption of the incandescent carbon bed through which the gases are made to pass. Thus the reduction is accomplished by the fluid reducing agent and the bed of incandescent carbon serves the practical purpose of insuring an intimate mixture of the reducing agent and the sulphur-bearing gases; further the coke also serves as a conducting and heating medium when it becomes desirable to employ the electric current for adding extraneous heat. Delicate and positive control of the feeding of the reducing agent and the avoidance of blow-holes in the carbon bed are thus attained.

The Cost of Doing Things

Cost at Nipissing Low-Grade Mill

The high-grade mill of the Nipissing Mining Co., Cobalt, treated 921 tons of 2,474-oz. ore and 553 tons of custom ore averaging 2,917 oz. per ton. The low-grade mill treated 77,183 tons averaging 31.49 oz. silver per ton, and crushed 262.82 tons per day giving a stamp duty of 6.57 tons. The table shows the cost of milling the low-grade ore:

COSTS AT NIPISSING LOW-GRADE MILL

	Cost per Ton
Crushing at mine	$0.156
Aerial tramway	.064
Surface tramway	.060
Picking plant	.184
Crushing and conveying	.051
Battery	.295
Tube mills and classifiers	.649
Desulphurizing and slime collecting	.190
Intermediate filtering	.084
Cyanide filter	.126
Clarifying and precipitation	.378
Refining	.103
Heating	.110
Water supply	.037
Construction	.017
Residue dam	.062
Consulting	.052
Cyanide treatment	1.295
	$3.913

Consumption of Supplies at Low-Grade Mill

	Total, Lb.	Cost Per Lb.	Pounds Per Ton	Cost Per Ton
Sodium cyanide	329,600	$0.2240	4.270	$0.9564
Lime	378,680	.0040	4.905	.0198
Caustic soda	213,144	.0284	2.760	.0785
Aluminum dust	51,040	.4210	.660	.2784
Aluminum plates	8,140	.2364	.106	.0249
Aluminum ingots	4,257	.2104	.055	.0117
Pebbles	400,675	.0090	5.190	.0466
Coal	2,102,000	.0029	27.234	.0788
Borax	6,305	.0456	.086	.0037
Power per kw.-hr.	4,922,400	.0117	63.776	.7476
				$2.2464

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Milling Costs at Goldfield

The Goldfield Consolidated Mines Co., Goldfield, Nev., in its report of operations in 1915, has compiled a number of tables of interest and value to operating engineers.

TABLE 1. INDIVIDUAL ITEMS CONSTITUTING CONCENTRATE-TREATMENT EXPENSE

Item	Quantity	Price per Unit	Quantity per Ton Concen.	Cost per Ton Concen.
Cyanide	130,972 lb.	$0.17497	5.76 lb.	$1.008
Zinc dust	15,235 lb	.10951	0.67 lb.	.073
Lime	720,200 lb.	.00669	31.67 lb.	.212
Lead acetate	10,535 lb.	.09115	0.46 lb.	.042
Water	31,159,474 gal.	.15984	1,370.19 gal.	.219
Fuel oil	327,173 gal.	.03794	14.39 gal.	.546
Sulphuric acid	134,400 lb.	.02399	5.91 lb.	.142
Muriatic acid	2,497 lb.	.04606	0.11 lb.	.005
Assaying	....	......	....	.027
Roaster parts	....	......	....	.027
Machinery and repairs	....	......	....	.015
Belting	....	......	....	.009
Lubrication	....	......	....	.017
Borax	135 lb.	.11911	0.01 lb	.001
Litharge	7,751 lb.	.07567	0.34 lb	.025
Coke	9,900 lb.	.00725	0.44 lb.	.003
Pig lead	2,560 lb.	.05845	0.11 lb.	.006
Slag	2,415 lb.	.0073	0.11 lb.	.001
Filter cloth	....	......	....	.020
Pipe and fittings	....	......	....	.033
General stores	....	......	....	.036
Pump parts	....	......	....	.015
Iron ore	4,354 lb.	.009	0.19 lb.	.002
Total supplies	....	......	....	$2.484
Operating labor	3,852 shifts	4.282	0.169 sh.	.726
Repair labor	517 sh.	4.453	0.023 sh.	.101
Power	252 hp.	72.00	4.045 hp.	.798
Total				$4.109

TABLE 2. SEGREGATION OF MILLING COSTS
Per Ton of Ore Milled

Department	Labor	Supplies	Power	Total	Per Cent. Total
Crushing and conveying	$0.020	$0.007	$0.007	$0.034	2.40
Stamping	.028	.039	.059	.126	8.91
Chilean milling	.015	.032	.041	.088	6.22
Elevating and classifying	.011	.003	.005	.019	1.34
Tube milling	.020	.062	.091	.173	12.23
Concentration	.025	.009	.014	.048	3.39
Neutralizing	.006	.072	....	.078	5.52
Settling	.012	.071	....	.083	5.87
Dissolution	.017	.355	.031	.403	28.50
Filtering	.028	.018	.012	.058	4.10
Tailing expense	.001	....	....	.001	0.07
Assaying	.002	.012	....	.014	0.99
Precipitation	.007	.044	.011	.062	4.38
Refining	.016	.021	....	.037	2.62
Water	....	.039	....	.039	2.76
Surface and plant	.004	.003	....	.007	0.50
Steam heating	....	.002	....	.002	0.15
Storehouse and office	.008	.001	....	.009	0.64
Stable	.001	.001	....	.002	0.15
Watchmen	.019	....	....	.019	1.34
Superintendence and foremen	.034	....	....	.034	2.40
Lighting	.001	.002	.013	.016	1.13
General expense	.001	.005	.001	.007	0.50
Mill tools	.001	.004	....	.005	0.35
Electrical department	.004	.015	....	.019	1.34
Pumping battery water	.006	.003	.013	.022	1.56
Experimental	.005	.004	....	.009	0.64
Totals	$0.292	$0.824	$0.298	$1.414	100.00
Per cent. of total cost of milling	20.65	58.27	21.08	100.00	
Per cent. of combined cost of milling and concentrate treatment	17.63	49.76	18.00	85.39	

TABLE 3. INDIVIDUAL ITEMS CONSTITUTING MILLING EXPENSE

Item	Quantity	Price per Unit	Quantity per Ton Concen.	Cost per Ton Concen.
Cyanide	622,931 lb.	$0.17566	1.61 lb.	$0.284
Zinc dust	137,106 lb.	.10952	0.36 lb.	.039
Lime	8,225,140 lb.	.00665	21.31 lb.	.142
Lead acetate	243,645 lb.	.09072	0.63 lb.	.057
Muriatic acid	76,331 lb.	.04746	0.20 lb.	.009
Water	93,478,014 gal.	.15984	242.23 gal.	.039
Lubrication	....	......	....	.006
Borax	1,215 lb.	.11816	0.003 lb.	....
Litharge	101,730 lb.	.07764	0.26 lb.	.020
Pig lead	23,040 lb.	.05845	0.06 lb.	.004
Shoes and dies	185,249 lb.	.05263	0.48 lb.	.025
Pebbles, flint	1,039,302 lb.	.01545	2.69 lb.	.042
Pebbles, rock	422,750 lb.	......	1.09 lb.	....
Tube-mill linings	91,795 lb.	.06222	0.24 lb.	.015
Chilean steel	127,296 lb.	.06541	0.33 lb.	.022
Machinery and repairs	....	......	....	.015
Screens	....	......	......	.004
Office supplies	....	....	....	.001
Filter cloth	....	....	....	.007
Iron and steel	....	....	......	.010
Assaying	....	....	...	.013
Hose and fittings	....	....	......	.001
Pipe and fittings	....	....	....	.004
Lumber	....	......	....	.004
Crusher parts	....	......	....	.004
Coal	70 tons	15.0543	0.36 lb.	.003
Coke	89,100 lb.	.00725	0.23 lb.	.002
Slag	21,735 lb.	.00731	0.06 lb.	....
Pump parts	....	......	....	.006
Waste	2,990 lb.	.11401	0.01 lb.	.002
Electrical operation and repair	....	......	....	.014
General stores	....	......	....	.020
Fuel oil	28,425 gal.	.0378	0.07 gal.	.003
Iron ore	39,187 lb.	.009	0.10 lb.	.001
Belting	....	......	....	.006
Total supplies	....	......	....	$0.824
Operating labor	18,142 shifts	4.566	0.047 sh.	.215
Repair labor	6,526 sh.	4.572	0.017 sh.	.077
Power	1,600 hp.	72.00	1.513 hp.	.298
Total				$1.414

The consumption of material of all kinds is given in considerable detail, and costs are shown with great accuracy.

The mill operated at its maximum efficiency and averaged 1,057 tons per day. This is a higher daily average by 110 tons than for any other year in its history. An average recovery of 90.45 % was made, which in view of the low-grade ore treated, is to be considered good work.

The costs were the lowest that have ever been achieved here and, compared with the previous year, show a reduction of 22c. per ton. The reduction is attributable to increased tonnage, reduction in the consumption of chemicals and in the cost of power through more accurate regulation of the peaks with a correspondingly higher power factor.

TABLE 4. SEGREGATION OF CONCENTRATE-TREATMENT COSTS

Per Ton of Concentrate Treated

Department	Labor	Supplies	Power	Total	Per Cent. Total
Raw cyanidation	$0.076	$0.385	$0.179	$0.640	15.58
Filtering and conveying	.170	.035	.041	.246	5.99
Roasting	.280	.589	.112	.981	23 87
Acid treatment	.069	.161	.239	.469	11.41
Cyanidation of roasted product	.091	.917	.197	1.205	29.33
Assaying	.012	.026	....	.038	0.92
Precipitation of copper	.055	.044	....	.059	1.44
Precipitation	.015	.083	.020	.118	2.87
Refining	.030	.040	....	.070	1.70
Disposal of tailings	.026	.016	.010	.052	1.27
General expense	.003	.009	....	.012	0.29
Water	....	.219	....	.219	5.33
Totals per ton of concentrate	$0.827	$2.484	$0.798	$4.109	100.00
Totals per ton of ore	.049	.146	.047	.242	
Per cent. of total cost of concentrate treatment	20.13	60.45	19.42	100.00	
Per cent. of combined cost of milling and concentrate treatment	2.96	8.81	2.84	14.61	

The accompanying tables give a full and clear account of the milling work done and the results obtained.

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The Tonopah Belmont Mill

The milling plant of the Tonopah Belmont Development Co., at Tonopah, Nev., treated 165,157 dry tons of ore during 1915, an average of about 452 tons per day. This ore contained a total of 32.348.289 oz. of gold and 3,237,602 oz. of silver, an average grade of 0.196 oz. of gold and 19.603 oz. of silver per ton. Average value was $13.88 per ton. The gross value was $2,292,943, calculating silver in bullion at 50c. per oz. The average per-ton value was lower than that of the previous year by $2.838, or about 17%. The average recovery was 96.18% of the gold and 91.69% of the silver contents; a combined extraction of 92.97%.

The average number of stamps dropped was 50, out of a total of 60, and the average 24-hr. duty per stamp was 9.15 tons. The daily average tonnage for the 361 days of actual operation was 457.5 tons.

The average direct milling cost was $2.366 per ton, 21c. per ton higher than the similar cost for the preceding year. The indirect cost for milling was $0.316 per ton, a little less than 1c. lower than the previous year's similar cost. The average total milling cost was $2.682, or $0.118 higher than the similar cost for the previous year. The direct cost of production of the unit ounce of doré bullion was $0.13. The higher cost per ton and per ounce of metals produced was due in part to the lower tonnage handled, but chiefly to the increased cost of chemicals and other supplies. Thus the increased direct milling cost was almost wholly due to advances in prices. The consumption costs of cyanide, lead acetate, zinc dust and grinding pebbles account for over 18c. of the increase.

The only change in filtering equipment or process is in the adoption of a new style of filter leaf with which, after fair tests, the mill has been equipped. The new leaf is cheaper as to first cost than those previously used and has a further and greater advantage of more thorough washing, by which the soluble losses have been reduced by nearly one-half. The Belmont tube-mill liners, installed during the previous year have proved satisfactory, this equipment having reduced the tube-mill cost, as compared with silex lining, by nearly 3.5c. per ton of ore ground. The accompanying table shows the segregated costs of milling at the Tonopah plant.

The Millers plant was operated throughout the year as a custom mill, treating 56,735 tons of custom ore of an average per ton content of 0.309 oz. of gold and 25.01 oz. of silver, having a gross value of $1,730,516. Recoveries of 93.75% of the gold and 40.13% of the silver were made, the combined recovery being 91.33% of the total value. The combined recoveries were greater by 3.35% than those of previous years. The average direct milling cost was $3.57 per ton, and the average indirect milling cost was $0.228 per ton. The direct cost of production per unit ounce of doré bullion was $0.156. The increased recoveries and decreased costs were due almost entirely to the installation of the continuous-decantation system, during the previous year in place of the old filter method of operation. The cost of remodeling the mill for the new process, amounting to $24,930, of which a balance of $19,662 was due at the beginning of the year, has been since completely refunded.

DETAILED MILLING COSTS AT TONOPAH MILL

	Cost per Ton
Crushing and conveying	$0.071
Stamping	.331
Classifying	.027
Tube milling	.398
Thickening	.056
Concentrating	.075
Agitating slimes	.864
Filtering and discharging slimes	.187
Precipitating	.225
Assaying	.016
Refining	.041
Lighting	.011
Shaft bosses	.039
Watchmen	.009
Surface and plant	.016
Total direct cost	$2.366
Administration	$0.062
Office and storehouse	.016
Taxes and insurance	.070
Depreciation	.151
General expense	.017
Total indirect cost	$0.316
Total milling cost	$2.682
Combined Milling Costs	
Labor, per dry ton	$0.428
Misc. and sup., per dry ton	1.792
Power, per dry ton	.462
Total milling cost	$2.682

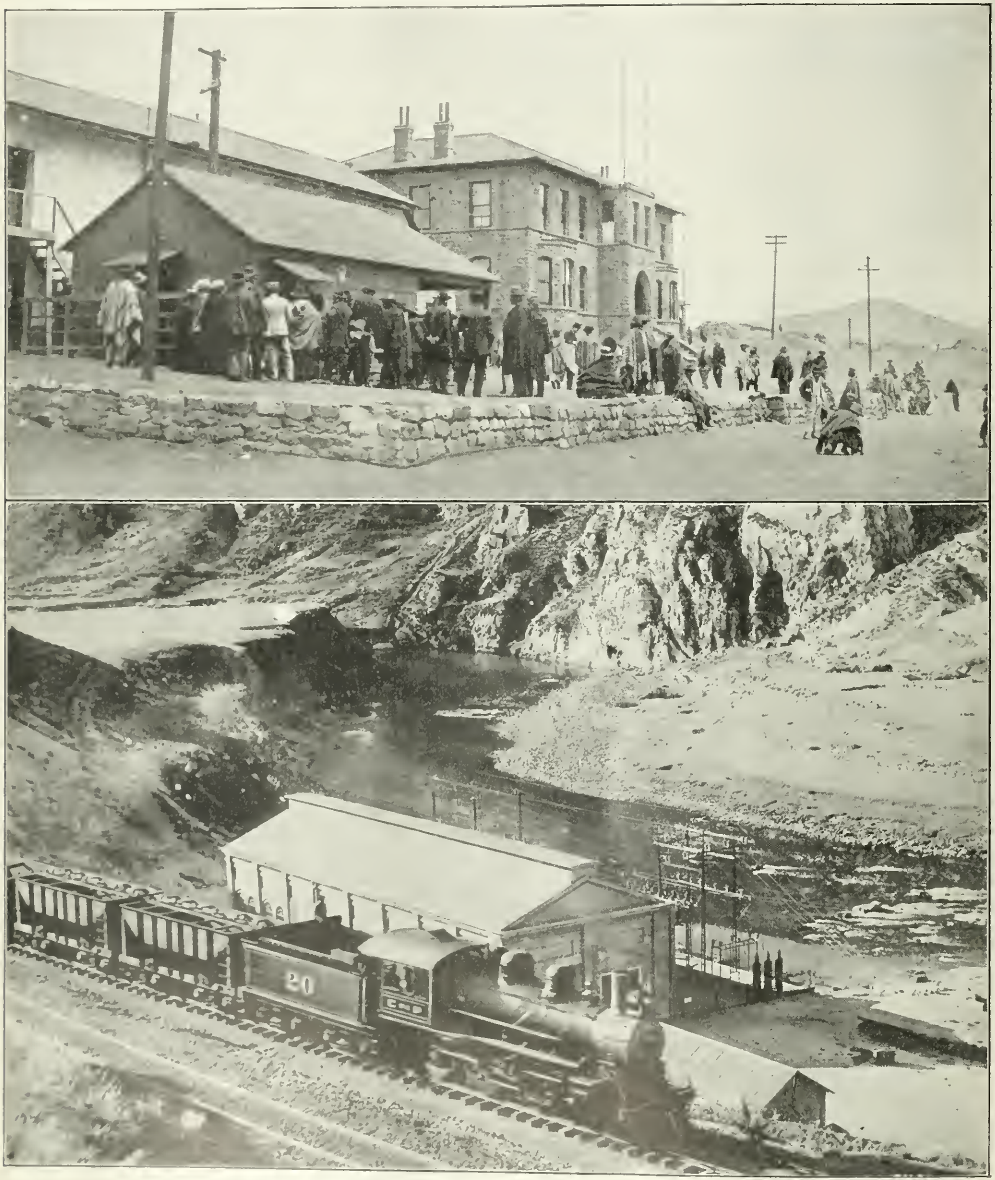
During the year 1,018 tons of sweepings has been recovered under a leasing system from the impounded Tonopah tailings. This contained an average of 0.343 oz. gold and 55.92 oz. of silver per ton, a total gross value of $34,328. The net return from the sweepings was $4,836. A small mill to treat this material will be installed, to cost less than $10,000, and the capital expenditure should be returned, together with some profit, by the end of the first season of operation.

A fire, in December, 1915, caused by the breaking of an oil-feed pipe to the bullion furnaces, almost destroyed the refinery at the Tonopah plant, but with small loss. No product was lost, since a cleanup had just been made.

⁂

McIntyre Porcupine Mines, Ltd., in its report for the year ended Mar. 31, 1916, shows a total of 105,758 tons milled at a total cost of $102,389, or $0.9681 per ton. The mill ran 94.4% of the possible time and made a recovery of 95.6%. Labor cost was $0.2531 per ton; supplies, $0.5263; power, $0.1392, and shops, $0.0495 per ton. The new unit of the mill was completed in March, 1916, at a cost of $48,063.

Photographs from the Field



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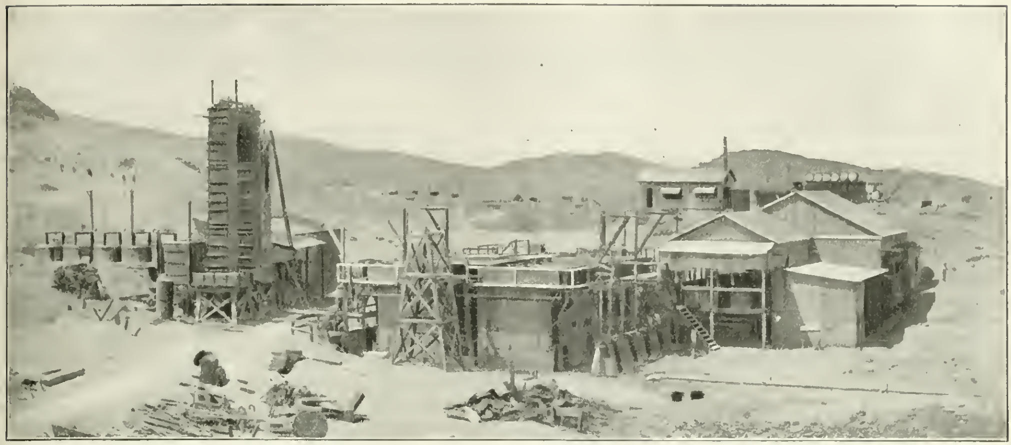
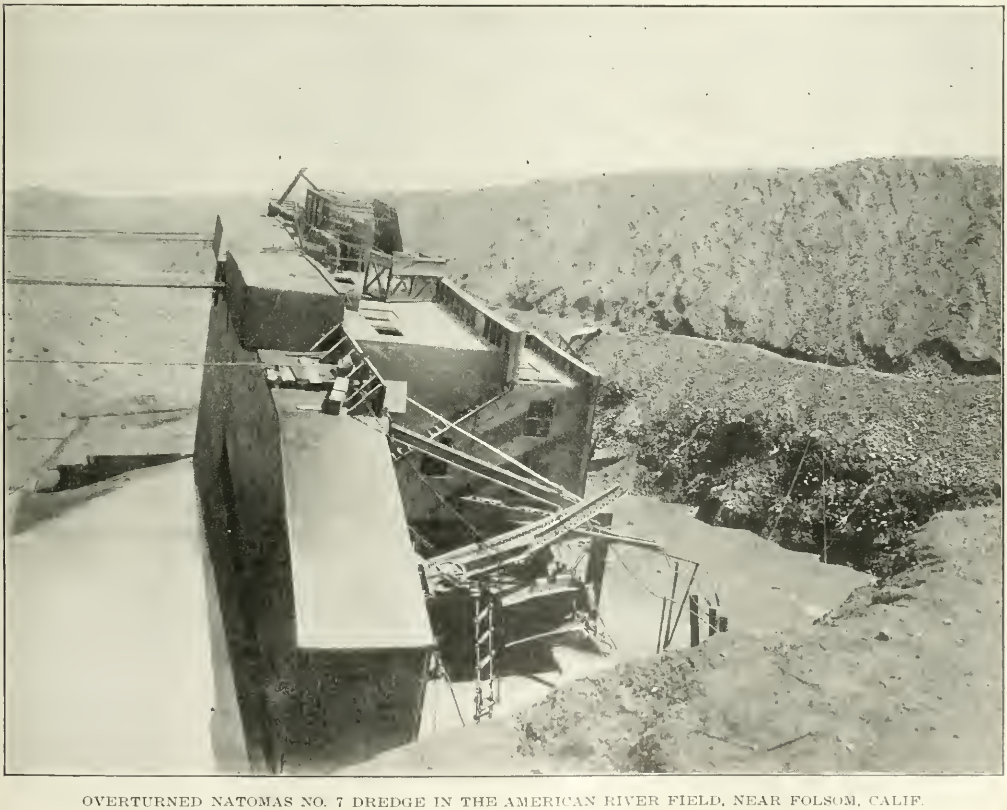
SOME OPERATIONS OF THE CERRO DE PASCO COPPER CO., PERU, SOUTH AMERICA

The upper photograph shows the general office and hotel of the company. The lower shows the power station of the company, near Oroyo, Peru, on the line of the company's railroad



EXPERIMENTAL PLANT OF THE NEW CORNELIA COPPER CO. IN THE AJO DISTRICT OF ARIZONA

The company, a subsidiary of Calumet & Arizona, is building a new town, called Cornelia, modeled on the plan of Washington, D. C. It has avenues radiating from a civic center, where the railroad station and business buildings will be located, together with the company's offices. A separate townsite is designed for Mexican employees



OVERTURNED NATOMAS NO. 7 DREDGE IN THE AMERICAN RIVER FIELD, NEAR FOLSOM, CALIF.

This remodeled steel dredge was put into operation about three years ago and has worked steadily up to the time of the accident

Correspondence and Discussion

Geological Relations of the Sudbury Nickel Ores

As a recent writer in the *Journal* has expressed very decided objections to the usually accepted theory of the origin of the Sudbury nickel-copper ores it may not be amiss to review the reasons which support the theory of magmatic segregation as applied to them.

Most of the important ore deposits of the region were discovered about 30 years ago, before much was known of its geology, but the keen-sighted prospectors were struck by the fact that all the deposits were associated with "diorite." The study of fresh specimens of the rock with the microscope proved that the so-called diorite is really norite; and Barlow and other geologists interpreted the sulphide deposits as magmatic segregations from the norite. Not long afterward it was proved by T. L. Walker that the norite with which the ore is associated passes upward into micropegmatite in certain characteristic localities.

The writer, then geologist to the Bureau of Mines of Ontario, was instructed to map the region, and with various assistants carried on field work there for three years, with the result that the norite-micropegmatite was proved to form a boat-shaped laccolith having a synclinal arrangement, separating ancient rocks beneath from sediments above, perhaps of Animikie age.

It was found also that there are several interesting relations between the eruptive sheet and the orebodies. They are all either at the lower and outer edge of the norite or strung out along irregular dike-like projections from it. For convenience the orebodies at the edge of the norite were called "marginal deposits" and the others "offset deposits." The final results of the field work confirmed the conclusions of the prospectors.

Veins in Country Rock

If one crosses the eruptive sheet from the inner to the outer edge at a marginal mine, such as the Creighton, the micropegmatite gradually merges into norite, which is found after a time to be spotted with blebs of ore. As the mine is approached these blebs become more numerous until half of the rock or more consists of sulphides. The margin between the pyrrhotite-norite and the ore is usually far from sharp and some of it is often included with the ore in mining. The ore itself contains more or less of the minerals of the norite and also often fragments of the country rock and sometimes of norite. These fragments may be angular or well rounded, like boulders or pebbles.

The ore often penetrates in veinlike ways for a short distance into the country rock and is sometimes more or less disseminated in it, though never for any great distance from the norite and never in well defined blebs completely surrounded by unchanged rock, as in the pyrrhotite-norite mentioned before.

A study of thin sections of pyrrhotite-norite from some of the marginal mines shows that the ore blebs are often contained in fresh rock in which even the hypersthene is unchanged. There is no hint of a channel through which the sulphides could have arrived at their present position. The foot wall of marginal deposits may be of any kind without affecting the character of the ore, and at one point or another all of the older rocks of the region are found in this position. The orebodies occur at outward bends of the norite and no ore nor even pyrrhotite-norite occurs at pronounced inward bends of the margin.

Where a bay of the sort just mentioned had no outlet into the country rock a marginal ore deposit is found; but when there was faulting or fissuring the ore and norite made their way outward, often in very irregular ways, and the orebodies may be strung out for three or four miles from the edge of the norite, forming what have been called offset deposits. Sometimes a continuous dike-like band of norite ties an offset deposit to the edge of the main sheet of norite, as at No. 2 mine, Copper Cliff, but in many cases no certain connection can be traced, though norite or pyrrhotite-norite is present at all offset mines, no matter how far from the edge.

Orebodies in Thickest Sheet

The norite-micropegmatite sheet varies a good deal in thickness, and the largest orebodies occur in general where the sheet is thickest; and where it is unusually thin, as in the township of Morgan, no ore has been found. The character of the ore in unfaulted marginal mines is very uniform, often consisting to the eye of pyrrhotite and a smaller amount of chalcopyrite only, though in some mines pentlandite may be found also. It has been shown by Campbell and Knight that pentlandite occurs in all the ores, and their excellent work makes it probable that this is the only important nickel-bearing mineral in the region.

In unfaulted marginal mines there is usually twice as much nickel present as copper, though near the country rock the amount of chalcopyrite always increases, and in offset mines, where rock is usually present in larger amounts, copper commonly surpasses nickel in quantity.

In all the mines there are evidences of slight migration of the minerals, especially chalcopyrite, since the deposits were formed, and in some of the narrower offsets changes due to water action seem to be of considerable importance.

The statement of facts just given represents the results of field work covering the whole of the basic edge of the norite, including visits to every known ore deposit and prospect, and details may be found in reports of the Bureau of Mines of Ontario and in a monograph on the nickel industry published by the Mines Branch at Ottawa. Examples illustrating the features mentioned may be seen in the Royal Ontario Museum and in the working collections of the University of Toronto.

How are the relations mentioned above to be accounted for? My assistants and I often discussed the matter as the work progressed, and it was forced upon us that the norite was the source of the ore. It is evident that the lightest part of the eruptive sheet, the micropegmatite, is on top, merging downward into the somewhat heavier norite. This becomes charged with blebs of ore at its lowest points and passes into pyrrhotite-norite, which is followed by the heaviest material of all, the ore, settling into all the hollows of the floor. Where there were outlets the heaviest and most fluid parts of the magma penetrated the country rocks forming the offset deposits.

The conclusion is irresistable that the sulphides were once part of the molten magma and that there was a slow segregation in the eruptive sheet, which averages a mile and a quarter in thickness, the materials arranging themselves according to their specific gravities. The separation was, however, not complete, since pyrrhotite-norite, often in immense amounts, overlies all the marginal orebodies. This rock contains innumerable shots of ore, caught when cooling advanced too far to let them settle to the bottom, just as shots of matte may be caught in slag in blast-furnace practice.

The field relations noted above are easily demonstrated and have been seen by many geologists, including a large part of the members of the Geological Congress, who were satisfied as to the correctness of the magmatic segregation theory in accounting for the facts. It would almost seem, however, that Knight has confined his fieldwork to regions outside the norite-micropegmatite sheet, since in his discussion of the relations he does not even refer to these perfectly evident features. Just how he reaches his sweeping conclusion that the magmatic theory is untenable is not evident, since none of his arguments seem to have any bearing on the subject. The statement that there are later granites near or even cutting some of the orebodies is correct, but the segregation process was complete before these granites were erupted, so that they evidently were not the bearers of the ore. The statement that the coarse granite beneath the Creighton orebody is later than the ore does not agree with my own observations nor with the more recent studies of Howe, but even if it were younger no reason can be assigned why granite should not come beneath an already existing orebody.

His second argument, that the Worthington orebody is simply a basic dike, agrees well with the magmatic segregation theory, since this long dike-like offset is traceable from the norite edge near Victoria Mines, and pyrrhotite-norite, a basic rock, occurs at every mine and prospect along it. The norite and ore were squeezed into all the interstices of this long brecciated zone and form the matrix of a sort of breccia to be found here and there for miles. The argument drawn from the Frood, or No. 3 mine, is equally beside the point. The ore and norite have penetrated most intricately all the fissures of the country rock and ore naturally occurs in crushed and brecciated zones of graywacke, as well as other rocks. It may be added that most of the many thousands of tons of ore mined at the Frood were literally pyrrhotite-norite. The members of the Geological Congress took typical specimens of this rock from the ore cars. The statement made that granite and greenstone are spotted with ore in the same way as the pyrrhotite-norite does not at all accord with my observations. The pyrrhotite-norite is often perfectly fresh rock with the blebs of ore clean cut and completely inclosed in unchanged rock minerals, while the granites and greenstones which are spotted with ore have been greatly weathered and attacked. It is quickly seen, also, that the sulphides in the latter rocks are mainly chalcopyrite, while the pyrrhotite-norite contains mainly pyrrhotite. In any case the amount of pyrrhotite-norite is enormous, while the country rocks are seamed and spotted with ore only on a small scale and close to orebodies. That secondary changes have taken place in and near orebodies has never been disputed, and this fact does not conflict with the magmatic segregation theory, which accounts for the origin of the ores and not for their later migrations or changes.

Knight's citation of opponents of the magmatic segregation theory is rather unfortunate. C. W. Dickson, one of the earliest opponents of the theory, called on me some years ago, spent several hours with the microscope over my thin sections of pyrrhotite-norite from Creighton and elsewhere, and could not deny that they favored the magmatic theory. Beck, who at first opposed the theory, is a firm convert to it, as may be seen from the last edition of his Erzlagerstätten. He went over the ground with T. L. Walker during the Geological Congress and made no objection to the usual interpretation. In a letter sent me after returning to Freiberg he expresses his pleasure in the excellent demonstration given at Sudbury. If Knight had read to the end of E. Howe's paper on the Sudbury Nickel Deposits in the June number of *Economic Geology* he would have found that the Creighton orebody is accounted for by magmatic segregation, though the theory receives a somewhat different form from the usual one.

As the presence of later granites in or near certain ore deposits of the Sudbury region seems to Knight convincing proof that they are not of magmatic origin one naturally asks how he accounts for the Sultana, Levack, Whistle, Garson and other marginal mines which are miles away from any late granite and rest upon greenstone, anorthosite or Laurentian gneiss and yet have the same character as orebodies close to the suspicious granites.

Knight has done such admirable work at Cobalt and elsewhere that I feel sure a few days' examination of the field relations of the norite and ore under the guidance of T. L. Walker or the present writer would convince him that the magmatic segregation theory is not the untenable affair that he imagines. It would be a pleasure to Walker and myself if other geologists interested in the problem would join us in such an excursion.

A. P. Coleman,
University of Toronto.

Toronto, Can., June 14, 1916.

*

Stand for Machine-Drill Repairing

In the *Journal* of May 20 was a description of a home-made stand on which machine drills could be bolted while making repairs to render them much more accessible than when laid on a bench.

While it might cost a little more, it would certainly be much more advantageous to purchase a tripod for this purpose, instead of using this home-made stand. The latter would not be stiff enough to test the drill after the repairs had been made, whereas with a tripod with weighted legs, a big block of wood can be set in or on the ground and the drill can be run, allowing the chuck to strike on the block, and the efficacy of the repairs made can thus be determined before the drill is shipped underground.

New York, June 6, 1916. M. R. Percy.

Compulsory Adoption of Metric System

In these days when Mr. McAdoo is being asked by the Bureau of Standards to push along the compulsory adoption of the metric system into this country by advocating it at the conference in Argentina, it is interesting to have a little side light on Argentine conditions as regards the use of the metric system.

The following excerpt from the May number of *The Americas*, published by the National City Bank of New York and appearing in the June 29, 1916, issue of the *American Machinist*, is from an article on "How to Translate Argentine Prices," by E. F. DuBrul. It will be noticed that while the metric system is by law made compulsory in Argentina, they still continue, according to this article, to measure great estates in square leagues and the square league varies in different provinces. The metric unit has not supplanted this older one.

Also, according to this article, occasionally old Argentine measurements and weights come up and puzzle the country, and the list shows that there are a good many of them. Evidently there would be as little success in this country in abolishing our own present measurements as there would be in any other country, and this article merely confirms the mass of other evidence offered by Mr. Halsey and Mr. Dale to the effect that a compulsory metric system merely adds another system and does not replace the old units. The extract referred to is given herewith:

> Great estates in Argentina are often measured in square leagues. The square league is measured differently in different parts of the country, being equal to 10.4255 sq.mi. (6,671.66 acres) in Buenos Aires, Santa Fé and Entre Rios provinces and to 9.6529 sq.mi. (6,177.85 acres) in the National Territories, with varying sizes in other provinces. In San Luis, Mendoza, San Juan and Catamarca the square league equals 2,615.627 hectares; in Cordoba, 2,709.827; in Corrientes, 2,701.088; in Tucuman, 2,662.560; in Santiago del Estero, 1,880.485.
>
> These are the metric measurements. Occasionally the persistent "old Argentine" measurements come up and puzzle the reader. A few of them are:
>
> Onza = 1.012803 oz. = 28.7125 grams
> Libra = 1.012803 lb. = 0.4594 kilos
> Arroba = 25.32 lb. = 11.485 kilos
> *Quintal = 101.28 lb. = 45.91 kilos
> Tonelada = 0.904288 English tons = 0.9818 metric tons
> Pulgada = 0.947 in. = 2.4055 cm.
> Pie = 0.947 ft. = 0.2886 m.
> Vara = 0.947 yd. = 0.866 m.
> Cuadra = 4.17 acres = 1.6871 hectares
> †Cuartilla = 7.549188 gal. = 34.2992 liters
> †Fanega = 3.774594 bushels = 1.3719 hectoliters
> Cuarta = 1.0455 pt. = 0.5937 liters
> Frasco = 2.091 qt. = 2.375 liters
> Galon = 3.345 qt. = 3.800 liters
> Barril = 16.728 gal. = 7.6 decaliters
> Pipa = 100.37 gal. = 4.56 hectoliters
> Pesada of dry hides = 35.448 lb. = 16.079 kilos
> Pesada of salted hides = 60.768 lb. = 27.564 kilos
> Pesada of washed sheepskins = 30.384 lb = 13.782 kilos
>
> *The international quintal is a metric measurement equaling 100 kilos.
>
> †These have also other values as variously stated.

⁂

Chemical Exposition To Be Held in New York

The second national exposition of chemical industries will be held at the Grand Central Palace, during the week of Sept. 25, 1916. The list of exhibitors contains the names of the most important and progressive companies engaged in industries in which chemistry plays a part. From this list it appears that the exposition will be twice the size of its predecessor. The American Chemical Society will hold its annual meeting during the whole week. The American Electrochemical Society has arranged to hold its meetings the latter part of the week, Sept. 28, 29 and 30 being the dates chosen, and at least one of these days will be devoted to papers relative to the chemical industry. Many other societies are arranging to hold meetings at the same time.

The Bureau of Commercial Economics at Washington is coöperating with the exposition by arranging an elaborate program of motion pictures covering subjects dealing with the industries depending on chemistry. Many of these films will be shown for the first time at the exposition. Among others, films on the following subjects will be shown: The manufacture of explosives, silver mining, mining and manufacturing of iron, and the manufacture of steel.

Indications are that this will be a greater success than the exposition held last year.

⁂

Anaconda's First-Aid Work

Butte Correspondence

The Bureau of Safety of the Anaconda Copper Mining Co. has made first aid an important part of its activities. This work was begun by the Bureau of Mines rescue car coming to Butte and training a small number of men in the principals of first aid to the injured. From the work done by these few men it was soon noted that there was less infection of wounds in cases that received first-aid attention; also, first aid helped considerably in accidents where men were overcome by gas or electric shock. In the early spring of 1915, when the advantages of first aid had become apparent, the Bureau of Safety asked the Bureau of Mines again to send the rescue car to Butte. The car arrived on Feb. 15 and was used until May 10 in giving first aid-training in Butte, Anaconda and Southern Cross.

Original Mine Team Represented Montana at the National First-Aid Meet

On May 9 a first-aid contest was held at Columbia Gardens, Butte. Much interest was manifested in this work, and more than 2,500 people turned out to witness the contest. The two teams that made the highest score were sent to Billings, Mont., to participate in the Montana state-wide contest on July 23-24, and brought home to Butte and Anaconda the highest honors, having won both first and second prizes respectively. After the Billings contest, the company decided to send a team to San Francisco to take part in the national first-aid contest and field meet. For the purpose of determining which team should represent the company and the State of Montana at this meet, a series of contests was held during August, resulting in the Original Mine team going to San Francisco where it made a very creditable showing in the national contest.

First-aid work was also inaugurated at the Washoe smeltery in April, 1915, and during the visit of the mine-rescue car at Anaconda 51 men received the training, and an elimination contest was held to determine which team should represent the smeltery at the Butte contest on May 9. Immediately following the Butte contest, the rescue car went to the Great Falls smeltery, where 60 men were trained and a contest held on May 15. The car next went to the company's coal mines at Tracy, Mont., where a number of men were trained. On May 29 a contest was held in which teams from the Great

Falls smeltery, the Tracy mine and several other mines of the Sand Coulee district took part.

While the people of Butte and the officials of the Anaconda company are proud of the achievements of the winning teams, they are still more indebted to the first-aid men individually for the good work done in helping injured men before medical aid can reach them. The real value of the first-aid man is, of course, his ability to help in actual cases of accident and injury. The winning of prizes in first-aid contests is a secondary feature; the idea in holding the first-aid contest is to stimulate public interest in this work.

In line with its policy of making working conditions as safe and healthful as possible, the Anaconda company has decided to put this work on a permanent and systematic basis, and for this purpose has employed John L. Boardman, who was formerly in charge of such work for the United States Bureau of Mines, to assume direction both of the first-aid and of the mine-rescue work in Butte. A new mine-rescue station has been built at the Anaconda mine, and another is being erected at the Tramway mine. Plans have been made to train and maintain a mine-rescue crew of five men on each shift at each mine, and in addition to this a large number of men will be trained in first-aid work. It is planned to register the first-aid men and devise a system whereby each man will be given credit and recognition for the actual first-aid work he does. This system will serve a dual purpose—first, that of encouraging men to take first-aid training and thus fit themselves for properly performing first aid, and second, it will give the Bureau of Safety a more accurate method of determining the value of first aid.

SERIES OF FIRST-AID CONTESTS

As before mentioned, the purpose of holding first-aid contests is to interest the public in the work rather than to promote rivalry between the teams. Accordingly, a series of contests has been planned for the present season. A rule was made that no team entering the series should contain more than two veteran contest men. The advantage of this rule was that each team had to train four new men with which to fill its ranks. The contest was arranged on the same general plan as a baseball series. Twelve teams, representing as many different mines, entered and a schedule of contests was so arranged that each team met each other team once in direct competition. A contest is held each week, in which six teams take part in such a manner that each weekly contest is really six contests between two different teams. For the purpose of illustration, the contest schedule, with percentages made by each team, for Friday evening, May 12, is given:

FIRST CONTEST, MAY 12, 1916

Leonard Team (99.32%) vs. Bell Team (99.11%).
Original Team (98.22%) vs. Mountain View (95.78%).
Moonlight Team (98.72%) vs. Pennsylvania (97.78%).

SECOND CONTEST, MAY 12, 1916

Bell Team (99.39%) vs. Moonlight Team (99.72%).
Pennsylvania (98.39%) vs. Original Team (99.22%).
Mountain View (98.39%) vs. Leonard Team (99.94%).

At the beginning of the series a list of 48 problems was given the teams, and for each contest three problems were selected from the list. After the fifth week of the series a new list of 31 problems was given the teams and three selected for work at each contest as before. By this method the teams will be obliged to practice on 79 problems and each team will work 39 of these in actual contests.

While it is rather difficult to reduce the value of first-aid work to a dollars-and-cents basis, the testimony of the physicians and surgeons in regard to the work proves its good effect, and the interest manifested by the physicians and surgeons of Butte, Anaconda and Great Falls in donating a great deal of their time to judging the contests and giving lectures to the men is greatly appreciated by all connected with this work.

(Later)—Prizes in the first-aid contest between teams of the various Anaconda mines in Butte have been awarded as follows: Moonlight, $200; Leonard, $150; Original, $125; High Ore, $100; Anaconda, $75; Mountain View, $50. The Poulin and Bell teams were tied for seventh prize.

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Mining Company's Liability to Licensee

Defendant mining company, owner of mineral lands in Missouri, permitted decedent and his associates to prospect on such lands. Finding an old skid boiler which had been used on the premises for many years by miners and prospectors, decedent obtained permission to use it. Shortly afterward a leak was discovered in the fire-box and defendant's employees gratuitously repaired it. Four weeks later the boiler exploded, killing decedent, who was attending it alone. There was no eye witness to the accident.

Decedent's widow sued defendant to recover damages on the theory that the accident was due to the negligent manner in which defendant's employees made the repairs, and a jury returned a verdict for $6,000 in her favor. The Springfield Court of Appeals has reversed the judgment, however, exonerating defendant from liability on the ground that plaintiff's proof failed to establish her claim of negligence on the part of defendant or its employees; that negligence could not be presumed from the mere occurrence of the accident, since plaintiff had elected to rely upon a claim of specific negligence in the manner in which the repairs were made, and since decedent, and not defendant, controlled boiler at time of the explosion.

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Chronology of Mining for June, 1916

June 1—Strike of miners on Mesabi Range began about this date.—Eagle White Lead Co. and Picher Lead Co. consolidated as Eagle-Picher Lead Co.

June 5—American Zinc, Lead and Smelting Co. purchased Granby Mining and Smelting Co.

June 9—First six smelter-fume suits against the Penn Mining Co. in U. S. District Court at San Francisco, decided in favor of defendant; eleven more cases are to be tried in September.

June 18—National Guard of entire United States called out on account of Mexican situation.

June 19—Couldburst in Joplin district flooded a number of mines and curtailed production.

June 20—Many American mine employees left Mexico; Greene-Cananea works closed.

June 23—Cresson mine in Cripple Creek district sold.

June 30—Yukon-Alaska Trust paid initial dividend.—Interstate Commerce Commission ordered an investigation into the Alaskan railroad and steamship situation.

Editorials

The Mexican Situation

The Mexican situation continues in the mess that was to be expected from bungling. We put a large part of our mobile forces into Mexico to chase a single bandit. Having put them there and not having caught the bandit, we cannot find immediately a way of withdrawing them without letting the Mexicans think they drove us out. In the meanwhile the entire National Guard of the states is mobilized to keep Mexican bandits from raiding our border, which the Mexican government is unable to attend to on its own account.

The mushy-minded of our fellow citizens are now beginning to talk of the pitifulness of things in Mexico and how we ought to go to the help of people there with Red Cross expeditions, etc. Well, we ought to go to their help to be sure, but it should be with a strong hand, for that is the only kind the Mexicans mind. It ought to be recognized, which the Washington Government has steadily failed to do, that anarchy and banditry have been the chronic state of things in Mexico ever since that country gained its independence, save for the period when Diaz established order and maintained it.

The restoration of order in Mexico will be effected only by such methods as Diaz used. There is no Mexican in sight who can do it. The United States sooner or later has got to do it. The present imbroglio will be cleared up, but intervention is merely delayed. It will not be long before some other clash will occur, and then perhaps another, but of course the patience of Uncle Sam is not endless.

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Sampling of Spelter

An interesting and entirely friendly controversy respecting the proper sampling of spelter recently arose between a well-known seller and an important brass manufacturer. The seller agreed to furnish two carloads of brass special spelter guaranteed to contain not more than 0.6% lead. The cars having arrived at the buyer's works, he drew 10 slabs from each and finding the assays to exceed slightly the stipulated lead content, called for an adjustment. The seller sent out the agent of a prominent firm of public assayers to draw a new sample of 30 slabs per car. The buyers refused in advance to abide by the result of this.

The issue was clear-cut. The seller claimed that he should be required only to deliver a carload of spelter whereof the average should conform to the guarantee, that in determining the average a large sample is more desirable than a small one and that the conditions of producing spelter do not permit the insurance of uniformity in slabs except in the case of high-grade spelter.

The seller, on the other hand, contended that the conditions of brass-making whereby the spelter is introduced into the melting pots in small lots necessitate uniformity, that its method of sampling during many years had been to draw only 10 slabs at random out of a carload and that no other system would be safe for it.

On none of these points have there been any officia rulings. The specifications of the American Society for Testing Materials require as to sampling only that at least 10 slabs shall be drawn. In the contract between buyer and seller in this case, and probably in most of such cases, there was no contractual understanding.

In the present instance the assays were made with the following results, those marked B being made by the buyer and those marked S by the public assayer acting in behalf of the seller:

Party	Car	No. Pieces	Lead, %	Iron, %
S	1	30	0.491	0.013
S	1	12	0.644	0.012
B	1	10	0.737	0.013
S	2	30	0.758	0.021
S	2	12	0.616	0.023
B	2	10	0.667	0.021

The interesting thing about these assays was that in the case of Car 1 the 30-slab sample showed lower lead than the 10-slab, while in the case of Car 2 it showed higher. The discrepancy between the 10-slab and the 12-slab samples is also noteworthy. Manifestly there was irregularity in the composition of the slabs.

As to the merits of the case there is a good deal to be said for each side. The brass maker needs uniformity of the product he is buying. On the other hand, the smelter can hardly insure it by his present methods unless he be distilling high-grade ore that is already uniform. In distilling ore containing lead, the proportion thereof that goes over with the zinc is governed primarily by the temperature of the retort, which varies in different parts of the furnace. In drawing the spelter, the kettle into which it is received holds but a relatively small quantity and the respective pourings from the same drawing may easily vary in composition, especially when lines are drawn so narrowly as they are as to lead content.

Apparently there are two things that need to be done: (1) Sellers in offering a guarantee should specify as to whether it pertains to average of a carload or to any 10 slabs selected at random. (2) If buyers must have uniformity, smelters must insure it by pouring and mixing their product in large pots or melting furnaces before casting the slabs to be marketed.

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The Situation of the Galvanizers

In previous articles on the zinc industry we have called attention to the paralysis that was produced in the domestic galvanizing industry by the extravagantly high price for spelter. Previous to the war the galvanizers were the largest consumers of spelter. Since the outbreak of the war the brass makers have displaced them from that position. Of course, the galvanizers have had some demand for their products for military purposes and to a certain extent could afford to continue buying spelter regardless of price, just as the brass makers did, but with increasing consideration on the part of the military buyers, less and less galvanized wire was bought for entanglements and more and more black wire has been purchased.

In the meanwhile the use of galvanized goods for domestic, peaceful purposes has been all but prohibited. One of the bad features of this is what we have previously remarked; namely, galvanization is by no means essential for many of the purposes for which supplied, substitutes are readily available and there was the danger that many consumers would be diverted permanently into using something else. In other words, zinc smelters in reaping ephemeral military profits courted the permanent loss of their trade.

A survey of the state of the galvanizing industry in Pittsburgh and the Ohio Valley that was recently made is interesting in this connection. Many concerns that previous to the war manufactured galvanized sheets have gone out of business entirely. Others are operating only a few pots. The present production of galvanized goods is estimated at only 30%—certainly not to exceed 40%—of what it was before the war. It is possible that at the present level of spelter price some concerns might resume production, but they are deterred by the fear of violent changes in the price. Some galvanizers express the opinion that their industry has received such a hard blow that even after spelter has returned to normal levels, a great deal of business will have been lost by the substitution of painted and black sheets, which will hold the field for many years to come. There is no doubt, however, that the difficulty of obtaining steel plays a part in the hesitancy of galvanizers to reënter the field, those who used to make sheets in their own plants now finding it more profitable to use the material in producing ingots and blooms.

The wire business has fallen off, and barbed wire seems to be the only product now inquired for. This wire for the past year, owing to high price of spelter, has been painted. The domestic demand has been very small, and it has been pointed out that farmers have neglected to repair their fencing, etc., on account of the high price of fence material.

While the pipe business in general has not suffered, the demand for galvanized pipe is receding, black being substituted. All the galvanizers have remarked that they are afraid a large part of their business has gone for good and that it will take them years to recover the lost ground. Various attempts have been made to use a terne mixture for pipe covering, but apparently without much success.

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Adit-Driving Methods

Two radically different methods of long adit driving, one in British Columbia and one in Alaska, were given in the *Journal* of June 3, one under "Details of Practical Mining" and the other under "Cost of Doing Things." One adit was 6,500 ft. long, with a cross-section 7x9 ft. The other was 3,671 ft. long, with a cross-section 7½x8 ft. in the clear. These two adits were driven by radically different mining methods. The first, driven originally with a 7x9-ft. cross-section, had later to be "straightened and widened to a minimum of 8 ft." In many places the roof was low and this had later to be taken down. Cutting the drainage ditch along the side of the tunnel was postponed until the tunnel was completed.

Widening a tunnel after it has been driven may be a justifiable necessity, but having to straighten it and take down low places in the roof shows either poor mining or that efficient mining was sacrificed for speed. The aligning, straightening and digging ditch in this tunnel required eight months' time and several thousand dollars, which ought to have been eliminated by more careful work in the original driving of the tunnel, unless there was some exigency not mentioned in our source of information. Even a good miner will occasionally have a hole that does not break well and will have left a low spot in the roof or a rib of rock along the side of his drift, which necessitates swinging his machine around at the next set-up and drilling a pop to shoot out the rib. If this happens once, it is apt to be forcibly commented on by the foreman. If it happens often, the machine man gets fired.

In an adit of this size, 7x9 ft., there is ample room for the setting up of the machines to get a satisfactory placing of the holes of the round to break to good advantage, and there would seem to be little excuse, other than the exigency of speed requirement, for driving such a ragged tunnel as to require eight months' labor at a cost of about $5,000 for straightening and trimming up.

As to whether the cutting of the drainage ditch should be done during the driving or left until the driving is completed may depend on local circumstances, but the method pursued in the British Columbia adit of drilling the right-hand lifter low and deep for the purpose of cutting the ditch is the accepted custom in good mining and takes the minimum, if any more, of extra labor and powder.

Good tunnel men of course are scarce, but a tunnel of these proportions costs so much money, the British Columbia 3,671 ft. long having cost $16.66 per ft., which is very low, that it is not to be undertaken lightly or without the most careful planning. Otherwise there will result delay in driving, higher cost per foot and a disagreeable and costly period at the end, slicking up a job that should have been done better in the first place.

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The Proposed Tax on Metals

Congress, in projecting a new revenue measure, proposes to put a tax on munitions of war, supposedly on the theory that their manufacture is highly profitable and therefore capable of being taxed roundly. On the same theory any highly profitable branch of manufacture might be singled out for special taxation. In the present case copper is included with munitions of war. It is a munition of war, but to a larger extent it is an article of domestic consumption for peaceful purposes. Boots and blankets are munitions of war in the same sense as copper. If the copper miner is to be taxed, why not the woolen manufacturer?

We need more money for some purposes, especially military preparedness. Let it be raised by taxation as it must be, but let the taxation be equal. Also the new taxation would not have to be so heavy if the public-building, river-and-harbor and other pork barrels could be eliminated.

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The fifth annual report of the Hollinger Gold Mines, Ltd., Ontario, for 1915, has on its front cover a short table showing the tons of ore milled, value of minerals recovered and dividends paid, for each of the last five years. This is a good idea, for it gives at first glance information for which ordinarily one has to hunt through a mass of figures.

BY THE WAY

Why Mining Engineers Go Insane—Our good friend E. B. Kirby has received a letter from "somewhere in Missouri" asking, "Can you locate gold and silver coins, or iron kettles about the size of a teakettle, if either is buried in the ground? If so, what is the least you would charge to come here and how soon could you come?

"P.S. I know of several farms around here where money was buried during the Civil War."

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We learn something new in finance every day. A recent advertisement states: "It is the intention of the management of the United Mines Co. to list this stock at an early date on the San Francisco Stock Exchange and other mining exchanges throughout the country, and give it a broad, active market, so that the stock can be bought or sold any day through any broker, but it will be listed at a figure much above the price at which this offer is made to you." Evidently the United idea is that one lists stock at any figure and market opinion of other people cuts no figure.

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Sum Buddie writes in to say that after reading an article on slimes, his brain was a maelstrom of colloids, ions, osculatory salt twins, etc., etc. Sallying forth with a 200-c.c. tube and a firm expression, he sampled the wash-mill overflow. Then, crystal-gazing into the murky depths with bated breath (the hero, not the mud), he perceived an erratic electroion-molecularcolloid detach itself and perform dizzy spirals up and town the tube . With visions of a Carnegie medal he grasped his trusty lens, called in his colleagues, and was deep in a learned dissertation on the elusive colloid when the colored office imp said, "Boss, dat am a skeeter wiggler."

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The following pneumatic incident is told in a recent number of the *Saturday Evening Post*: A country girl from the lower part of South Carolina—they call them Crackers down there—went to Savannah to pay her first visit to a dentist. The dentist found a jaw tooth badly in need of his services. He drilled away the decayed spots, and then, to clear the cavity of small particles, brought into use a small hand bulb. As the first gush through the blowpipe struck her mouth, the patient flinched.

"Can you feel that air?" inquired the dentist.

The young woman gazed up at him, puzzled.

"That air whut?" she inquired simply.

⁂

Certain aspects of the operations by bandits in northern Mexico in the past year are rather forcefully illustrated by a statement in the annual report of the Greene-Cananea Copper Co., just issued. During the year, says the president of the principal subsidiary company, there were "forced payments, requisitions of supplies, and actual robbery in excess of $200,000" on the part of the outlaws. Some of the company's employees were attacked or killed. In spite of this, the company believed at the time of writing the report that a firm government has been established in Sonora, and that operations at the plants would be uninterrupted. The plant has since been left to the tender mercies of said government and all American employees withdrawn.

June Mining Dividends

Dividends paid in June, 1916, by 50 United States mining companies making public returns amounted to $27,917,090, as compared with $10,590,656 paid by 38 companies in June, 1915. Industrial and holding companies allied to mining paid $17,487,378, as compared with $7,432,952 in 1915. Canadian and Mexican companies paid $1,264,667 in June, 1916, and $355,268 in June, 1915.

The totals for the first six months of the year 1916 are as follows: Mining companies, $84,654,924, as against $26,001,044 in 1915; metallurgical and holding companies, $54,529,165, as against $34,164,152 in 1915; Canadian and Mexican mines, $11,428,687, as against $4,535,622 in 1915. The accompanying table shows details of the month's payments.

United States Mining Companies	Situation	Per Share	Total
Amer. Zinc, Lead and Smelting, z.		$12 50*	$2,414,000
Argonaut Con., g.	Calif.	.10	20,000
Barnes-King Dev.	Mont.	.075	30,000
Fig Four Explor	Utah	05	20,000
Bunker Hill & Sullivan, l.s.	Ida.	.50	163,500
Bunker Hill Con., g.	Calif.	.025	5,000
Butte & Superior, z.	Mont.	10 75	2,931,500
Caledonia, l s.c.	Ida.	03	78,150
Calumet & Arizona, c.	Ariz.	2 00	1,283,204
Calumet & Hecla, c.	Mich.	15.00	1,500,000
Cardiff, l.z.	Utah	.25	125,000
Champion, c.	Mich.	6.40	640,000
Chino, c.	N. M.	2.25	1,957,455
Con. Interstate-Callahan, l.z.	Ida.	1.50	697,485
Copper Range, c.	Mich.	2 50	985,002
Federal Min. and Sm., pld.	Ida.	1 00	120,000
Gemini, l g.s.	Utah	5.00	25,000
Golden Cycle, g.	Colo.	.02	30,000
Grand Gulch, c.	Nev.	.03	7,195
Hecla, l.s.	Ida.	.15	150,000
Hercules, l.s.	Ida.	.30	300,000
Homestake, g.	S. D.	.65	163,254
Horn Silver, l.s.z.	Utah	.05	20,000
Joplin Ore and Spelter, l.z.		.0575	23,000
Jumbo Ex., g.	Nev.	.05	77,500
Kenefick Zinc, z.	Mo.	.10	20,000
Kennecott, c.	Alaska	1.50	4,170,874
Magma, c.	Ariz.	.50	120,000
Mammoth. s.g.	Utah	.05	20,000
National Zinc and Lead, l.z.	Mo.	.05	25,000
Nevada Con., c.	Nev.	.75	1,499,593
New Idria, q.	Calif.	1.00	100,000
New Jersey Zinc, z.	N. J.	5.00	1,750,000
North Star, g.	Cal.	.30	75,000
Old Dominion. c.	Ariz.	3.00	486,000
Oroville Dredging.		.12	82,380
Quincy, c.	Mich.	4.00	440,000
Ray Con., c.	Ariz.	.50	777,483
Reorg. Booth, g.	Nev.	.05	50,000
St. Joseph Lead.	Mo.	.25	352,350
Socorro, g.	N. M.	.05	18,865
Success, z.	Ida.	.03	45,000
Tomboy, g.	Colo.	.24	75,330
United Globe, c.	Ariz.	18 00	414,000
United Verde, c.	Ariz.	1 50	450,000
Utah Con., c.	Utah	.75	225,000
Utah Copper, c.	Utah	3.00	4,873,470
Yak, s l.	Colo.	.07	70,000
Yellow Aster, g.	Calif.	.12	12,000
Yellow Pine, l.z.s.	Nev.	.15	150,000
Yukon Gold, g.	Alas.	.075	262,500

* Payable in new preferred stock, par value of which is $25.

Iron, Industrial and Holding Companies	Situation	Per Share	Total
American Smelting and Refining, com.		$1.50	751,620
American Smelting and Refining, pfd.		1.75	875,000
Crucible Steel.	U. S.	2.00	488,730
General Development.	U. S.	1.50	180,000
Great Northern Ore	U. S.	.50	750,000
International Nickel, com.	U. S.	2.00	3,346,768
National Lead, com.	U. S.	1.00	206,554
National Lead, pfd	U. S.	1.75	426,433
Old Dominion of Me.		3.00	880,059
Phelps, Dodge.	U. S.	6.00	2,700,000
St. Mary's Mineral Land.	Mich.	2.00	320,000
U. S. Steel, com.	U. S.	1.25	6,353,781
Yukon-Alaska Trust.		1.00	208,433

Canadian and Mexican Companies	Situation	Per Share	Total
Dome Mines, s.	Ont.	$0 50	200,000
Hedley. g	B. C.	.50	60,000
Hollinger, g.	Ont.	.20	120,000
Kerr Lake, s.	Ont.	.25	150,000
Lucky Tiger, g.	Mex.	.08	57,227
Rambler-Cariboo, c.	B. C.	.02	35,000
Right of Way, s.	Ont.	.05	84,275
Santa Gertrudis, g s.	Mex.	.24	364,500
Seneca Superior.	Ont.	.30	143,665
Standard Silver Lead.	B. C.	.025	50,000

The payment by the Yukon-Alaska Trust was its initial dividend. The dividend on Hollinger was on the old stock, and is the last that will be paid on it, the Hollinger merger having been completed.

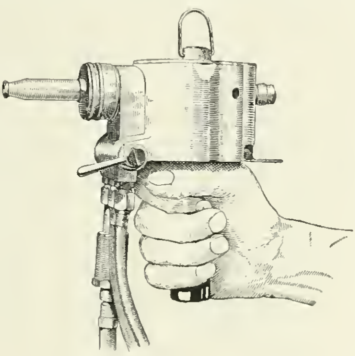
A Metal-Spraying Process

The Schop process for spraying minute plastic particles of metal upon any prepared surface is being exploited by the Metals Coating Co., of America, Boston, Mass., by means of a unique device.

The spray particles enter into the pores of the substance without oxidation and form an impervious coating. Any metal or alloy may be used, and the spray causes no injury to the surface on which it is placed. It has been employed successfully for coating on metal, wood, paper, stone, clay, cement, cotton and silk fabrics, and glass.

It is applied by means of a spraying pistol that weighs only 3½ lb. and operates in the following manner:

Cold wire is pulled from a reel into one side of a cylindrical case, continuously and uniformly, at the rate of about 12 ft. a minute, while at the mouth of the short nozzle at the opposite side there issues a continuous hot blast that carries entrained in it, with a velocity of about 3,000 ft. a second, a very fine spay of molten metal. The mechanism within the case consists of an air-driven feeding and wire-straightening device that leads the metal into the nozzle core. The wire remains cold and unaltered until within $\frac{1}{32}$ in. of the nozzle tip, at which point it undergoes the transformation into spray.



GUN FOR METAL SPRAYING

The nozzle is directed at right angles to the surface to be covered and 5 to 6 in. distant from it. The temperature of the molten metal spray varies according to the melting point of the wire used, yet at the trivial distance of 6 in. none of the materials that have been mentioned are injured or altered in the act of being metallized. Matches held in the zinc spray are immediately coated over without ignition, and the thinnest paper and wood receive the impacting particles into their pores without charring.

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British Iron and Steel in 1915

The statistics of the British iron and steel trade for 1915 have been collected for the first time by the new Statistical Bureau of the Iron, Steel and Allied Trades Federation, which took over the work last year for the purpose of securing prompter and more systematic returns than have hitherto been made. New classifications have been introduced, and the figures are presented in satisfactory form.

The production of pig iron, which was given in the *Journal* of May 6 in detail, was 8,793,659 gross tons in 1915, against 9,005,898 tons in 1914, and 10,481,917 tons in 1913, the last normal year.

The quantity sold or exported in semi-finished form in 1915 was as follows in gross tons:

	Bessemer	Open Hearth	Total
Blooms, billets and slabs.	324,942	618,603	943,545
Sheet and tinplate bars.... ...	163,264	1,356,313	1,519,577
Total......	488,206	1,974,916	2,463,122

The total finished rolled and other manufactured steel reported as made in 1915 was 6,325,844 gross tons. The larger items were 1,367,577 tons sheets; 1,160,327 tons plates, over ⅛ in.; 762,717 tons angles and shapes; 534,503 tons merchant steel; 446,502 tons rails. Included in sheets were 603,386 tons tin and terne plates and 353,593 tons galvanized sheets. This report being made under a new classification, comparisons with previous years cannot be made.

The production of steel ingots in 1915 was as follows, in gross tons:

	Acid		Basic		Total	
	Tons	%	Tons	%	Tons	%
Bessemer or converter...	821,408	9.8	479,816	5 8	1,301,224	15 6
Open hearth... .	4,090,752	49.0	2,958,968	35.4	7,049,720	84 4
Total..	4,912,160	58 8	3,438,784	41.2	8,350,944	100 0.
Total, 1914.... ...	4,477,920	57.2	3,357,193	42 8	7,825,113	100 0
Total, 1913........ .	4,860,154	63.4	2,803,722	36 6	7,663,876	100.0

As was to be expected from the nature of the demand, in 1915 the production of steel increased by 515,831 tons over 1914, being the largest make ever reported in Great Britain. At the same time the quantity of wrought iron showed a decrease. The gain was chiefly in openhearth steel

The output of puddled bars for the year is reported at 942,906 gross tons. The production of finished forms of wrought or puddled iron was 1,015,911 tons. The leading items were 549,293 tons bars and rods; 120,777 tons angles and shapes; 135,992 tons hoops and strips; 110.159 tons pipes and tubes.

NEW PATENTS

United States patent specifications listed below may be obtained from "The Engineering and Mining Journal" at 25c. each. British patents are supplied at 40c. each.

CLAD METALS—Process of Making Clad Metals. Byron E. Eldred, New York, N. Y., assignor, by mesne assignments, to General Electric Co. (U. S. No. 1,189,194; July 27, 1916.)

CONCENTRATING TABLE. Howard A. McClelland, Allensworth, Calif., assignor of three-fourths to H. H. Tucker, Los Angeles, Calif. (U. S. No. 1,186,811; June 13, 1916.)

CRUSHER JAW-PLATE. Walter S. McKee, Chicago, Ill., and Frank E. Johnson, Salt Lake City, Utah, assignors to American Manganese Steel Co., Augusta, Me. (U. S. Nos. 187,159 to 1,187,163, inclusive; June 13, 1916.)

CRUSHING—Double-Acting Grinding Pan Mill and Amalgamator. Charles Davey Tregoning, Grass Valley, Calif. (U. S. No. 1,186,709; June 13, 1916.)

DRILL-HOLE SURVEYING—Instrument for Surveying Drill-Holes. Charles Broe Galvin, Cornwall-on-the-Hudson, N. Y. (U. S. No. 1,187,519; June 20, 1916.)

DRILL-SHARPENER, Die, Gager and Former. Charles L. Lawton, Hancock, Mich. (U. S. No. 1,186,806; June 13, 1916.)

ELECTROLYTIC APPARATUS. William E. Greenawalt, Denver, Colo. (U. S. Nos. 1,186,898; June 13, 1916; and 1,187,903; June 20, 1916.)

FLOTATION—Apparatus for Concentrating Ores. Gustaf Emil Ohrn, Lidingö, Stockholm, Sweden, assignor to Minerals Separation Ltd., London, Eng. (U. S. No. 1,187,772; June 20, 1916.)

HOISTING—Controlling Mechanism for Mine Hoisting Engines. Charles E. McDonald, Butte, Mont. (U. S. No. 1,188,292; June 20, 1916.)

LEAD SULPHATE—Method of Manufacturing Lead Sulphate. Bernard S. White, Joplin, Mo., assignor to Picher Lead Co., Joplin, Mo. (U. S. Nos. 1,187,949 and 1,187,950; June 20, 1916.)

MANGANESE—Process for the Recovery of Metals from Ores and the Like. Charles S. Vadner, Butte, Mont. (U. S. No. 1,188,705; June 27, 1916.)

OPEN-HEARTH FURNACE. Bradley P. Wheeler, Duluth, Minn., assignor of one-half to Thomas S. Blair, Jr., Chicago, Ill. (U. S. No. 1,188,867; July 27, 1916.)

TUBE-MILL LINER—Ribbed Tube-Mill Linor. Joseph S. Peterson and Walter Brown Rogers, Smuggler, Colo. (U. S. No. 1,188,203; June 20, 1916.)

PERSONALS

A. F. Bennett from Salmon, Idaho, is in New York.

E. B. Durham is now at Coram, Calif., at the Stowell Mine.

George W. Harris, lately in Mexico, is now at New Orleans.

W. M. Benham, lately at Douglas, Ariz., is now at Cobden, Ill.

Horace H. Crary has gone from Tooele, Utah, to Eugene, Ore.

Douglas Muir, lately at San Antonio, Tex., has gone to California.

E. T. Ledoum, recently in Chicago has gone to the Joplin district in Missouri.

W. F. Chase, lately in Chicago, is now with the Commercial Acid Co. in St. Louis.

Lyon Smith is now metallurgist with the Snyder Electric Furnace Co., Chicago.

Hsinag Tsai, recently at Columbia University, New York, is now at Hankow, China.

Edwin E. Chase and son have been in the Butte district in Montana, leaving there this week.

Dr. Milton Hersey, of Montreal, has gone to examine the new mineral regions in Manitoba.

Marion L. Thomas left New York July 5 on a five weeks' trip to examine mines in Venezuela.

Blanchard M. Snyder, late at Los Angeles, Calif., is now at Basin, Mont., with the Cornet mines.

C. E. Minor has gone from Carrizozo, N. M., to Bonanza, Colo., where he is at the Rawley mine.

Heath Steele has returned to New York from a professional engagement in Bonne Terre, Mo.

Alfred James, consulting engineer, has removed his offices to 28 Victoria St., Westminster, London.

Malcolm H. Carpenter lately in Chicago is now with the Shaffer Gold Mines Co. at Seneca, Calif.

Roscoe F. Allen, lately at Billings, Mont., is now with the Winnemucca Mountain Mining Co. in Nevada.

M. B. R. Gordon, formerly of Cobalt, Ont., has gone to Rice Lake, Man., to take charge of three claims the Boulder Mining Co. has taken up.

J. C. Gwillim, professor of mining engineering at Queen's University, Kingston, Ont., has been appointed an officer in the Canadian Engineers.

L. O. Kellogg sailed from New York, July 5, on his way to take up his work as superintendent for the South American Development Co. in Ecuador.

G. A. Scott, of the Coniagas Mines, Cobalt, Ont., is examining properties in the Schist Lake and Flin Flon camps, in The Pas mining region, Manitoba.

Geo. E. Farish, for the past month examining properties along the Mother Lode in Nevada County, California, is expected in New York about July 10.

H. P. Henderson left New York July 5 for the West, to be gone for six weeks. He will visit in turn Springfield, Mo., Jerome, Ariz., and Seward, Alaska.

Richards Harris, of Denver, Colo., who has spent two months in the Rice Lake and Long Lake camps, Manitoba, has returned to Denver to report to his principals.

John Seward has been examining a property in the South, and is now in Ontario investigating several mining properties. He will return to New York about the end of July.

J. E. Spurr, vice-president and consulting engineer of the Tonopah Copper Co. of Nevada, is superintending the proving of a sulphide orebody at Schist Lake, northern Manitoba.

Lieut. Carleton C. Green, mining journalist, of Haileybury, Ont., who was officially reported killed in action, and whose death was briefly noted in this column last week, is alive and has rejoined his regiment.

H. A. Nash, of the Alaska Gastineaux Co., **M. A. Neuman,** Tennessee Copper Co., and **Raymond Brooks,** Arizona Copper Co., recently passed through The Pas on the way to the northern Manitoba mining camps.

Carl J. Trauerman has resigned the position of mill superintendent of the August Mining Co., Landusky, Mont., and is inspecting the properties of the Beaver Creek Mines Co., of Zortman, Mont. After examining mines in the Kendall, Elliston and York districts, of Montana he will return to his headquarters at Butte.

Bernard MacDonald has moved his office from Los Angeles, Calif., to 715 Mills Bldg., El Paso, Tex., where he will continue his professional work. At present he is collaborating with the engineering staff of the Alvarado Mining and Milling Co. in designs for increasing the capacity of that company's mill at Parral, Chihuahua, from 400 to 600 tons per day. The machinery has been ordered and will be installed as soon as peace is established in Mexico.

Naosaburo Hanabusa, Hogakuhakushi, who has been since 1897 director of the General Statistical Bureau of the Imperial Cabinet of Japan, has resigned that position, and has been named honorary counselor of the bureau. In his administration of nearly 20 years Dr. Hanabusa has brought the bureau to a high degree of efficiency. He is succeeded as director by **Toratoro Ushizuka,** Hogakushi, for some time past secretary of the Imperial Cabinet.

OBITUARY

Joseph K. Dale died at Franklin, Penn., June 26, aged 84 years. Born in Clarion County, Penn., he had been a resident of western Pennsylvania all his life. He was one of the pioneer oil operators in that section and was extensively engaged in the business nearly all his active life.

SOCIETIES

American Society for Testing Materials—The officers elected at the annual meeting at Atlantic City, N. J., last week were: President, A. A. Stevenson, vice-president, Standard Steel Works, Philadelphia; vice-president, S. S. Voorhees, engineer-chemist, bureau of standards, Washington, D. C. Members of the executive committee: W. H. Bassett, American Brass Co., Waterbury, Conn.; John Brunner, Illinois Steel Co., Chicago; G. W. Thompson, National Lead Co., New York, and F. E. Turneaure, University of Wisconsin, Madison, Wis.

INDUSTRIAL NEWS

The Goldschmidt Thermit Co. has removed its general offices to the Equitable Building, 120 Broadway, New York.

The E. H. Moyle Engineering and Equipment Co., of Los Angeles, Calif., has moved into new and larger quarters at 508 East 9th St., Los Angeles.

The T. L. Smith Co. announces that its district manager, E. R. Marker, on July 1, moved to new quarters at 609 Wells St., Milwaukee, Wis., where he will take charge of the business of the company as Wisconsin representative. Mr. Marker will carry a stock of mixers on the floor and will also stock a complete line of contractors' supplies.

George T. Snyder, formerly chief engineer at the National works of the National Tube Co., McKeesport, Penn., has been transferred to a similar position at the Lorain works of the company at Lorain, Ohio. **A. L. Hoerr** has been appointed chief engineer at the National works to succeed Mr. Snyder. **F. W. Waterman,** formerly chief engineer at the Lorain works, has been appointed manager of the new tube mills now being built by the Gary Tube Co., at Gary.

The Jeffrey Manufacturing Co., of Columbus, Ohio, announces the reopening of the Northwestern branch office at Seattle, Wash., and the appointment of Percy E. Wright, consulting mechanical engineer, as district manager for Oregon, Washington, Alaska, British Columbia and Alberta. Mr. Wright, who has been in the Northwest since 1910, and whose connection with this company, dates back to 1902, has had a wide and varied experience and training in the handling of the Jeffrey line in the engineering, construction and sales departments, which will enable him to be of great assistance in solving elevating, conveying and transmission problems.

The Pittsburgh By-Product Coke Co., incorporated under the laws of Delaware with a capital stock of $10,000,000, will own and operate plants for the manufacture of coke and by-products. It will own, among others, all stock of the Seaboard By-Product Coke Co., now building a plant at Jersey City, N. J., and the Minnesota By-Product Coke Co., building a plant at St. Paul. H. B. Rust is president; W. F. Rust and C. J. Ramsburg, vice-presidents; S. T. Brown, treasurer. The directors are A. W. Mellon, R. B. Mellon, H. W. Croft, Hamilton Stewart, H. B. Rust, W. F. Rust and C. J. Ramsburg, all of Pittsburgh.

Editorial Correspondence

SAN FRANCISCO—June 28

An Important Orebody in Cerro Gordo Mine, in Inyo County, was recently opened on the 200 level. This strike is at a point about 500 ft. southeast of the shaft. The ore occurs as a replacement in limestone, is circular in form, 25 ft. in diameter, and where exposed shows an average zinc content of better than 36%. Considerable lead-silver ore also occurs near the zinc. The management considers this orebody the most important disclosed in the mine in recent years. About 40 years ago approximately $500,000 was taken from an orebody directly above the new find through what was known as the Buena Vista tunnel. The square-set system will be employed in extracting the ore and stoping is already in progress. A winze has also been started in the ore on the 200 level. The company is employing 70 men at present and is making regular shipments, the lead-silver ore going to Salt Lake. The ore is carried by bucket tramway 8 mi. to the shipping station at Keeler on Owens Lake, where it is loaded in cars of the narrow-gage railroad built by Ogden Mills several years ago for the handling of the soda products of the Inyo Development Co. In the early life of the Cerro Gordo mine, the silver ores and the lead product of the Cerro Gordo smeltery were transported across the lake by steamboat built for that purpose and hauled 700 mi. by mule teams to Los Angeles; thence transported by steamers to Selby; some of the lead-silver ore was shipped to Wales. This mine has been reopened several times, but until taken over by the Cerro Gordo Mines Co., under the direction of Louis D. Gordon, was not successfully operated.

The Accident-Insurance Rate in the mining classifications was the subject of a recent circular letter by C. W. Fellows, manager of the State Compensation Insurance Fund. Mr. Fellows states that the reduction in the standard rate for gold mines in California from 7.88% in 1914 to 5% in 1915 was entirely due to the efforts of the State Fund; that after the Uniform Rating Law and the amendments to the Workmen's Compensation Insurance and Safety Act. became effective, the Compensation Service Bureau attempted to secure the approval of a substantial increase in the rate over that finally adopted. But the Insurance Fund insisted that the $5 rate, appearing in the basic manual for California gold mines should not be changed but should be extended to cover other metal mines, the latter then being rated at 7.65%. The issuance of this circular letter was brought about by a charge recently made in a paid advertisement that the Insurance Fund was responsible for the increase in rate for gold mines from 5% to 5.75%. The fact is that it actually succeeded in reducing the rate for other (than gold) metal mines from 7.65% to 5.75% and recommended a rate of 5% for all mines; and the management is still urging the adoption of the 5% rate and the merit-rating system, and invites mine owners to coöperate in devising such system as will be acceptable to the State Insurance Commission. Mr. Fellows states that the Insurance Fund has never openly subscribed to the theory that compensation, being a tax upon employers, should be collected without paying a middleman's profit; and that it will not subscribe to such theory until it is demonstrated that insurance companies cannot or will not combine safety to workmen with fair rates for employers. The bitterness with which Mr. Fellows and the Insurance Fund were attacked in the advertisement referred to, appears to have been engendered by statements which were derogatory to some of the competitors of the Insurance Fund. The letter will be welcomed by mining employers who are desirous of knowing the facts and who care nothing about the quarrels that insurance companies may have with the state. The question at issue between the state and the competitors referred to is that of the necessary loading upon pure premium for catastrophe and for expense. Concluding the discussion the letter states that the state ratio of expense to premiums was less than one-half of that of any company; that it is distributing a dividend to California mine owners which averages over 15%, thus reducing the actual cost of 5% to more nearly 4%; that the State Fund is able to save for its policy holders a material part of that loading and in addition its profit on underwriting. The losses have been less than the legal reserve and it has therefore a substantial undivided profit which will be later returned.

Butte—June 28

Agreement in Labor Controversy was reached at an executive session, held June 24, by the arbitration committee, composed of three representatives of the Silver Bow Employers' Association and three representatives of the city's labor organizations. The differences regarding the prevailing wage scale that precipitated the recent strike of the Workingmen's and the Teamsters' Union, were finally settled satisfactorily to both sides. Under the new arrangements workingmen now get $3.75 a day and teamsters $4 a day. When copper drops below 15c., however, wages will drop to $3.50 and $3.75 respectively. The former scale for both organizations was $3.50 a day, so that the new arrangement means an advance all around; overtime will be paid for at 60c. an hour as against 50c. previous to the strike. The settlement is considered by all parties concerned as a step forward in that it established the principle of arbitration and points toward continued peace in the industrial life of the City of Butte.

Northeast Section of Butte District is now coming in for increased attention. The progress made in development work at the Butte & Great Falls and the announcement that the Butte & Bacorn will resume work in July, has brought this section of the district back into the limelight again. Moreover, recent exploration work in the North Butte properties has revealed the existence of valuable orebodies lying undeveloped to the north of present workings. Similar work northward in the Badger, the Black Rock, the Elm Orlu and others has materially added to the ore reserves of these mines and has given to many properties in that section added speculative value. Several new companies are now in progress of formation to develop claims in the northern section of the camp. At the Butte & Great Falls, the farthest north of the developing properties, drifting on the Genevieve has opened promising bodies of copper ore, which upon testing furnished concentrates running 11.5% copper and 4.4 oz. in silver per ton, with a gross value at present prices of over $60 per ton. The crosscut driven to intersect the Big Dewey vein is now estimated to be within 90 ft. of vein. Two other companies are beginning development just east of the Butte & Great Falls properties.

DENVER—June 28

El Paso Consolidated Gold Mining Co., formerly a flourishing concern but of late years leading an uncertain existence (partly through extravagant financing), has been recently emerging from its indebtedness and it is now reported as entirely unencumbered and ready to start a treasury reserve. This company has paid dividends to date amounting to $1,707,545, but the last disbursement was more than two years ago. Fifteen sets of lessees are working and the June production is estimated at about 2,000 tons that will average 1 oz. gold per ton. The company is doing some development in the lower levels.

The Drop in Tungsten Prices is not having much influence on the spirit with which prospecting and development continue in the Boulder field. New mills are being erected. The town of Nederland is planning the liveliest sort of a Fourth of July celebration with all the usual Western sports. About 200 lessees are reported to be working in the Primos properties. A considerable increase in tungsten sales has occurred and miners are adjusting themselves to the idea of producing their ores economically and thus netting good profits even on the reduced margin. The 60% concentrate or ore is now selling at $20 per unit with a 50c. drop for each 1% drop in tungstic-acid content.

SALT LAKE CITY—June 29

Final Figures of Gold and Silver Production of the United States during 1915 show Utah's output in these metals to have been 189,045 oz. gold, valued at $3,907,900; and 13,073,471 oz. of silver valued at $6,522,200.

Production of Utah Copper in June is expected to exceed 17,000,000 lb., the output being well above the previous record of 16,000,000 lb. An average of 34,000 tons daily has been handled; and on June 26, shipments to the Magna and Arthur mills amounted to 41,800 tons, the record output. It is understood that the capacity of the mills will be gradually increased until it reaches 50,000 tons daily. The check for the quarterly dividend of $1.50 a share and the special dividend of $1.50 a share—amounting to $4,873,470—recently sent out is probably the largest single check ever signed in Utah by the treasurer of a mining company.

The United States Fuel Co. is undertaking development that will double the output of its coal mines in Carbon County. Smelters in Salt Lake Valley and even the Pacific coast afford a market for the product. When wider markets have been established the production will be further increased.

Two Land Auctions—one of 1,600 acres in Wayne County, June 28 and one of 2,800 acres at St. George in Washington County, July 15—have been announced by the state land board. The minimum price has been fixed at $2.50 an acre, with 10% down, and 5% interest. The land is nonirrigated. Notice has been received by I. C. Thoreson, U. S. Surveyor General, as to changes in the Dixie national forest in the southern part of the state, which will throw some land open to settlement in the near future.

Assessed Valuation of Bingham & Garfield Ry. has been in controversy for some time between the company and the tax assessor. The matter has now been settled and the assessed valuation reduced from $5,482,772 to $4,000,000. The reduction was made by the commissioners of Salt Lake County, meeting as a board of equalization through the permission of the state board of equalization. It was contended by the company that the valuation was higher in proportion to the investment than that placed on railroads in the state assessed by the state board of equalization. It was also urged that the earnings of the railroad could not be made the basis of valuation, as these are entirely dependent upon the hauling contract with the Utah Copper.

JOPLIN—July 1

Interstate Mine Operators Association was finally organized this week by operators in the Missouri, Kansas, Oklahoma and Arkansas lead-and-zinc districts. This organization will be given over entirely to the financial interests of the mine operators and there will be distinct limitations in regard to membership. No man having any interest in zinc-smelting companies or who might in any way be allied with smelting interests as opposed to the mining interests, will be eligible. It is expected, however, that the association will have about 300 members.

Employees Called to War will not lose by their patriotism so far as the Kenefick Zinc Corporation is concerned. Arthur Day, vice-president and general manager of the company, came to Joplin this week and announced that any of the company's employees at its five mines in this district, who have been called to join the militia, will have their positions held for them until their return, and if they have dependents will receive $50 a month from the company at least until Jan. 1, 1917, and that further arrangement in this regard will be made at that time.

New Milling Practice for the Joplin district is being initiated by the Eagle-Picher Lead Co., in its third concentrating plant at Picher, Okla. The crusher department, though housed in the same building, is entirely separate from the jig department and between the two is a 300-ton bin for the crushed material. The crusher equipment will have a capacity of 80 tons per hour, but can readily be operated only at one-half that capacity if desired. In the jig department, middlings from the two rougher jigs will go to a chat rougher, thence to the cleaner jig. The sludge department, which is in a separate building, will include 22 tables, an Eccleston ball mill, the first to be brought into this district, to handle the middlings from the tables, and two Dorr thickeners. A surface railway with two 5-ton gasoline engines will be used to bring the ore from three field shafts, which are in addition to the two mill shafts. The plant will have a capacity of 600 tons per 10-hr. shift.

WALLACE, IDAHO—June 28

Bunker Hill & Sullivan Smeltery, near Kellogg, is beginning to assume more definite form. Extensive sidetrack facilities have been put in by the railroad company to expedite handling building material and the Bunker Hill company has also put in trackage leading to the elevated ground to be occupied by the smeltery. Forms for the foundation are now about completed and pouring concrete will begin probably the coming week A new townsite has been laid out and every lot in the original site has been sold. Additions to the new town which will be called Smelterville, are being platted.

The Interstate-Callahan now ranks third among the zinc producers of the United States. The manager of that company recently stated that the property would continue to earn good dividends with spelter at 5 or 6c., should this low figure be reached. The present milling capacity is 400 tons per day and there are difficulties which prevent the best results from milling operations. It is understood that these will be overcome before late fall by the construction of a new mill with at least double the capacity of the present one and which will include a large and improved flotation plant. The company has acquired a desirable millsite at Enaville, which will involve a new outlet to the mine on Beaver Creek through a tunnel that will give at least 1,000 ft. depth below the present working tunnel. A shaft is now being sunk from the main level which will connect with the Beaver Creek tunnel. The ore reserves accessible by this new development and a modern mill of large capacity will insure great economy in mining and milling and will enable the Interstate-Callahan to successfully meet any condition of the spelter market. It should be recalled that the Interstate-Callahan produces considerable lead and silver also.

Decline in Price of Spelter may seriously affect the profits of certain Coeur d'Alene companies but it should be remembered that the district as a whole is still a lead-producing camp. With the exception of a few development companies which make irregular shipments, there are only two mines here in which zinc is the major product: Namely, the Interstate-Callahan and the Success. The zinc production of several large lead mines, notably the Morning, Green Hill-Cleveland and Hercules, while a factor of much importance, has not reached a point where the low price of spelter would be an obstacle to profitable operation. That is to say, at these properties zinc is a byproduct with lead and silver as the metals depended upon for profits. Of course these profits have been greatly swelled by the war price of spelter, but these mines were paying good dividends before zinc became a factor and are in position to continue doing so when the price of spelter returns to normal. The most serious result of a permanent decline in the price of spelter would be in discouraging development of new zinc producers.

DULUTH, MINN.—June 30

Crib No. 1 for the new ore dock at Ashland, Wis., is completed and pile driving has been under way for some time. It is estimated that 7,500 piles, 2,000,000 ft. of timber and 750 tons of steel will be required for the two cribs only.

Strike Agitators have been busy in Duluth, endeavoring to get the dock workers to leave their places, to assist the cause of the striking miners, but without avail. The dock workers are receiving higher wages than they ever have in the past and seem perfectly satisfied. The mine strikers are poorly organized and are becoming discouraged. The strike benefits that were promised by the I. W. W. have not been forthcoming. It is not believed the men can be hoodwinked much longer. Many who left work a few weeks ago are returning to the mines, and most of the pits are in operation. All the underground properties, with the exception of a few on the western Mesabi are still idle, but it would not be surprising if some of them would resume next week. Public opinion is now strongly against the I. W. W. because of strikers attacking a man going to work near one of the Oliver properties, taking his dinner pail away from him and giving him a severe beating. Officers, who were close by, rescued the man, but not until a chief of police and one of his assistants had been cut several times with knives. This affair did a great deal to weaken the cause of the strikers. Some of the mining companies have placed boarding cars in their pits, where the men eat and sleep and are not molested. Armed guards patrol the pits and keep all strikers at a safe distance. A few shovels are idle, but shipments are being maintained, the ore coming from the pits and the stockpiles.

TORONTO—June 29

The Rice Lake Mining Area of Manitoba continues to attract numbers of prospectors, but the camp is making slow progress owing to want of transportation facilities. This is shortly to be remedied, as the provincial government will send an engineer to survey a road from the east side of Lake Winnipeg to a central point of the field.

To Facilitate Registering Mining Claims in Northern Manitoba, Hon. W. J. Roche, Canadian Minister of the Interior, is creating a new mining district with headquarters at The Pas It comprises an area of approximately 200,000 square miles extending from head of Lake Winnipeg to the Arctic seas, an from Hudson Bay to the Manitoba-Saskatchewan boundary

Excess Profits Tax is shortly to be a reality for Canadia mines. The Canadian Finance Department is sending ou notices to 15,000 corporations and firms liable to taxation o excess profits asking them to fill in forms showing the amoun of their bonds, paid-up capital, unimpaired reserve and profits The assessment will be made before Sept. 1 and payment o the tax must be made before November.

Serious Labor Troubles Are Anticipated in the Porcupin and Cobalt camps, notwithstanding recent increases in the pa of miners. Labor is scarce on account both of the number o enlistments and increased activity of mining operations an the men are becoming insistent in their demands for increase wages. The prospect of labor disturbances is said to be affecting the market price of some mining issues.

The Mining News

ALASKA

ALASKAN FREIGHT RATES are to be investigated by Interstate Commerce Commission on complaint of J. D. Wickersham and the Sampson Hardware Co. It is charged that the American Smelting and Refining Co. exercises undue control of the copper industry of the territory through ownership of Alaska Steamship and Kennecott Copper companies. The Commission is expected to establish joint rail and water rates to Alaska and within the territory.

ALASKA-MEXICAN (Treadwell)—In May, crushed 16,667 tons, yielding $17,055, or $1.02 per ton; operating expense, $24,346; operating loss, $7,291; construction, $3,541; miscellaneous income, $3,730.

ALASKA TREADWELL (Treadwell)—Crushed in May, both mills, 82,082 tons, yielding $133,953, or $1.65 per ton; operating expense, $96,420; operating profit, $37,532; construction expense, $17,254; net operating profit, $20,277; other income, $11,200.

ALASKA UNITED (Treadwell)—Crushed in May, Ready Bullion mill, 25,298 tons; 700-Ft. Claim mill, 19,040, yielding $56,740 and $25,122, or $2.26 and $1.33 per ton respectively. Operating expense, $31,549 and $39,093. Operating profit, Ready Bullion, $25,191; loss, 700-Ft. Claim, $13,970. Construction, $6,229 and $4,790 respectively.

ARIZONA

Cochise County

McCABE & DOREDOR (Bisbee)—Have installed 60-hp. boiler, compressor and several drills at silver-lead property in Montezuma Cañon.

HELEN'S DOME MINING CO. (Bowie)—Organized to develop Quillin group of 18 gold claims in Apache Pass section. J. H. Jaque, secretary.

BOWIE COPPER CO. (Bowie)—New company to work the Weber-Simmons copper property in Gold Gulch, 14 mi. southwest. P. S. Simmons, manager.

GREAT WESTERN (Courtland)—Leasers have opened good ore; mine recently visited by Courtland Young, president of company, which may operate.

SCHEELITE found in wide quartz vein at entrance of Miller Cañon, by Kelly brothers; James Prescott, representing Eastern investers, has made examination.

NEEDLES MINING AND SMELTING (Courtland)—Sinking Maid of Sunshine shaft of Leadville mine. Shafts 1 and 2 soon to be connected with tunnel; 50 men employed.

Gila County

GREATER MIAMI COPPER (Miami)—McGee & Sikes have been awarded contract for driving 150 ft. of new development tunnel. N. E. Milford, president.

Mohave County

OATMAN UNITED (Oatman)—Installing 40-hp. hoist.

PIONEER (Oatman)—Sacking high-grade ore from narrow stringer.

MIDNIGHT (Chloride)—Shaft down 300 ft. and station being cut. Drifting will be done at this level.

OATMAN CRESCENT (Oatman)—New compressor and drills installed; tunnel being advanced with two shifts.

TELLURIDE (Oatman)—Vein on 475-ft. level crosscut without disclosing commercial ore. Now crosscutting for second vein.

METALLIC ACCIDENT (Chloride)—Crosscut tunnel being driven to cut main vein at about 300-ft. level of this Mineral Park mine.

TOM REED (Oatman)—Starting to sink on Red Cloud claim, which endlines the United Eastern on the northwest. Vein opened at 300-ft. level of Grey Eagle claim.

Yavapai County

G. G. LEMMONS, of London, England, who is endeavoring to establish custom smeltery at Prescott, has optioned Cottonwood group on Groom Creek, Buster property in Bradshaw Mountains, and the Great Belcher on Bug Creek.

NEW STATE (Prescott)—Crosscut on 360-ft. level exposed 5-ft. high-grade gold-silver vein.

BLACK ROCK (Wickenburg)—A 26-ft. vein sulphide ore exposed on 400-ft. level; shaft being sunk to 800-ft. point.

C. D. ROGERS (Wickenburg)—First shipment to El Paso averaged $46 in silver, lead and copper; 16 claims in Pikes Peak district.

COMMERCIAL (Copper Basin)—Operations soon to be resumed; idle several months account Clarkdale smeltery refusing ore; Phelps-Dodge operation.

TIP TOP CONSOLIDATED (Tip Top)—An 8-in. high-grade tungsten vein struck on Tip Top claim; about one ton being broken daily; big shipment to be made in July.

GREEN MONSTER (Jerome)—Electric power will be furnished by Arizona Power Co.; 677-cu.ft. compressor will be installed, and shaft sunk to 1,000-ft. point.

SHEA COPPER (Jerome)—Will sink two-compartment shaft on four claims south of the Copper Chief. Churn drilling also to be begun about July 1. D. J. Shea, president.

UNITED VERDE EXTENSION (Jerome)—One carload daily going to Humboldt and six to Douglas. New 1,300-cu.ft. compressor in operation; 6-in. pipe line being installed in shaft.

BIG STICK (Congress Junction)—Sold to oil operators of Tulsa, Okla. Auto road will be built at once; large tonnage low-grade ore on dump and in mine; 20-stamp mill on property.

POCAHONTAS COPPER QUEEN (Mayer)—Operations being resumed; new shaft being sunk and old shaft being unwatered. Ore will be treated in Gray Eagle mill, 3 mi. from mine.

UNITED VERDE (Clarkdale)—To take care of new men added to mine and smeltery forces, over 70 tents have been erected. Tents supplied with electric lights, water, sanitary and garbage systems.

DUNDEE-ARIZONA COPPER CO. (Jerome)—Sinking shaft, now down 200 ft. on two patented claims, surrounded by United Verde Extension and Jerome Verde. J. H. Hubbard, superintendent; W. E. Defty, consulting engineer.

ZEIGER (Congress Junction)—Charles Zeiger is developing Bishop and Peterson gold groups, 12 mi. east in Weaver mining district. About 2,500 ft. of old workings, including shafts and Bishop and Main tunnels. Completing camp buildings.

LONE PINE VERDE COPPER CO. (Jerome)—New organization, $250,000, to develop 175 acres adjoining Copper Chief, Shea and Jerome-Portland. W. A. Jordan, president; A. C. Labrie, secretary. Several shallow shafts, winzes and 279-ft. tunnel. Tunnel will be driven to tap ore at bottom of winze.

CALIFORNIA

Amador County

PLYMOUTH CONSOLIDATED (Plymouth)—Treated in May, 11,780 tons; yield, including concentrates, £12,139; operating expenses, £6,117; development, £1,426.

OLD EUREKA (Sutter Creek)—Unwatering of this and adjoining Wildman-Mahoney-Lincoln group is progressing. Temporary hoist soon to be replaced with more powerful equipment and steel headframe.

Inyo County

SANTA ROSA (Bishop)—Lessees have opened rich gold ore in a vein, 4 ft. wide. West End Consolidated, of Tonopah, holds control.

Mono County

MASONIC DISTRICT renewing activity. Serita mine producing good tonnage of milling ore; improvements being made in mill; operated by Stall interests. Pittsburgh-Liberty also obtaining good ore.

Plumas County

JAMISON (Johnsville)—Mine now in regular operation, employing 40 to 45 men.

COPPER CLAIMS, north of Chilcoot, in Last Chance district, reported sold by Andrew Murdock; purchasers not announced. Leasers on the Murdock-Canonica recently shipped $4,000 worth of copper ore.

San Bernardino County

TRIAL SHIPMENT of 15 tons of manganese ore recently received at San Diego from Island of San Marcos, on west side of Gulf of California. Los Angeles men reported interested.

RED BIRD (Barstow)—Good ore reported opened for a distance of 200 ft. in this group at Goldstone.

COPPER WORLD (Nipton)—Under lease to Doctor Godsell and associates. Ore being hauled by caterpillar tractors to Cima, on Salt Lake route. Large dumps of this old producer can now be profitably shipped.

PACIFIC MINES CORPORATION (Ludlow)—This company, which took over copper-gold properties of Bagdad-Chase and Roosevelt companies, has begun shipipng ore to United Verde smeltery, at Clarkdale, Ariz. Good ore on bottom level. Frank W. Royer, manager.

Shasta County

MOLYBDENUM is being mined on Boulder Creek, 4 mi. west of Gibson. E. A. Wiltsee, of San Francisco, owner.

MAMMOTH COPPER (Kenneth)—Shipping zinc ore regularly to company's affiliated zinc smelteries in Kansas.

DELTA CONSOLIDATED (Bayles)—Voted recently to erect 50-ton mill and cyanide plant in Dog Creek district.

Sierra County

HERKIMER and BUNKER HILL (Downieville)—Gravel properties bonded to Gustav De Bretteville, of San Francisco.

MORNING GLORY (Alleghany)—Bonded to A. A. Codd, of Reno, Nev. Machinery to be installed and working force increased.

ROCK CREEK (Downieville)—On Alleghany-Downieville serpentine belt. High-grade free-milling ore developed; installing stamp mill. Dolan & Bell own and operate.

ALHAMBRA (Downieville)—A 700-ft. drift in payshoot of good width. Milling to begin on completion of surface improvements. Richardson, Rixey & Sporndli, owners and operators.

Siskiyou County

POLAR BEAR (Gazelle)—Recently shipped car of high-grade copper ore to Mammoth smeltery.

HIGH-GRADE CHROME ORE shipment of 35 tons, made from Gazelle by Frank Chastain and associates.

MINNEHAHA (Yreka)—This San Francisco company hydraulicking on Horse Creek with its new water supply from Collins Creek, 2 mi. distant.

Tuolumne County

PITTSBURGH-SILVER PEAK (Jamestown)—This company, which recently bonded the Bacigalupi gold claims, is sinking 300-ft. shaft.

Trinity County

MANGANESE CO. OF CALIFORNIA (Oakland)—Preparing to ship 50 tons daily of chrome ore from deposit near Wildwood.

COLORADO

Lake County

IMPORTANT DEVELOPMENT in Leadville district is being undertaken by George O. Argall, manager of Iron Silver Mining Co., and several Eastern mining operators, who plan to unwater and develop a rich section of the camp, embracing such properties as the R. A. M., Devlin, Pyrenees, Cyclops, Sawtooth, Keystone and Young America. Development work is to be carried on through the new Mikado shaft, also known as the Gallagher; this is a three-compartment shaft, 1,206 ft. deep, now flooded to the 800-ft. level. About $300,000 will be required for the undertaking, as a complete surface plant is needed, retimbering of shaft throughout, electrical pumping machinery, etc. Equipment ordered and new headframe now being erected at Mikado shaft. Draining this shaft will be large undertaking as extensive stopes exist in many of the old mines in this section. When Mikado shaft is unwatered, it is planned to sink shaft several hundred feet.

VALLEY MINING CO. (Leadville)—Rich silver and manganese ore encountered in workings from tunnel in Prospect Mountain. Tunnel had been driven 1,700 ft. without intercepting any promising orebodies and it was decided to sink an interior shaft on a small fissure cut by the tunnel; at depth of 250 ft., this has developed into an important oreshoot. Attracting much interest as Prospect Mountain is most extensive undeveloped area in Leadville district. Warren F. Page, manager.

Ouray County

MINERAL FARM (Ouray)—This old property, 1 mi. southwest of town, leased by C. R. Wilfley and H. C. Branch. It is understood that ore will be treated by flotation.

Teller County

MODOC (Victor)—At annual meeting in Pueblo decided to resume leasing certain blocks in the mine. Average grade of ore shipped during fiscal year was $34 per ton. Officers elected. A. A. Heiman, president; Anton Frankenberg, vice-president and superintendent; William Young, treasurer; Charles H. Hermsmeyer, secretary.

IDAHO

Bonnerville County

GILBERT & BULLARD (Bingham, Utah)—Have purchased from Idaho Improvement Co. lead-silver property near Antelope, about 32 mi. from Mackay. Will sink shaft.

Lemhi County

GILMORE DISTRICT is becoming more active. New power plant planned by operators interested in the Gilmore Transportation, Tunnel and Tramway Co., which has driven adit intersecting important properties at depth. Producing mines are the Pittsburgh-Idaho, Allie, Gilmore and Latest Out.

Shoshone County

STAR ANTIMONY (Kellogg)—Shipped fourth car of ore. Employing 10 men. G. T. Henwood in charge.

HECLA (Wallace)—Manager J. F. McCarthy states company hopes eventually to increase production 50%. Federal mill recently leased will soon be running one shift, treating 125 to 150 tons.

CONSTITUTION MINING AND MILLING (Kellogg)—Recent development has added materially to ore reserve; drifting on 200-ft. level. Zinc content exceeds lead. Site selected for 100-ton mill. Judge George Turner, of Spokane, president.

RAY-JEFFERSON (Wallace)—New mill will be completed by Aug. 1. Original capacity planned, 250 tons per day; after construction started decided to increase to 400 tons. Mill is at junction of Beaver and Carbon Creeks, 10 mi. from railroad. The Oregon-Washington Railroad and Navigation Co. will probably extend its Murray branch up Beaver Creek to the Ray-Jefferson this summer.

MICHIGAN

Copper

AHMEEK (Ahmeek)—Northern end of mine showing better grade ore than was anticipated in early openings. Two stamps [illegible].

COPPER RANGE CONSOLIDATED (Painesdale)—Production being handled at Baltic and Champion mills; regrinding plant working satisfactorily. No steps yet taken toward rebuilding Trimountain mill; steel work being cut up and sold at better prices than anticipated, as much of it is available for construction purposes.

Iron

EMPIRE [illegible]—[illegible] started, night shift to be added as soon as [illegible] can be hired.

BIRD (Cr[illegible])—Negotiations for lease in progress; offered 20c. a ton [illegible] at Cleveland for $3.25 a ton. Ore low-grade.

WAKEFIELD [illegible]—Heavy rains washed sand into pit. Shovels at [illegible] pit. Mine will ship about 1,000,000 tons th[illegible].

SPIES (Iron Ri[illegible])—[illegible] stopped; sinking again in progress; down about [illegible] to 650 ft. Decided not to get out any ore th[illegible].

AURORA (Ironwood)—New shaft started. Expect to complete first of next year. Pabst shaft will be started this month. Delay in receiving materials. The two new shafts will replace three old ones now being used.

MINNESOTA

Mesabi Range

NORTH UNO (Hibbing)—One shovel working in stockpile.

GRANT (Buhl)—Stripping finished for present. One shovel commencing to load ore.

LEONARD (Chisholm)—Hoisting ore through shaft and mining under north bank of pit; 300 men at work.

DEAN-ITASCA (Buhl)—Two shovels are stripping north side of pit. This work will continue throughout the summer.

LAMBERTON (Hibbing)—This mine of the Great Northern Iron Ore properties will begin shipping about July 1. Stripping began last December.

HARRISON (Nashwauk)—Big shovel at work. Shipping. Washing plant working one shift. Butler Bros., contractors, in receipt of three new 70-ton locomotives with 19x24-in. cylinders. Two will be used at Lamberton mine and one at the Harrison.

MISSOURI

Joplin District

MARCUM (Cardin)—Mill completed but bad air holding back operations. Good ore showing.

BINGO (Joplin)—Rebuilding and improving sludge plant totally destroyed by storm two weeks ago.

CULBERT (Joplin)—Moving mill to mine on Banker's land from Shapp land at Tuckahoe. Will mine ore at only 60 ft.

LINCOLN (Prosperity)—Sands from settling tank at Seneca plant will be flumed 325 ft. to settling tank at Mary C mill.

WHAT-CHEER (Duenweg)—Has taken additional 20-acre tract on west. Will reopen old shaft and prospect with drills.

COAHUILA (Duenweg)—Place of C. A. Smith, manager, major in Missouri National Guard, taken by R. C. Bean, until recently manager of company's rubber operations in Mexico.

ADMIRALTY (Cardin)—Second mill started. Two Texas pumps in shaft at third mill unable to lower water rapidly. Unexpected orebody found in shaft at No. 2 mill. Company making three cars concentrates weekly.

BUCHANAN & HOFFMAN (Baxter)—Will erect mill as result of drilling campaign on Toskoff land, just north Kansas-Oklahoma line. Ten holes show rich orebody from 252 to 277 ft. Compressor and pumps already ordered.

MONTANA

Beaverhead County

BOSTON & MONTANA DEVELOPMENT CO. (35 Congress St., Boston, Mass.)—Three shifts working at Spain mine in French Gulch; ore to be hauled by motor truck to Anaconda. At Elkhorn property, shaft will be sunk on Park vein to meet crosscut from tunnel. W. R. Allen, president.

Jefferson County

EAGLES NEST (Alhambra)—A 5,000-ft. tunnel started to cut at depth copper-zinc-silver-gold veins in this group of 32 claims in Warm Springs district.

BOSTON & CORBIN (Corbin)—Mined and milled 3,228 tons of ore in May, with an average recovery of 70 lb. of copper per ton. Directors ordered immediate construction of flotation unit, which is expected to save about $3,000 per month.

Lewis and Clark County

JILSON (Wolf Creek)—Homestake Mining Co. has bonded this group of five claims on Little Sheep Creek, 3 mi. from station, and will sink to water level. New hoist and compressor will be installed.

PEERLESS JENNIE (Rimini)—C. S. Carpenter and D. A. Levy, of Chicago, have leased this old copper-silver-lead producer and will begin operations in July. Mine closed since 1887. Plan to sink new shaft.

Lincoln County

BANNER & BANGLE (Troy)—Improvements costing $500,000 being made by Snowstorm Mines Co. Employing 275 men on railroad to connect with the Great Northern at Troy, hydro-electric power station, and concentrator. Expect to be ready for operation by September.

Silver Bow County

BUTTE & LONDON (Butte)—Two stations on 1,600 level completed and crosscutting will begin with three shifts.

NORTH BUTTE (Butte)—On night of June 24, James Mathews, a motorman, on 3,000 level of company's Speculator mine, was killed; fell from motor and was dragged 35 ft.

BUTTE-COLUMBIA COPPER MINING CO. (Butte)—Butte owners of 35 claims, 5 mi. southeast of Butte, will sink shaft deep enough to establish permanency of copper ore revealed by numerous openings along surface. Tunnel already in 700 ft. will be continued to intercept vein system. Short aërial tramway will be installed to connect mine with N. P. Ry.

DAVIS-DALY (Butte)—Production increased to over 100 tons of ore per day from 1,400, 1,500 and 2,500 levels, that from upper levels averaging 2.5% copper, that from 2,500 level between 5 and 6% copper. On 2,500 level northwest drift from southwest crosscut is in ore for over 400 ft. Manager Creden states that output can be doubled as soon as new hoist is completed in September.

ANACONDA (Butte)—Fire, started by defective electric wiring, destroyed fanhouse at top of downcast air-shaft of company's Tramway mine on night of June 26 and got into first two sets of the shaft timbering. The company's and the Meaderville fire department appeared on scene and soon extinguished the fire. Fearing that fire might mark repetition of the Pennsylvania disaster, all men underground were hoisted to surface in record time and without mishap of any kind. On June 23 Sam Parnell, a miner, was instantly killed on first floor of 2,400 level of company's Belmont mine by a fall of ground.

NEVADA

Esmeralda County

REORGANIZED CRACKER JACK (Goldfield)—Surface equipment completed and shaft repaired to 115-ft. level where south drift is being extended to get under oreshoot indicated in the surface trenches.

HORN SILVER (Hornsilver)—Heavier hoist and compressor being added preparatory to sinking present 540-ft. shaft to 750-ft. level. May consolidate with Silver King. Both properties have shipped.

ATLANTA MINES CO. (Goldfield)—Developments on 1,580-ft. and 1,750-ft. levels said to show considerable low-grade gold-copper ore. On 1,750-ft. level crosscut started west in footwall of main ledge to pick up extension of oreshoot encountered on 1,580-ft. level, Grizzley Bear claim.

Humboldt County

SEVEN TROUGHS COALITION (Seven Troughs)—Bird winze at depth of 1,660 ft. has encountered oreshoot from 1,600 north drift, exposing 18 in. of high-grade ore. Vein apparently straightening.

NEVADA PACKARD (Lovelock)—Mill now running on ore from Knowles-Hampton block. Crosscut from one of three working tunnels disclosed 25 ft. of milling ore, about 185 ft. from surface on dip of 45° vein. J. W. Wilkey appointed superintendent, vice K. Freitag, resigned.

Lander County

COPPER BASIN (Battle Mountain)—Shipments being made to Garfield smeltery by Frank Paul, of Berkeley, Calif., who has six months' option on this Glasgow & Western property.

COPPER CANON (Battle Mountain)—This Glasgow & Western property, 20 mi. from Battle Mountain, leased to L. E. Whicher and associates of New York. Being unwatered. About 200 tons old dump ore being shipped weekly to Garfield, Utah. William Campbell, superintendent.

Lyon County

WEIDLEIN LEACHING PLANT, in leased section of Mason Valley Mines Co.'s idle smelting works at Thompson, has been operating for two months on 10-ton scale and has lately been increased to 20-ton basis. Carbonate copper ores or sweet-roasted sulphides are leached with sulphuric acid—coarse ore in tanks, and fines in six-deck Derr classifier by counter-current flow of solution. Before precipitation, solution is neutralized with lime and treated with sulphur dioxide until it has dissolved a percentage of gas equal to that of the contained copper in solution. Precipitation of copper ensues when solution is heated to 160° C. under pressure of 100 lb.; in precipitation, sulphuric acid is regenerated in twice the amount originally present in combination with the copper. E. R. Weidlein, manager.

EMPIRE-NEVADA (Yerington)—Shipping several cars of copper ore monthly. J. E. Gelder, manager.

BLUEJAY (Yerington)—E. J. Schrader has leased this copper mine, 4 mi. east of town, and will explore with 200-ft. adit.

YERINGTON CONSOLIDATED (Mason)—Shipping 200 tons copper ore per month to Utah; 15 men employed; L. L. Turner, lessee.

MONTANA-YERINGTON (Yerington)—C. R. Archer and associates working 20 men and shipping about 1,000 tons monthly.

WEST END (Mason)—A. H. Barlow, leasing this property in Mason Pass district, ships about 200 tons of copper ore monthly to Weidlein leaching plant at Thompson.

NEVADA-DOUGLAS (Ludwig)—Employing about 200 men. Shipping 1,200 tons high-grade copper ore per month to Utah smelteries. Remodeled mill and leaching plant recently placed in operation; expected to treat 200 tons daily.

Nye County

TONOPAH ORE PRODUCTION for week ended June 24 was 9,075 tons, valued at $188,610, compared with 8,937 for week previous. Producers were: Tonopah Belmont, 2,978 tons; Tonopah Extension, 2,200; Tonopah Mining, 2,000; Jim Butler, 750; West End, 708; Rescue-Eula, 210; Halifax, 158; North Star, 43; miscellaneous leases, 28 tons.

TONOPAH EXTENSION (Tonopah)—New mill equipment now in operation increased daily capacity by about 50 tons. New cross 5-ft. vein encountered on 1,260-ft. level between Murray and North Merger veins. Repairing Victor shaft.

NEW MEXICO

Dona Ana County

ORGAN DISTRICT is active. Phelps, Dodge & Co. developing the Torpedo and Bennett-Stephenson mines, employing about 100 men. Black Prince mine again worked by owners, shipping high-grade ore to El Paso.

Socorro County

HYDRO-ELECTRIC POWER for Mogollon district may be provided by Earl C. Cleaveland and associates. Measurements on West Fork Creek have demonstrated availability of minimum of 1,000 to 1,500 hp. during dry seasons The mines lately have used crude oil, freighted about 90 mi. by wagon, as a source of power, at a cost of around $150 per horsepower-year. It is understood operators will contract for power at $100 per horsepower-year.

MOGOLLON MINES CO. (Mogollon)—New three-compartment shaft now 40 ft. below 700-ft. level; being sunk 2 ft. a day; is in commission for regular hoisting above 500-ft. level. Milling about 900 tons weekly. S. J. Kidder, manager.

SOCORRO MINING AND MILLING (Mogollon)—Constructing conveyor to dispose of tailings by elevating and fluming to comparatively flat area in region of mill and avoid discharging into creek, which caused trouble with ranchers in past years. Plant treats 230 tons daily.

OAKS CO (Almy)—In Eberle mine, encountered pay ore from north drift of raise in south tunnel. Shipping to custom mill. Orebody No. 1 in Clifton mine proved to the north by crosscut in footwall of adit tunnel.

OREGON

Lane County

CHAMPION CONSOLIDATED MINING CO. (Portland)—This company, organized by Olaus Jeldness, of Spokane, and Portland men, to operate the Champion, Helena and Music groups, near Bohemia. Flotation department and 20 stamps are to be added to 30-stamp mill and concentrator. C. V. Bobb, managing director; H. C. Mahon, secretary.

TEXAS

Pecos County

CALUMET & ARIZONA (Warren, Ariz.)—This copper company has been testing Fort Stockton sulphur field. Some petroleum also encountered. Other companies planning to drill.

UTAH

Beaver County

MONTREAL (Milford)—Alfred Frank, of Salt Lake City, has optioned this old Glasgow & Western copper property 5 mi. from Milford.

Juab County

TINTIC SHIPMENTS for week ended June 23 amounted to 187 cars, decline being due to reduction orders from smelters.

RIDGE & VALLEY (Eureka)—New ore opened. Drifting being done from 1,500 level of the Gemini.

UTAH MINERALS CONCENTRATING (Eureka)—Several cars of tungsten ore shipped from Nevada are being treated.

BULLION BECK (Eureka)—Two large new boilers being installed to replace four old ones of smaller type. Development of unprospected section of mine may be undertaken.

EAGLE & BLUE BELL (Eureka)—Ore has been opened on all levels from the 700 to the 1,700 and 100 ft. below it. Shaft to be sunk to the 1,850. During past seven years—in which time mine has been developed from prospect—$446,573 has been paid in dividends. Now earning $360,000 yearly.

Salt Lake County

ALBION (Alta)—Second-class ore from old workings to be treated in jigging plant. Conditions on lower levels improving.

SILVER SHIELD (Bingham)—Development of new strikes has proved disappointing, although there is still some ore showing.

SOUTH HECLA (Alta)—Fifty tons daily being shipped from Wedge workings. So far little development done on new strike made at depth.

BINGHAM MINES (Bingham)—Dalton & Lark mine is producing over 100 tons daily, part of the output being lead-silver and part copper-iron sulphide ore. Conditions at the Yosemite promising.

UTAH CONSOLIDATED (Bingham)—Received an average of 18.61c. per lb. for copper in 1915. Average value of lead ore at smeltery was $12.61 per ton, profit $8.46. At end of year, new lead orebody in Highland Boy limestone west of 13½ fault was being developed. Grade much higher than that shipped during year.

UTAH APEX (Bingham)—Producing about 4,000,000 lb. of lead monthly. May earnings about $150,000 as compared to $152,000, decline being due to drop in the price of lead. Cash on hand, after payment of dividend, will be over $500,000. Sales of shares through London have gradually reduced foreign holdings from 135,000 to 80,000.

WASHINGTON

Ferry County

WALLA WALLA COPPER MINING CO. (Keller)—Compressor and drills being added to expedite development. Electro-chemical treatment plant to be erected when reserves warrant. William E. Malm, consulting engineer; William E. Johnson, mine superintendent.

Stevens County

ELECTRIC POINT (Northport)—Another strike reported in this mine, in drifts south from 210-ft. level; 18 ft. of high-grade lead ore carrying up to 20 oz. Ag. Hauling ore to Boundary, B. C., for shipment to Trail. About 1,000 tons on dump. Roy A. Young, president.

CANADA

British Columbia

NEPTUNE AND UNDERHILL (Sheep Creek)—These silver-lead-zinc claims bonded by W. R. Salisbury, of Salmo.

EMERALD (Sheep Creek)—This group of 20 lead-silver claims on Iron Mountain bonded to H. T. Irvine and associates of Spokane, Wash.

DOLLY VARDEN MINES CO. (Alice Arm)—Work on new 400-ton mill nearing completion; expect to start late in July. R. B. McGinnis, manager.

DEER PARK (Rossland)—In this Consolidated Mining and Smelting Co. property in south belt, 10-ft. orebody high in gold has been opened. Other development with diamond drills is planned.

Ontario

HOLDING (West Shining Tree)—Shaft being put down from which rich samples of gold ore have been taken. D. Rothschild, of Sudbury, holds option

NEWRAY (Porcupine)—Management has called for bids for 30,000 ft. of diamond drilling. No. 1 vein, which produced $200,000 before it faulted, will be the first sought.

SUDBURY NICKEL REFINERIES, LTD. (53 Queen St., Ottawa)—Has acquired nickel properties in Sudbury district. Plan to treat ore by Burrows' method. A. W. Fraser, secretary.

CROWN RESERVE (Cobalt)—In drifting on vein found on 700-ft. level, another 6-in. vein was encountered running across it. Veins of good milling grade with patches of high grade.

The Market Report

Metal Markets

NEW YORK—July 5

Last week was another one of dullness. The most noteworthy feature was the sharp decline in spelter, the market for which exhibited signs of demoralization.

Copper, Tin, Lead and Zinc

Copper—Our summary for last week might be repeated with accuracy, save that there was a further yielding of prices on the offerings of agencies and trading houses that seem to be becoming more and more anxious to make sales. That tendency reflects the cheaper offerings of producers of crude copper whose output is not under contract.

The new Federal revenue bill as prepared by the Committee on Ways and Means and introduced this week in the House of Representatives, contains the following provisions: " . . . . . . Every person smelting copper ore, refining metallic copper, or alloying copper, shall pay for each taxable year an excise tax equivalent to the following percentages of the gross;

"Receipts during such year from the sale or disposition of refined copper or copper alloys and from the sale or disposition of crude or unrefined copper, if sold or disposed of for any purpose except for refining or alloying:

"One per centum of the amount by which such receipts exceed $25,000 and do not exceed $1,000,000.

"Two per centum of the amount by which such receipts exceed $1,000,000 and do not exceed $10,000,000, and

"Three per centum of the amount by which such receipts exceed $10,000,000."

Copper Exports from Atlantic ports in June are estimated at 35,900 gross tons.

Exports from Baltimore for the week included 6,202,272 lb. copper and 933,458 lb. brass to Havre, France.

Copper Sheets are unchanged at 37.5c. for hot rolled and 38.5c. for cold rolled. Copper wire is 31@32c. per lb. for large lots at mill.

Tin—This market continued to sag off in sympathy with the other metals. Transactions were small in volume.

Arrivals of tin at Pacific ports in June are reported at 2,198 tons, indicating a considerable import of Chinese tin.

Lead—A good business was done on Thursday and Friday. The sales included some for export, especially through Pacific Coast ports, which business was taken at 7c., f.o.b. ship. The next three days were observed as holidays by nearly everybody and scarcely any business was done. Late on Wednesday afternoon the A. S. & R. Co. reduced its price to 6.50c., New York, with corresponding cuts in the scale for other places. The news came around through consuming quarters before the official announcement was made. Consequently, lead was available at the reduced price before the trade was generally apprised of the fact.

Spelter—On June 29 a rather large volume of business in spelter for prompt and early delivery was transacted, sales beginning at 10¾c., and running off sharply during the day. Consumers did not figure in this business and throughout the week were conspicuous by their absence. On the part of producers, both large and small, there developed real pressure to sell, and the market became demoralized. The quotations for the week reflect offerings rather than sales, for the reason that the level at which buyers would be interested was not found. Spelter for prompt and early delivery is in ample supply, stocks having accumulated in the hands of producers. Spelter for distant futures has been offered at prices much lower than we quote. Along with the decline in the New York market there was a similar slump in London. At the close the spelter market is in a weak, uncertain and demoralized condition.

Zinc Sheets are unchanged, the base price remaining at $18 per 100 lb., f o.b. Peru, Ill., less 8% discount.

Zinc Exports are reported lighter. Zinc oxide in April was 2,418,821 lb. exported.

Other Metals

NEW YORK—July 5

Aluminum—This metal is quieter and buyers have not been pressing in their demands. At the same time deliveries seem to be more freely made. The current price is 62@64c. for No. 1 ingots, New York.

Antimony—Business was extremely dull, with a weakish tendency. We quote 17@17½c. per lb. for spot. None of the important interests would quote on future shipments from China.

Quicksilver—Market dull. We quote $80 per flask, New York. San Francisco, by telegraph, reports $82.50, market strong. London is unchanged at £16 10s. per flask.

Nickel—The market continues steady with about the same amount of domestic business as usual and with some demand

DAILY PRICES OF METALS IN NEW YORK

June July	Sterling Exchange	Silver, Cts. per Oz.	Copper	Tin	Lead		Zinc
			Electrolytic, Cts. per Lb.	Spot, Cts. per Lb.	New York, Cts. per Lb.	St. Louis, Cts. per Lb.	St. Louis, Cts. per Lb.
29	4.7575	65⅞	25¼ @25¾	39½	6.80 @7.00	6.62½ @6.75	10.00 @10.75
30	4.7575	65	25¼ @25¾	39½	6.80 @7.00	6.62½ @6.75	10.00 @10.50
1	4.7575	65	24¾ @25¼	39¼	6.80 @7.00	6.62½ @6.75	9.50 @10.00
3	4.7575	65	24½ @25	39¼	6.80 @7.00	6.62½ @6.75	8.75 @9.25
4	.	. .			. .		. . .
5	4.7575	63⅞	24¼ @24¾	39	6.50	6.42½	8.50 @9.00

The quotations herein are our appraisal of the average markets for copper, lead, spelter and tin based on wholesale contracts for the ordinary deliveries of the trade as made by producers and agencies; and represent, to the best of our judgment, the prevailing values of the metals, reduced to basis of New York, cash, except where St. Louis is given as the basing point. St. Louis and New York are normally quoted 0.17c. apart.

The quotations for electrolytic copper are for cakes, ingots and wirebars. Electrolytic copper is commonly sold at prices including delivery to the consumers and is subject to discounts, etc. The price quoted for copper on "regular terms" (r.t.) is the gross price including freight to the buyer's works and is subject to a discount for cash. The difference between the price delivered and the New York cash equivalent is at present about 0.25c. on domestic business. The price of electrolytic cathodes is 0.05 to 0.10c. below that of electrolytic. Quotations for lead represent wholesale transactions in the open market for good ordinary brands. Quotations for spelter are for ordinary Prime Western brands. Only the St Louis price is herein quoted, St. Louis being the basing market. We quote the New York price at 17c. per 100 lb. above the St. Louis price.

Silver quotations are as reported by Handy & Harman and are in cents per troy ounce of silver bars 999 fine.

Some current freight rates on metals per 100 lb. are: St. Louis-New York 17c.; St. Louis-Chicago, 6.3c.; St. Louis-Pittsburgh, 13.1c.

LONDON

June-July	Silver	Copper				Tin		Lead		Zinc	
		Standard		Electrolytic							
		Spot	3 Mos.	£ per Ton	Cts. per Lb.	Spot	3 Mos.	£ per Ton	Cts. per Lb.	£ per Ton	Cts. per Lb.
29	31$\frac{1}{16}$	104	100	132	28.10	173½	174	29¼	6.23	63	13.41
30	31	103	100	132	28.10	173¾	174½	28¾	6.13	61	12.99
1	.	.....	.....	.....	.....						.
3	31	102	98	132	28.10	172½	173	28¼	6.01	51	10.86
4	30¾	98½	96½	132	28.10	170¼	171	26¾	5.70	48	10.22
5	30½	96½	94½	132	28.10	172¼	172½	28	5.96	46	9.79

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2,240 lb., except silver which is in pence per troy ounce of sterling silver, 0.925 fine. Copper quotations are for standard copper, spot and three months, and for electrolytic, price for the latter being subject to 3 per cent. discount. For convenience in comparison of London prices, in pounds sterling per 2,240 lb., with American prices in cents per pound the following approximate ratios are given, reckoning exchange at 4.80. £15 = 3.21c.; £20 = 4.29c.; £30 = 6.43c.; £40 = 8.57c.; £60 = 12.85c. Variations, £1 = 0.21⅜c.

for export. Quotations are 45@50c. per lb. for ordinary forms, according to size and terms of order. Electrolytic nickel brings 5c. per lb. premium.

Minor Metals—Current quotations for **Bismuth** are $3.15@3.30 per lb., New York—**Cadmium** is quoted at $1.30@1.50 per lb.—**Cerium**, electrolytic, is sold at $8@9 per lb.—**Cobalt Metal** is quoted at $1.25 per lb.—**Magnesium** is still high, being quoted at $5.50 per lb. for 99% pure.—**Selenium** is from $3 up to $5 per lb., according to size of order.

The Scotch Shale Oil industry had a fairly prosperous year, notwithstanding competition. All the companies but one were able to pay dividends in the fiscal year 1915-16. Their reports show that about 3,000,000 tons of shale are annually dealt with, yielding nearly 25,000,000 gallons of burning oil, over 5,000,000 gallons of naphtha, 24,000,000 gallons of lubricating and gas-making oils, 30,000 tons of solid paraffin, and 60,000 tons of sulphate of ammonia. The mines and works afford employment to about 10,000 men. The gross receipts were increased by higher prices, especially for byproducts; but the expenses also increased owing to higher prices for supplies and higher wages.

IMPORTS

Imports of the Principal Metals, other than iron and steel, in Great Britain, five months ended May 31, in long tons:

	1915	1916	Changes
Copper	95,187	58,704 D.	36,483
Tin	21,332	15,172 D.	6,160
Lead	112,167	76,378 D.	35,789
Zinc	44,149	16,665 D.	29,484

Gold, Silver and Platinum

NEW YORK—July 5

Gold continues to come in at New York, although the amount reported this week has been less than for several weeks past. The amount has been so large lately that a considerable quantity has been sent to the Philadelphia Mint for storage.

A consular report says that at the close of May the gold holdings of Japan amounted to 540,000,000 yen ($269,190,000), of which 170,000,000 yen ($84,745,000 was held at home, 90,000,000 yen ($44,865,000) in the United States, and 28,000,000 yen ($13,958,000) in Europe.

Platinum continues dull. The jewelry trade is taking none at present, and in other lines buyers are taking only what they are obliged to. Supplies do not improve. April imports were only 2,544 oz. Quotations are $74@77 per oz. for refined platinum. Hard metal is $4@6 per oz. higher, according to quality.

The French Mint during the year 1915 produced for French circulation 13,963,409 silver pieces of 2 fr., 47,955,158 1-fr. pieces, and 20,892,772 50-centime pieces. There were also produced 535,227 nickel 25-centime pieces, 4,362,468 bronze 10-centime pieces, and 6,032,140 bronze 5-centime pieces. No gold coins were produced during the year. The total number of coins emitted for French circulation was 93,741,174 of a face value of 87,200,022 fr. ($16,829,604). In addition to the above there were manufactured for Morocco, Tunis, Ethiopia, and Servia 2,602,580 pieces of 2 dinars, 7,529,016 of 1 dinar, and 7,901,068 of 50 paras.

Silver—The market has been a declining one the past week, owing to lack of demand in London. The more peaceful outlook in Mexico has removed the apprehension of a shutdown in Mexican mining operations in case of a war. The London stock of silver has increased, being now some £1,500,000. Indian banks have sold silver in London, which has caused a drop in price coming on a dull market and London closes quiet at 30½ pence.

Zinc and Lead Ore Markets

PLATTEVILLE, WIS.—July 1

The base price paid this week for zinc ore was $68@71 per ton 60% zinc for top grades down to $65 base for medium grades assaying down to 50% zinc. The base price paid for 80% lead ore was $80 per ton.

SHIPMENTS, WEEK ENDED JULY 1

	Zinc Ore, Lb.	Lead Ore, Lb	Sulphur Ore, Lb.
Week	5,876,000	187,300	1,852,400
Year	119,716,000	4,335,010	29,999,800

Shipped during week to separating plants, 7,628,000 lb. zinc ore.

JOPLIN, MO.—July 1

Blende, high price, $87.50; per ton 60% zinc, premium ore, $85; medium, $80@70; low, $65; calamine, per ton 40% zinc, $55@45; average, all grades of zinc, $78.81 per ton. Lead ore, high price, $79.30; base, $82.50 per ton 80% metal content; average selling price, all grades of lead $77.98 per ton, a large quantity of the shipment being from previous purchases on $80 base.

SHIPMENTS WEEK ENDED JULY 1

	Blende	Calamine	Lead	Values
Totals this week	13,267,080	346,340	2,453,180	$631,460
Totals this year	360,017,010	28,857,170	61,724,520	$22,416,800

Blende value, the week, $527,760; 6 months, $18,614,220.

Calamine value, the week, $8,720; 6 months, $1,033,720.

Lead value, the week, $94,980; 6 months, $2,768,860.

Compared with the first six months of 1915 the zinc shipment is a gain of 37,540 tons; the lead shipment is a gain of 9,390 tons and the gain in value is $10,752,000. The average price of blende six months this year is $103.78 against $70.20; last year; the average of calamine is $71.73 against $41.49; the average of lead is $89.74 against $51.81 per ton. While the prices of blende and calamine rose to a phenomenal level in June, 1915, the early part of the half-year ore sold on a low level. The half-year of 1916, just closed, was opened with the strong price level at the close of 1915 and held at a high average until the second week in May, when the average price fell below $100 per ton, all grades of zinc ore.

OTHER ORES

Manganese Ore imports at Baltimore for the week were 9,000 tons from Brazil. These Brazilian ores imported are mainly under contract and very little comes on the open market.

Antimony Ore—Little or no business is reported and the price is nominally unchanged at $2 per unit.

Tungsten Ore—The position has not changed materially. While many inquiries are coming in, no large sales have been made. For the small business transacted the price remains nominally at $30@35 per unit.

The concentrating mills in the Boulder District in Colorado have reduced their prices to $20 per unit for 50% ore.

Iron Trade Review

NEW YORK—July 5

The month of July is generally counted a dull one in the iron trade, and this year it seems to be no exception to the rule so far as domestic business is concerned.

The export trade is very active, though not quite so heavy as some reports would have us believe. However, the larger mills are generally filled up for the next six months and will have no motive to cut prices. The smaller mills, or at least some of them are not so fortunate and may need work by the end of the quarter, and will then be ready to take work as they can get it.

The trouble with Mexico causes much discussion. The general belief is that the Government will need a lot of material and will insist on precedence for its contracts. This will interfere considerably with the export business.

Exports from Baltimore for the week included 7,830 tons pig iron and 1,007 tons steel billets to Genoa, Italy.

According to the summary prepared by the "Railway Age Gazette," railroad orders placed in the half-year ended June 30 included 3,066,850 tons of rails, 89,293 cars and 1,177 locomotives; these totals being more than three times those for the first half of last year.

PITTSBURGH—July 3

The steel market has now entered upon the July-August period, which is invariably dull; but this year the summer dullness really began about the first of June. There is very little fresh domestic demand coming out for any finished steel products, but specifications on contracts are fully as heavy as expected in the circumstances. Deliveries are reported as better, but are no greater than buyers require and there is no semblance of a surplus of steel in any quarter. Outputs will be cut down by hot weather in the next couple of months.

The large mills are adhering very strictly to base prices and are so well sold up through the year that there is no expectation of their cutting prices even should the market continue relatively dull through the fall. The small mills on the other hand have an average of perhaps no more than about two months of work ahead of them and demand will have to be somewhat better than at present to carry them to the end of the year.

Export demand continues excellent, and while there is still demand for shell steel, despite the heavy buying in May, the demand from neutral countries is quite prominent by comparison. Russia is still to place some rails, as well as cars and locomotives. The car and locomotives orders will likely be placed in Canada, a large portion to be then farmed out in the United States.

Pig Iron—The market continues to suffer sentimentally from the weakness in Southern iron, due to the offering of warrants held speculatively, and there is little inquiry except for export bessemer, for which good prices are obtained. W. P. Snyder & Co. announce their computations of average prices obtaining on all sales of Valley iron in June in lots of 1,000 tons and upward at $21, Valley, for bessemer, an advance over May of 16.7c., and at $18, Valley, for basic, a decline of 16.07c. Thus it is shown that sellers of basic did not obtain their asking prices of $18.25 to $18.50. The average price of foundry iron in June as shown by market quotations was $18.39, Valley. The market is quotable as follows: Bessemer, $21; basic, $18; foundry and mallcable, $18,25@18.50; forge, $18@18.25, f.o.b. Valley furnaces, 95c. higher delivered Pittsburgh.

Steel—The billet market is even stronger than formerly, reflecting a tightly sold up condition of the mills, as while the demand is fair it is not of really large proportions. The export market is by far the more active, and the demand in that quarter is for ingots as well as billets, probably because they can be rolled to size when delivered, while billet sizes must be specified long in advance. Soft openhearth ingots readily bring $42@43 for export. Bessemer billets and sheet bars are quotable at $42@43 and openhearth at $44@45 f.o.b. maker's mill, Pittsburgh or Youngstown.

FERROALLOYS

Ferromanganese—The market is very dull and not enough inquiry is developed to fix the prompt market closely. It is quotable at about $200@250, with contracts for delivery in 1917 at $175 as formerly.

Further restrictions have been placed on exports of ferromanganese from Great Britain, the object being to prevent exports of steel to any hostile countries.

Imports of ferromanganese at Baltimore for the week were 2,350 tons from Great Britain.

Spiegeleisen, 20% is quoted at $50@55 at furnace; high grade, 30% brings $60@65 per ton at furnace.

Ferrosilicon is nominally unchanged at $83@85 at furnace for 50%, but premiums are still charged for early delivery. Bessemer ferrosilicon is quoted from $33 for 10% up to $43 for 16%, at furnace.

Exports from Baltimore for the week included 79,691 lb. ferrosilicon to Chile.

An electric furnace plant containing three 750-kilowatt furnaces has been established at Keokuk, Ia., by the Keokuk Electro-Metals Co. to produce ferro-alloys using power from the Mississippi River dam at that point. The furnaces are after designs by the company and have been placed in operation, although shipments have not been started. Their annual capacity is 2,500 to 3,000 tons of 50% ferrosilicon per year.

British Exports of spiegeleisen, ferromanganese and ferrosilicon, five months ended May 31, were 28,290 gross tons in 1915, and 56,304 tons in 1916; increase, 28,014 tons.

FOREIGN IRON

Swedish Iron Production for the quarter ended Mar. 31 was 197,600 metric tons pig iron; 29,700 tons wrought iron; 18,600 tons bessemer steel ingots; 135,300 tons openhearth ingots. The rolled iron and steel reported was 104,500 tons. Exports for the quarter were 114,600 tons, the chief items being 49,600 tons pig iron, including ferrosilicon, and 34,600 tons wrought iron bars and wire rods.

Steel Production in Germany in April is reported by the German Iron and Steel Union at 1 203,398 metric tons, being 144,397 tons less than in March. For the four months ended Apr. 30 the make of steel was, in metric tons:

	Basic	Acid	Total
Converter	2,419,760	50,353	2,470,113
Openhearth	2,055,922	107,400	2,163,322
Direct castings	189,969	102,229	292,198
Crucible		34,617	34,617
Electric		56,678	56,678
Total	4,665,651	351,277	5,016,928
Total, 1915	3,806,223	214,365	4,020,588

The production keeps up well to about 60% of that of a normal year.

British Exports of Iron and Steel, five months ended May 31, were 1,201 117 gross tons in 1915, and 1,572,588 tons in 1916; increase 371,471 tons. The larger gains were in pig iron, bars, plates and sheets. Imports for the five months were 452,283 gross tons in 1915, and 392,794 tons in 1916; increase, 32,489 tons. The gains were chiefly in steel ingots, steel bars, iron bars and pipe.

IRON ORE

The movement of iron ore has been very active. The figures of Lake ore shipments for June are not yet at hand, but it is probable that the total surpassed the large shipments of May.

The strike of the miners on the Mesabi range has not yet affected the rate of shipments. Ore is being sent forward from stockpiles, as well as from mines. The attempt of the strikers to get out the dockmen failed and there has been no interruption at the ports. The strike seems to be losing ground at the mines.

COKE

Coke production in the Connellsville region for the week is reported by the "Courier" at 417,540 net tons; shipments, 420,709 tons.

Connellsville—With the large contract business done in recent weeks there is very little uncovered furnace coke consumption for the second half. The contracting was done at rather steadily declining prices, the latest contracts being chiefly at $2.35 for the half year, but sales for July, and July and August, brought $2.50 without difficulty. Spot furnace coke has been in light demand despite the necessary curtailment in production and shipments this week on account of the holiday. We quote: Spot furnace, $2.40@2.50; contract, $2.35@2.50; spot foundry, $3.25@3.50; contract, $3.50, per net ton at ovens.

Exports and Imports of Fuel in the United States four months ended Apr. 30, in long tons:

	Exports		Imports	
	1915	1916	1915	1916
Anthracite	949,261	1,092,075	191	4,445
Bituminous	3,023,255	4,381,898	515,197	610,246
Coke	217,570	365,055	12,269	24,159
Bunker coal	2,265,359	2,248,745	.	......
Total	6,455,445	8,087,773	527,657	638,850

The bunker coal, or coal furnished to steamships in foreign trade, is practically all bituminous. The chief trade, to the imports and exports, is with Canada. The larger increases in exports this year were to Argentina, Brazil and Italy.

Exports of Fuel in Great Britain five months ended May 31 were, in gross tons:

	1915	1916	Changes
Coal	18,775,284	15,809,763	D. 2,965,521
Coke	366,996	604,673	I. 237,677
Briquettes	509,471	586,296	I. 76,825
Bunker coal	6,334,542	5,467,575	D. 866,967
Total	25,986,293	22,468,307	D. 3,517,986

The bunker coal is fuel furnished to steamships in foreign trade, or sent abroad for the use of such ships.

Chemicals

NEW YORK—July 5

The general market has been quiet over the holiday, and prices have shown some tendency to weaken.

Arsenic—Spot arsenic is rather scarce and prices have held together pretty well. Quotations are $6.25@6.50 per 100 lb. for spot material.

Copper Sulphate—The market is again easier on a moderate demand and prices have weakened again. Sales are reported at $10@11 per 100 lb., and there is talk of further shading.

Nitrate of Soda—Shipments are reported as running heavy, but the demand is good and prices are firm. Current quotations are $3.10 per 100 lb. for spot, and $3.07½ for July.

Exports from Chile five months ended May 31 were, in long tons:

	1914	1915	1916
To United States	276,950	298,650	520 100
To Europe	680,100	303,900	548 500
Total	957,050	602.550	1,068,600

The quantity afloat for Europe on May 31 was 322,300 tons.

Pyrites—Imports at Baltimore for the week included 5,937 tons iron pyrites from Huelva, Spain.

Sulphur—The market is firm and prices continue high, owing chiefly to high freight rates. Current quotations are $30 per ton, New York, for early delivery.

Sulphuric Acid—The market is easier owing to increased production, and sellers are inclined to urge their product on the market. Ordinary 60-deg. acid can be had at $20 per ton at works; while 66-deg. acid is quoted at $35@40 per ton for prompt shipment.

PETROLEUM

The monthly statement of the "Oil City Derrick" shows new oil wells completed in June: Pennsylvania grade, 642; Lima-Indiana, 106; Central Ohio, 30; Kentucky, 52; Illinois, 184; Kansas, 488; Oklahoma-Arkansas, 806; Texas Panhandle, 65; North Louisiana, 42,; Gulf Coast, 130. In all this is 2,545 new wells, with a total production of 190,741 bbl. daily. There were 142 gas wells and 393 dry holes reported. There were 4,492 wells in progress at the close of June.

Mining Companies—United States

Name of Company and Situation		Shares		Dividends		
		Issued	Par	Total	Latest	Amt.
Acacia, g.	Colo.	1,438,989	$ 1	$ 122,004	Jan '11	$0.01
Adams, a.l.c.	Colo.	80,000	10	778,000	Dec. '09	0.04
Ahmeek, c.	Mich.	200,000	25	4,650,000	Apr. '16	3.00
Alaska Mexican, g.	Alas.	180,000	5	3,507,381	Nov. '15	0.10
Alaska Treadwell, g.	Alas.	200,000	25	15,785,000	May '16	0.50
Alaska United, g.	Alas.	180,200	5	2,045,270	Feb. '16	0.30
Allouez, c.	Mich.	100,000	25	350,000	Apr. '16	1.50
Am. Zinc, Lead & Sm.	U. S.	193,120	25	1,108,820	Apr. '13	0.50
Anaconda, c.	Mont.	2,331,250	50	106,566,875	May '16	1.50
Argonaut, g.	Calif.	200,000	5	1,740,000	June '16	0.10
Arizona Copper, com.	Ariz.	1,519,896	1.20	17,923,484	Mar. '16	0.30
Arizona Copper "A," pf.	Ariz.	160,000	1.20	247,795	Apr. '16	.....
Arizona Copper, pf.	Ariz.	1,266,120	1.20	1,940,880	May '16	.....
Baltic, c.	Mich.	100,000	25	7,950,000	Dec. '13	2.00
Barnes-King, c.	Mont.	400,000	5	60,000	June '16	0.075
Bingham N. H., c.	Utah	228,689	5	960,493	Dec. '15	0.05
Bonanza Dev., g.	Colo.	300,000	1	1,425,000	Oct. '11	0.20
Brunswick, g.	Calif.	395,287	1	203,315	Sept. '15	0.06
Bunker Hill Con., g.	Calif.	200,000	1	851,000	June '16	0.02½
Bunker Hill & Sul., l.s.	Ida.	327,000	10	17,590,500	June '16	0.50
Butte-Alex Scott, c.	Mont.	79,311	10	1,054,119	Apr. '16	10.50
Butte-Ballaklava, c	Mont.	250,000	10	125,000	Aug. '10	0.50
Butte & Superior, z.	Mont.	272,697	10	11,383,024	June '16	10.75
Caledonia, l.s.c.	Ida.	2,605,000	1	1,325,581	June '16	0.03
Calumet & Arizona, c.	Ariz.	641,602	10	25,666,253	June '16	2.00
Calumet & Hecla, c.	Mich.	100,000	25	132,250,000	June '16	15.00
Camp Bird, g.s.	Colo.	1,100,051	5	10,806,551	Jan. '16	0.24
Centen'l-Eur., l.s.g.c.	Utah	100,000	5	4,150,000	Apr. '16	1.00
Center Creek, l.z.	Mo.	100,000	10	580,000	Apr. '16	0.25
Champion, c.	Mich.	100,000	25	14,120,000	June '16	6.40
Chief Consolidated, s.g.l.	Utah	880,676	1	439,219	May '16	0.05
Chino, c.	New Mex.	869,980	5	9,742,925	June '16	2.25
Cliff, g.	Utah	300,000	1	90,000	Jan. '13	0.10
Cliff, g.	Alas.	100,000	1	210,000	Oct. '13	0.01
Colo. Gold Dredging	Colo.	100,000	10	775,000	Feb. '16	1.00
Colorado, l.s.g.	Utah	1,000,000	0.20	2,570,000	Dec. '12	0.03
Commercial Gold	Ore.	1,666,000	1	230,490	May '16	0.00½
Cons. Inter. Callahan l.z.	Ida.	464,990	10	3,952,415	June '16	1.50
Continental, z.l.	Mo.	22,000	25	561,000	Dec. '15	10.00
Copper Range, c.	Mich.	394,001	25	16,744,753	June '16	2.50
Daly Judge, s.l.	Utah	300,000	1	1,230,000	Apr. '16	0.25
Daly West, s.l.	Utah	180,000	20	6,606,000	Jan. '13	0.15
Doctor Jackpot, g.	Colo.	3,000,000	0.10	84,814	Mar. '10	0.00½
Doe Run, l.	Mo.	65,749	100	3,550,969	Dec. '13	0.76
Eagle & Blue Bell, g.s.l.	Utah	893,146	1	446,573	Dec. '15	0.05
Elkton Con., g.	Colo.	2,500,000	1	3,579,460	May '15	0.02
El Paso, g.	Colo.	490,000	5	1,707,545	Feb. '14	0.10
Ernestine, g.s.	N.M.	300,000	5	150,000	July '15	0.10
Fed. M. & S., com.	Idaho	60,000	100	2,708,750	Jan. '09	1.50
Fed. M. & S., pf.	Idaho	120,000	100	12,816,795	June '16	1.00
Florence, g.	Nev.	1,050,000	1	840,000	Apr. '11	0.10
Free Coinage, g.	Colo.	10,000	100	180,000	Dec. '09	1.00
Fremont Con., g.	Calif.	200,000	2.50	258,000	Oct. '14	0.02
Frontier, z.	Wis.	1,250	100	146,202	Nov. '13	2.00
Gemini-Key'ne, l.g.s.	Utah	5,000	100	2,330,000	June '16	5.00
Gold Chain, g.	Utah	1,000,000	1	130,000	May '13	0.03
Gold Dollar Con.	Colo.	2,500,000	0.10	100,000	Dec. '12	0.00½
Gold King Con., g.	Colo.	1,000,000	1	1,417,319	Nov. '15	0.01
Golden Cycle, g	Colo.	1,500,000	1	4,350,000	June '16	0.02
Golden Star, g.	Ariz.	400,000	5	140,000	Mar. '10	0.05
Goldfield Con., g.	Nev.	3,559,148	10	28,999,832	Oct. '15	0.10
Grand Central, g.	Utah	500,000	1	1,633,250	Dec. '15	0.02½
Granite, g.	Colo.	1,650,000	1	286,500	Dec. '12	0.01
Hazel, g	Cal.	900,000	1	971,000	Dec. '13	0.01
Hecla, l.s.	Idaho	1,000,000	0.25	4,405,000	June '16	0.15
Hercules, l.s.	Idaho	1,000,000	1	12,150,000	June '16	0.30
Homestake, g.	S. D.	251,160	100	39,871,432	June '16	0.65
Horn Silver, l.s.z.	Utah	400,000	25	5,682,000	June '16	0.05
Inspiration, c.	Ariz.	1,159,471	20	1,449,339	May '16	1.25
Iowa, g.s.l.	Colo.	1,666,667	1	270,167	Dec. '15	0.00½
Iowa-Tiger, g.s.	Colo.	3,000	1	25,179	Dec. '15	1.00
Iron Blossom, s.l.g.	Utah	1,000,000	0.10	2,650,000	Apr. '16	0.10
Iron Silver, s.l.g.	Colo.	500,000	20	4,950,000	Dec. '14	0.10
Jamison, g.	Cal.	390,000	10	386,100	Dec. '15	0.01
Jerry Johnson, g.	Colo.	2,500,000	0.10	187,500	Nov. '14	0.01
Kendall, g.	Mont.	500,000	5	1,555,000	Apr. '16	0.10
Kennecott Cop., c.	Alas.	2,780,583	....	6,950,974	June '16	1.50
Kennedy, g.	Cal.	100,000	100	1,831,001	Apr. '10	0.03
Klar Piquette, z.l.	Wis.	20,000	1	259,000	Apr. '13	0.50
Knob Hill, g.	Wash.	1,000,000	1	70,000	Oct. '13	0.00½
Liberty Bell, g.	Colo.	133,551	5	1,752,795	Sept. '15	0.20
Little Bell, l.s.	Utah	300,000	1	90,000	Apr. '16	0.05
Magma, c.	Ariz.	240,000	5	480,000	June '16	0.50
Mammoth, g.s.c.	Utah	400,000	2.50	2,360,000	June '16	0.05
Mary McKinney, g.	Colo.	1,309,252	1	1,169,308	July '14	0.02
May Day, g.s.l.	Utah	800,000	0.25	284,000	May '16	0.02
Mexican, g.s.	Nev.	201,600	2.50	161,910	June '14	0.75
Miami, c.	Ariz.	747,114	5	7,454,441	May '16	1.50
Modoc, g.s.	Colo.	500,000	1	275,000	Dec. '11	0.01
Mohawk, c.	Mich.	100,000	25	4,275,000	Feb. '16	7.00
Monarch-Mad'a, g.s.l.	Colo.	1,000,000	1	40,000	May '11	0.01
Montana-Tonop., s.g.	Nev.	921,865	1	488,588	Dec. '12	0.10
Mountain, c.	Cal.	250,000	25	4,216,250	May '08	0.44
National, g.	Nev.	750,000	1	570,000	May '11	0.10
Nevada Con., c.	Nev.	1,999,457	5	22,475,480	June '16	0.75
New Century, z.l.	Mo.	330,000	1	237,600	Oct. '09	0.01
New Idria, q.	Cal.	100,000	5	2,030,000	June '16	1.00
North Butte, c.	Mont.	430,000	15	12,922,000	Apr '16	0.50
North Star, g.	Cal.	250,000	10	4,912,040	June '16	0.30
Old Domin'n, M. & Sm.	Ariz.	162,000	25	7,371,000	June '16	3.00
Ophir, s.g.	Nev.	201,600	3	2,068,360	Jan. '12	0.10
Opohongo, g.s.l.	Utah	898,978	0.25	80,907	Jan. '13	0.02
Oroville Dredging	Cal	686,498	5	2,034,936	June '16	0.12
Osceola, c.	Mich.	96,150	25	13,621,925	Apr. '16	4.00
Parrot, c.	Mont.	229,850	10	7,871,839	July '15	1.63
Pearl Con., g.	Wash.	1,909,711	0.05	181,422	Dec. '10	0.02
Pharmacist, g.	Colo.	1,500,000	1	87,500	Feb. '10	0.00½
Pioneer, g.	Alas.	5,000,000	1	2,041,526	Oct. '11	0.03
Pittsburgh-Idaho, l.	Ida.	809,407	1	217,083	Apr. '13	0.04
Pittsburg Silver Peak, g	Nev.	2,790,000	1	771,200	July '14	0.02
Portland, g.	Colo.	3,000,000	1	10,357,080	Apr '16	0.03
Quilp.	Wash.	1,500,000	1	67,500	Feb. '12	0.01

Corrected to July 1, 1916.

Mining Companies—United States—(*Continued*)

Name of Company and Situation		Shares		Dividends		
		Issued	Par	Total	Latest	Amt.
Quincy, c.	Mich.	110,000	$ 25	$22,547,500	June '16	$4.00
Ray, c.	Ariz	1,571,279	10	6,695,913	June '16	0.50
Reorg. Booth, g.	Nev.	1,000,000	1	400,000	June '16	0.05
Republic, g.	Wash.	1,000,000	1	170,000	Nov. '12	0.01½
Rochester, l.z.	Mo.	4,900	100	190,846	July '12	0.50
Round Mountain, g.	Nev.	1,266,591	1	363,365	Aug. '13	0.04
Seven Troughs Coal., g.	Nev.	1,443,077	1	246,419	Apr. '16	0.02½
St. Joseph, l.	Mo.	1,409,466	10	10,902,113	June '16	0.25
Shannon, c.	Ariz.	300,000	10	750,000	Jan. '13	0.50
Shattuck Arizona, c.	Ariz.	350,000	10	3,762,500	Apr. '16	1.25
Silver King Coal., l.s.	Utah.	1,250,000	5	13,960,885	Apr. '16	0.15
Silver King Con., l.s.	Utah.	637,582	1	878,615	Apr. '16	0.10
Sioux Con., s.l.g.	Utah.	745,389	1	872,097	July '11	0.04
Skidoo, g.	Cal	1,000,000	5	365,000	Oct. '14	0.01
Snowstorm, c.g.	Ida	1,500,000	1	1,192,103	Oct. '13	0.02
South Eureka, g.	Calif.	299,981	1	722,870	May '16	0.07
Standard Con., g.s.	Cal.	178,394	10	5,274,407	Nov. '13	0.25
Stewart, s.l.	Ida.	1,238,362	1	2,012,314	Dec. '15	0.05
Stratton's Ind., g.	Colo.	1,000,000	0.60	618,625	Jan. '16	0.04
Success, z.	Ida	1,500,000	1	1,380,000	June '16	0.03
Superior & Pitts., c.	Ariz.	1,499,792	10	10,318,569	Dec. '15	0.38
Tennessee, c.	Tenn.	200,000	25	5,206,250	Apr. '16	0.75
Tomboy, g.s.	Colo.	310,000	4.85	3,860,055	June '16	0.24
Tom Reed, g.	Ariz.	909,555	1	2,528,648	Oct. '15	0.01
Tonopah Belm't, s.g.	Nev.	1,500,000	1	8,018,027	Apr. '16	0.12½
Tonopah Ext., g.s.	Nev.	1,272,801	1	1,209,907	Apr. '16	0.10
Tonopah of Nev., s.g.	Nev.	1,000,000	1	13,300,000	Apr. '16	0.15
Trimountain, c.	Mich.	100,000	25	1,450,000	Dec. '13	2.00
Tuolumne, c.	Mont.	2,500,000	1	520,000	May '13	0.10
Uncle Sam, g.s.l.	Utah.	500,000	1	495,000	Sept. '11	0.05
United Cop. Min., c.	Wash.	1,000,000	1	40,000	Nov. '12	0.01
United (Crip. Ck.) g.	Colo.	4,000,100	1	440,435	Jan. '10	0.04
United Globe, c.	Ariz.	23,000	100	3,335,000	June '16	18.00
United Verde, c.	Ariz.	300,000	100	38,197,000	June '16	1.50
Utah, s.l.	Utah.	100,000	10	281,860	Dec. '10	0.02
Utah, c.	Utah.	1,624,490	10	41,656,592	June '16	3.00
Utah Con., c.	Utah.	300,000	5	9,600,000	June '16	0.75
Valley View, g.	Colo.	1,000,000	1	210,000	Dec. '10	0.04
Victoria, g.s.l.	Utah.	250,000	1	207,500	Mar. '10	0.04
Vindicator Con., g.	Colo	1,500,000	1	3,352,500	Apr. '16	0.03
Wasp No. 2, g.	S. D.	500,000	1	649,466	May '16	0.02½
Wellington Mines, g.	Colo	10,000,000	1	650,000	Nov. '15	0.02
Wolverine, c.	Mich.	60,000	25	8,880,000	Apr. '16	6.00
Yak, s.l.	Colo.	1,000,000	1	2,127,685	June '16	0.07
Yankee Con., g.s.	Utah.	1,000,000	1	167,500	Jan. '13	0.01
Yellow Aster, g.	Cal.	100,000	10	1,185,789	June '16	0.12
Yellow Pine, l.z.s.	Nev.	1,000,000	1	1,393,008	June '16	0.15
Yukon Gold, g.	Alas.	3,500,000	5	8,108,110	June '16	0.07½

Iron, Industrial and Holding Companies

Am. Sm. & Ref., com	U. S.	501,080	$100	$30,586,033	June '16	$1.50
Am. Sm. & Ref., pf.	U. S.	500,000	100	56,546,386	June '16	1.75
Am. Smelters, pf. A.	U. S.	170,000	100	11,289,944	Apr. '16	1.50
Am. Smelters, pf. B.	U. S.	300,000	100	16,250,000	Apr. '16	1.25
Greene Cananea	U. S.	486,209	100	4,344,061	Feb. '16	1.00
Guggenheim Expl.	U. S.	833,732	25	34,036,783	Apr. '16	11.85
Inter'l Nickel, com.	U. S.	1,673,384	25	30,941,338	June '16	2.00
Inter'l Nickel, pfd	U. S.	89,126	100	5,614,824	May '16	1.50
National Lead, com.	N. Y.	206,554	100	9,448,662	June '16	1.00
National Lead, pf.	N. Y.	243,676	100	32,206,118	June '16	1.75
Old Dominion, c.	Ariz.	293,353	25	8,933,919	June '16	3.00
Phelps, Dodge & Co.	U. S.	450,000	100	51,059,304	June '16	6.00
U. S. Steel Corp., com.	U. S.	5,083,025	100	235,068,001	June '16	1.25
U. S. Steel Corp., pf.	U. S.	3,602,811	100	408,122,852	May '16	1.75
U. S. S., R. & M., com.	U.S.-Mex.	351,115	50	6,976,794	Apr. '16	1.00
U. S. S., R. & M., pf.	U.S.-Mex.	486,350	50	17,646,805	Apr. '16	0.87½

Canadian, Mexican and Central American Companies

Ajuchitlan, g.s.	Mex.	50,000	$ 5	$ 212,500	Oct. '12	$0.25
Amparo, g.s.	Mex.	2,000,000	1	1,860,883	May '16	0.05
B. C. Copper	B. C.	591,709	5	615,198	Jan. '13	0.15
Beaver Con., s.	Ont.	2,000,000	1	649,912	Apr '16	0.03
Buffalo, s.	Ont.	1,000,000	1	2,787,000	July '14	0.05
Canadian Goldfields, g.	B. C.	600,000	0.10	290,000	July '14	0.001½
Chootalpan, g.s.l.z.	Mex.	7,000	25	61,250	May '14	0.75
Cobalt Townsite, s.	Ont.	45,000	1	1,042,259	May '14	0.10
Coniagas, s.	Ont.	800,000	5	8,040,000	Feb. '16	0.25
Con. M. & S. Co. of Can	B. C.	337,100	25	2,529,966	Apr. '16	2.50
Crown Reserve, s.	Ont.	1,999,957	1	6,102,408	July '15	0.02
Dome Mines, s.	Ont.	400,000	10	800,000	June '16	0.50
Dos Estrellas, g.s.	Mex	300,000	0.50	10,335,000	Dec. '13	1.50
El Oro, g.s.	Mex.	1,147,500	4.85	8,947,260	July '13	0.24
Esperanza, s.g.	Mex.	455,000	4.85	12,013,882	July '15	0.24
Granby, s.l.c.	B.C.	149,985	100	6,275,319	May '16	1.50
Greene Con., c.	Mex.	1,000,000	10	12,044,400	May '16	1.00
Guanajuato D., pf., s.	Mex.	10,000	1000	214,356	Jan. '10	3.00
Hedley Gold	B. C.	120,000	10	1,943,520	June '16	0.50
Hollinger, g.	Ont.	600,000	5	4,890,000	June '16	0.20
Kerr Lake, s.	Ont.	600,000	5	6,420,000	June '16	0.25
La Rose Con., s	Ont.	1,498,627	5	5,536,983	Apr. '16	0.05
Le Roi No. 2, g.	B. C.	120,000	24.30	1,566,450	Mar. '16	0.30
Lucky Tiger Com., g.	Mex.	715,337	10	3,470,839	June '16	0.08
McK.-Dar. Sav. s.	Ont.	2,247,692	1	4,675,194	Apr '16	0.03
Mines Co. of Am. (new)	Mex.	862,658	10	4,958,600	July '13	0.12½
N. Y. & Hond. Ros., g.	C. A.	200,000	10	3,990,000	Apr. '16	0.50
Nipissing, s.	Ont.	1,200,000	5	14,040,000	Apr. '16	0.25
Peñoles, s.l.g.	Mex.	80,000	25	6,361,688	June '13	1.25
Pinguico, pf., s	Mex.	20,000	100	840,000	Oct. '13	3.00
Right of Way Mns, s.	Ont.	1,685,500	1	712,309	June '16	0.05
Rio Plata, s.	Mex.	374,518	5	345,745	Feb. '13	0.05
San Rafael, g.s.	Mex	2,400	25	1,442,380	Jan. '14	0.50
San Toy, g.s.	Mex.	5,750,000	1	530,000	July '13	0.01
Seneca-Superior	Ont.	478,884	1	1,316,431	June '16	0.30
Sorpresa, g.s.	Mex.	19,200	20	3,979,240	Jan. '11	34.00
Stand'd Silver-Lead	B. C.	2,000,000	1	2,100,000	June '16	0.02½
Temiskaming, s.	Ont.	2,500,000	1	1,534,156	Mar. '16	0.03
Tem. & Hud. Bay, s.	Ont.	7,761	1	1,940,250	Nov. '14	3.00
Trethewey, s.	Ont.	1,000,000	1	1,061,998	July '14	0.05
Wettlaufer-Lorrain, s	Ont.	1,416,590	1	637,465	Oct. '13	0.05

Assessments

Company	Delinq.	Sale	Amt.
Advance, Mont	June 15	July 15	$0.005
Algomah, Mich.	May 18	....	1.00
Blue Bell, Ida	July 8	Aug. 5	0.002
Bullion, Ida	July 10	July 31	0.01
Cedar Creek, Ida	July 5	Aug. 5	0.01
Central Eureka, Calif	June 16	July 14	0.05
Challenge, Nev	June 12	July 7	0.05
Columbus Ext., Utah	July 13	Aug. 8	0.02
Confidence, Nev	June 23	July 14	0.10
Cons. Imperial, Nev	July 18	Aug. 10	0.01
Crackerjack, Nev.	July 3	Aug. 1	0.01
Emerald, Utah.	June 15	July 8	0.0033
Fortuna, Utah	June 15	July 8	0.005
Friend, Ida	June 30	July 20	0.002
Giant, Ida	June 16	July 17	0.003
Goldstrike Bon., Utah	June 15	July 15	0.01
Gold Mt. Champion, Utah	July 20	Aug. 10	0.0025
Gould & Curry, Nev	July 14	Aug. 3	0.03
Hope, Calif	July 17	Aug. 14	0.01
Imperial, Ida	June 12	July 12	0.005
Independence, Ida	July 8	July 29	0.001
Laclede, Ida	July 3	July 25	0.003
Leonora, Utah.	June 20	July 11	0.005
National, Ida	June 2	July 3	0.02
Nevada-Douglas, Nev	July 15	Aug. 16	0.10
North Franklin, Ida	June 19	July 8	0.005
North Lake, Mich	June 14	....	1.00
Old Veteran, Ida	July 8	Aug. 5	0.002
Ophir, Nev.	June 13	July 6	0.05
Rio Grande, Nev.	June 22	July 22	0.002
Rob Roy, Ida.	June 10	July 10	0.002
Rockford, Ida	June 30	July 21	0.002
Sierra Nevada, Nev	July 11	Aug. 3	0.10
Silver Moon, Ida.	July 8	Aug. 3	0.005
Silver Pick, Nev	July 5	Aug. 14	0.01
Spearhead Reor., Nev	July 3	Aug. 3	0.01
Swansea Ext., Utah.	July 10	Aug. 1	0.0025
Tintic Central, Utah	July 12	Aug. 8	0.005
Ton. Gypsy Queen, Nev.	July 11	Aug. 15	0.01
Uvada, Nev	June 24	July 27	0.02
Wallace, Ida	June 29	July 29	0.0025
Wasatch-Utah, Utah.	June 19	July 22	0.0025
Wisconsin North Fork, Calif	June 12	July 10	0.01

Stock Quotations

SAN FRANCISCO	June 30
Name of Comp.	Bid.
Alta	.05
Andes	.10
Best & Belcher	.06
Bullion	‡.03
Caledonia	.44
Challenge Con.	.10
Confidence	.18
Cons. Imperial	.01
Con. Virginia	.11
Gould & Curry	.02
Hale & Norcross	.08
Jacket-Cr. Pt.	.04
Mexican	.16
Occidental	.70
Ophir	.31
Overman	.06
Savage	.07
Seg Belcher	.02
Sierra Nevada	.23
Union Con.	.76
Utah Con.	.02
Belmont	4.00
Jim Butler	.95
MacNamara	.05
Midway	.22
Mont.-Tonopah	.25
North Star	.16
Rescue Eula	.34
West End Con.	.92
Atlanta	.10
Blue Bell	.01
Booth	.15
C.O.D. Con.	.03
Comb. Frac.	.07
D'field B.B.	.02
D'field Daisy	.02
Jumbo Extension	.78
Pitts.-Silver Peak	.09
Round Mountain	.61
Sandstorm Kendall	.03
Silver Pick	.09
Central Eureka	.10
Argo	.15
Big Jim	.81
Lazy Boy	.13
Oatman Cres	‡.42
Oatman No. Star.	.17
Tom Reed	1.45
United Eastern	3.68
United Western	.12

LONDON	June 19
Alaska Tre'dwell	£[illegible] 5s 0d
Burma Corp	2 14 4
Cam & Motor	0 5 0
Camp Bird	0 9 6
El Oro	0 10 0
Esperanza	0 11 6
Mexico Mines	4 2 6
Nechi, pfd	0 13 6
Oroville	0 16 0
Santa Gert'dis	0 14 3
Tomboy	1 3 0

SALT LAKE	July 1
Name of Comp.	Bid.
Alta Con.	.42
Black Jack	.05
Colorado Mining	.17
Crown Point	.04½
Daly-Judge	7.10
Emma Cop.	.43
Gold Chain	.25
Grand Central	.69
Iron Blossom	1.65
Lower Mammoth	.04
May Day	.12¾
Opohongo	‡.01¾
Prince Con.	1.32½
Seven Troughs	‡.02¾
Silver King Coal'n	2.67½
Silver King Con.	3.10
Sioux Con.	.13½
Uncle Sam	.06
Yankee	‡.20¼

COLO. SPRINGS	June 30
Acacia	‡.03¾
Doctor Jack Pot	.09¼
Elkton Con.	.15
El Paso	.78
Findlay	.03
Gold Sovereign	.03½
Golden Cycle	2.12½
Granite	.64
Isabella	.17
Jack Pot	.05
Jerry Johnson	‡.04
Mary McKinney	.37
Portland	1.50
Vindicator	2.39

TORONTO	July 1
Adanac	1.37½
Bailey	.07
Chambers Ferland	.22
Coniagas	4.87½
La Rose	.61
Peterson Lake	.24
Right of Way	.05
Seneca Superior	.36
T. & Hudson Bay	59.00
Temiskaming	.60
Trethewey	.21
Wettlaufer-Lor.	.20
Dome Exten.	.36
Dome Lake	.31
Foley O'Brien	.50
Hollinger	29.75
Imperial	‡.03
Jupiter	.31
McIntyre	1.59
Porcu. Crown	.88
Preston E. D.	.03
Vipond	.54
West Dome	.37

N. Y. EXCH.	July 3
Name of Comp.	Clg.
Alaska Gold M.	18
Alaska Juneau	8
Am.Sm.&Ref.,com.	94¼
Am. Sm. & Ref., pf.	111
Am. Sm. Sec., pf. A	92
Am. Sm. Sec., pf. B.	83½
Am. Zinc	37¾
Am. Zinc, pf.	65½
Anaconda	82¾
Batopilas Min.	1¼
Bethlehem Steel	425
Bethlehem Steel, pf.	130
Butte & Superior	67
Chile Cop.	21¼
Chino	50⅜
Colo. Fuel & Iron	42
Crucible Steel	71⅞
Dome Mines	26
Federal M. & S.	12½
Federal M. & S., pf.	36¼
Great Nor., ore ctf.	34⅜
Greene Cananea	41½
Homestake	130
Inspiration Con.	50
International Nickel	47¾
Kennecott	49
Lackawanna Steel	‡66
Miami Copper	35¼
Nat'l Lead, com.	65
National Lead, pf.	113
Nev. Consol.	16¼
Ontario Min.	6¾
Quicksilver	2⅞
Quicksilver, pf.	5
Ray Con.	22¼
Republic I&S, com.	45
Republic I&S, pf.	107½
Sloss-Sheffield	46
Sloss-Sheffield, pf.	94
Tennessee Copper	35½
Utah Copper	78
U. S. Steel, com.	86¾
U. S. Steel, pf.	117¼
Va. Iron C. & C.	46

N. Y. CURB	July 3
Beaver Con.	.39
Buffalo Mines	1
Butte & N. Y.	1¼
Butte C. & Z.	5¼
Can. Cop. Corpn.	1¾
Cashboy	.05
Cerro de Pasco	34
Con. Ariz. Sm.	$1\frac{5}{16}$
Con. Coppermines	2¼
Con. Nev.-Utah	28⅛
Crystal Cop.	1
First Nat. Cop.	3⅛
Florence	.35
Goldfield Con.	.83
Goldfield Merger	.08½
Granite	30
Hecla Min.	5⅛
Howe Sound	4¼
Jerome Verde	1¾
Joplin Ore & Spel.	3
Kenefick Zinc	‡13½
Kerr Lake	4
Magma	14
Majestic	.75
McKinley-Dar-Sa.	.50
Mother Lode	.29
Nevada Hills	.17
N. Y. & Hond.	15⅞
Nipissing Mines	7
Oro	‡.05
Ray Hercules	3⅛
Rochester Mines	.58
St. Joseph Lead	15¾
Standard S. L.	1¼
Stewart	$\frac{7}{32}$
Success	.87
Tonopah	5⅛
Tonopah Ex.	5⅛
Tribullion	.31½
United Zinc	8¾
White Knob, pf.	‡1¼
Yukon Gold	$2\frac{1}{16}$

BOSTON EXCH	July 3
Name of Comp.	Bid
Adventure	2½
Ahmeek	95
Algomah	1¼
Allouez	64½
Ariz. Com., ctfs.	9
Bonanza	.25
Butte-Ballaklava	2
Calumet & Ariz.	67½
Calumet & Hecla	530
Centennial	15¼
Copper Range	59½
Daly West	2¾
East Butte	12¾
Franklin	6½
Granby	85
Hancock	12½
Helvetia	.25
Indiana	2¼
Island Cr'k, com.	46¼
Island Cr'k, pfd.	88½
Isle Royale	27
Keweenaw	3¾
Lake	12
La Salle	1
Mason Valley	2¼
Mass.	11¼
Mayflower	1¾
Michigan	3
Mohawk	98½
New Arcadian	6
New Idria	12
North Butte	22¾
North Lake	1½
Ojibway	1¼
Old Colony	1⅛
Old Dominion	65
Osceola	85
Quincy	86
St. Mary's M. L.	74⅛
Santa Fe	1⅛
Shannon	8
Shattuck-Ariz.	28
So. Lake	5¼
So. Utah	.15
Superior	14½
Superior & Bost.	3⅛
Tamarack	41
Trinity	4¾
Tuolumne	.40
U. S. Smelting	68¾
U. S. Smelt'g, pf.	50¾
Utah Apex	4¼
Utah Con.	12¾
Utah Metal	8¾
Victoria	3
Winona	5
Wolverine	53
Wyandot	1½

BOSTON CURB	July 3
Bingham Mines	10¼
Boston Ely	.89
Boston & Mont.	$1\frac{1}{16}$
Butte & Lon'n Dev	.68
Calaveras	5
Calumet-Corbin	.03½
Chief Con.	$1\frac{11}{16}$
Cortez	.30
Crown Reserve	.51
Davis-Daly	1⅞
Eagle & Blue Bell	1⅝
Houghton Copper	1½
Iron Cap Cop., pf.	6
Mexican Metals	.30
Mines of America	2¾
Mojave Tungsten	6
Nat. Zinc & Lead	$1\frac{1}{16}$
Nevada-Douglas	.95
New Baltic	1½
New Cornelia	12
Ohio Copper	.10
Oneco	1
Raven Copper	‡.18
Rex Cons.	.14
Rilla	.29
United Verde Ext.	27¼

‡Last Quotations.

Monthly Average Prices of Metals

SILVER

Month	New York 1914	New York 1915	New York 1916	London 1914	London 1915	London 1916
January	56.572	48.855	56.775	26.553	22.731	26.960
February	57.506	48.477	56.755	26.573	22.753	26.975
March	58.067	50.241	57.935	26.788	23.708	27.597
April	58.519	50.250	64.415	26.958	23.709	30.662
May	58.175	49.915	74.269	26.704	23.570	35.477
June	56.471	49.034	65.024	25.948	23.267	31.060
July	54.678	47.519	......	25.219	22.597	....
August	54.344	47.163	......	25.979	22.780	....
September	53.290	48.680		24.260	23.591	
October	50.654	49.385	......	23.199	23.925	
November	49.082	51.714	......	22.703	25.094	
December	49.375	54.971	......	22.900	26.373	
Year	54.811	49.684	......	25.314	23.675	

New York quotations cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine

COPPER

Month	New York Electrolytic 1915	New York Electrolytic 1916	London Standard 1915	London Standard 1916	London Electrolytic 1915	London Electrolytic 1916
Jan.	13.641	24.008	60.756	88.083	65.719	116.167
Feb.	14.394	26.440	63.494	102.667	*	133.167
Mar.	14.787	26.310	66.152	107.714	*	136.000
April	16.811	27.895	75.096	124.319	*	137.389
May	18.506	28.625	77.600	135.457	*	152.522
June	19.477	26.601	82.574	112.432	95.333	137.455
July	18.796	......	76.011	......	91.409	......
Aug.	16.941	......	68.673	......	82.333	......
Sept.	17.502	......	68.915	......	85.250	......
Oct.	17.686	......	72.601	......	88.000	......
Nov.	18.627	......	77.744	......	93.273	......
Dec.	20.133	......	80.773	......	100.43	......
Year.	17.275	......	72.532	......	......	......

TIN

Month	New York 1915	New York 1916	London 1915	London 1916
January	34.260	41.825	156.550	175.548
February	37.415	42.717	176.925	181.107
March	48.426	50.741	180.141	193.609
April	47.884	51.230	166.225	199.736
May	38.790	49.125	162.675	196.511
June	40.288	42.231	167.636	179.466
July	37.423	......	167.080	......
August	34.389	......	151.440	......
September	33.125	......	152.625	......
October	33.080	......	151.554	......
November	39.224	......	167.670	......
December	38.779	......	167.000	......
Av. year	38.590	......	163.960	......

LEAD

Month	New York 1915	New York 1916	St. Louis 1915	St. Louis 1916	London 1915	London 1916
January	3.729	5.921	3.548	5.826	18.606	31.167
February	3.827	6.246	3.718	6.164	19.122	31.988
March	4.053	7.136	3.997	7.375	21.883	34.440
April	4.221	7.630	4.142	7.655	21.094	34.368
May	4.274	7.463	4.182	7.332	20.347	32.967
June	5.932	6.936	5.836	6.749	25.170	31.011
July	5.659	......	5.531	......	24.611	......
August	4.656	......	4.520	......	21.946	......
September	4.610	......	4.490	......	23.151	......
October	4.600	......	4.499	......	23.994	......
November	5.155	......	5.078	......	26.278	......
December	5.355	......	5.266	......	28.807	......
Year	4.673	......	4.567	......	22.917	......

SPELTER

Month	New York 1915	New York 1916	St. Louis 1915	St. Louis 1916	London 1915	London 1916
Jan.	6.386	16.915	6.211	16.745	30.844	89.810
Feb.	8.436	18.420	8.255	18.260	39.819	97.762
Mar.	8.541	16.846	8.360	16.676	44.141	95.048
April	10.012	16.695	9.837	16.525	49.888	99.056
May	14.781	14.276	14.610	14.106	68.100	94.217
June	21.208	11.752	21.038	11.582	100.614	68.591
July	19.026	......	18.856	......	97.250	......
Aug.	12.781	......	12.611	......	67.786	......
Sept.	13.440	......	13.270	......	67.841	......
Oct.	12.800	......	12.596	......	66.536	......
Nov.	15.962	......	15.792	......	88.409	......
Dec.	15.391	......	15.221	......	89.400	......
Year	13.230	......	13.054	......	67.553	......

New York and St. Louis quotations, cents per pound. London, pounds sterling per long ton. * Not reported.

PIG IRON IN PITTSBURGH

Month	Bessemer‡ 1915	Bessemer‡ 1916	Basic‡ 1915	Basic‡ 1916	No. 2 Foundry 1915	No. 2 Foundry 1916
January	$14.59	$21.60	$13.45	$18.78	$13.90	$19.70
February	14.55	21.16	13.45	18.93	13.90	19.51
March	14.55	21.81	13.45	19.20	13.95	19.45
April	14.55	21.65	13.45	18.95	13.95	19.45
May	14.61	21.78	13.60	19.11	13.83	19.58
June	14.70	21.95	13.67	18.95	13.77	19.34
July	14.94	......	13.91	......	13.68	......
August	16.01	......	15.31	......	14.75	......
September	16.86	......	15.95	......	15.70	......
October	16.95	......	15.96	......	15.80	......
November	17.57	......	16.47	......	17.20	......
December	19.97	......	18.44	......	18.95	......
Year	$15.82	......	$14.76	......	$14.95	......

‡As reported by W. P. Snyder & Co

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The Yellow Pine District, Nev.

By Leroy A. Palmer*

SYNOPSIS—The mining district about Goodsprings, Nev., was discovered in 1860 and produced lead ore. Gold and copper were found also. Zinc ore, the camp's mainstay now, was not recognized until 1906. The camp is gradually increasing in importance, and production is growing. Its features are discussed.

Toward the close of 1914 the Yellow Pine mining district, in the vicinity of Goodsprings, Nev., was working about 40 men, and its future appeared decidedly uncertain. Due to the extraordinary rise in the prices of lead and zinc, the principal products of the camp, 1916 opened with about 20 mines in operation and 400 men employed, with a monthly payroll of $45,000 and a monthly output approximating $400,000.

The first mining in this locality was at the Potosi, now the second largest producer of the district, which was discovered in 1860 by Mormon prospectors. This property produced rich lead ore that was mined by the Mormons and used by them in the manufacture of the bullets necessary in the border warfare of pioneer days.

THE TOWN OF GOODSPRINGS, CENTER OF THE YELLOW PINE MINING DISTRICT

Some gold and copper ores were found also, and gold and silver were associated with the copper and lead. So for years the district was a small but steady producer of these four metals, but the most momentous event of its history did not occur until 1906. Associated with the lead ores was a heavy gray-white material of unknown composition, considered worthless and commonly referred to as country rock. The credit of identifying this "country rock" as zinc ore seems to belong to Connie Brown, an engineer, who observed it while making a professional visit to the camp. These pages of the camp's history remind one of the awakening at Leadville, or the recognition of the "black iron" that was the source of much profanity among the ranches of what is now the Boulder tungsten district.

The district is about 15 mi. long and from 10 to 12 wide, toward the southern end of the Spring Mountain range and near the Nevada-California line. Goodsprings, the only town, is reached by an 8-mi. auto ride over good roads from Jean, Nev., on the Salt Lake route. The gold which, aside from that associated with the copper ores, once formed an important part of the production of the district, is found in altered igneous rocks, but no gold is produced now except as a byproduct.

The zinc-lead ores occur as replacement and fissure deposits in upper Carboniferous limestone. The two kinds of ore occur in the same orebodies, but usually with a fairly clear line of demarcation, so that it is frequently possible to mine a practically clean high-grade product that needs no milling before being shipped to the smelter. The country has been subjected to fracturing and complex folding. The ores are found through a vertical range of 3,000 ft. in close proximity to the fractures and folds. The eastern limit of the ore zone is a prominent fault that passes nearly through the town of Goodsprings. This fault shows particularly well just northwest of town, where the displacement has been estimated at 4,000 ft. and the red Permian sandstone can be seen at a geographic level several hundred feet lower than the white Pennsylvanian limestones.

At some pre-Tertiary time the limestones were intruded by quartz monzonite that is found as large irregular masses and sills which are cut by crossdikes of a similar material. Overlying the other rocks is a series of Tertiary basalt and andesite flows. The flows bear no relation to the orebodies of the district; in fact, with the exception of those of the Yellow Pine, these are not associated with any of the igneous rocks. In this mine the ores are found both in fissures and as replacements from 40 to 50 ft. from the intrusives. In no other mine of the district, however, is there any apparent connection between the orebodies and the igneous rocks.

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*Mining engineer, San Francisco, Calif.

While the lead and zinc mines are the mainstay of the district, there are two other deposits of interest and doubtless of future importance. One of these is the Boss, which presents an interesting study to the geologist and mineralogist. The commercial products of this mine are gold, silver, copper and platinum, but many of the rarer metals are found in small quantities. The copper occurs in the form of chalcocite, bornite, malachite and azurite. The platinum is presumably covellite. The ore is a replacement in the limestone in a mineralized zone proved to be 190 ft. wide, with lenses up to 28 ft. in width, the deposits occurring across the bedding planes. One such lens being developed at the time these notes were made showed a length of 265 ft., a width of 12 ft. and a depth of 112 ft., with neither top nor bottom in sight. An average of one orebody, estimated to contain 11,000 to 15,000 tons, is 6% copper, 1 oz. platinum and $12 gold per ton. Other assays, not of picked samples, but of considerable bodies, have been 12% copper, 1½ oz. platinum, 3 oz. silver and $0.10 gold and 1½ to 2% copper with 4 to 5 oz. each of gold and platinum.

Another deposit out of the ordinary for this district is at the Lavena mine, between Goodsprings and the Yellow Pine mine. The Lavena is on a dike of monzonite porphyry 250 ft. wide, similar to that of the Bingham copper deposits, throughout which are veinlets of quartz carrying pyrite, chalcopyrite and gold. One 2-ft. vein in the porphyry gives assays of 2 to 4% copper, 8 oz. silver and $2.80 to $10 gold. Development on this property is limited as yet, but at the lower levels there seems to be a general dissemination of the copper through the porphyry with the possibility of their being developed into a large body of low-grade ore.

SYSTEMS OF MINING EMPLOYED

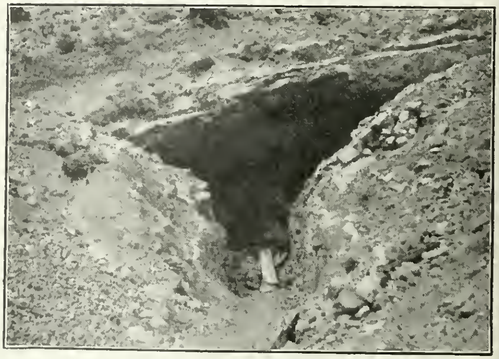
Various systems of mining are in vogue in the district. The deposits are worked by vertical and inclined shafts, tunnels and opencuts. Some of the companies, such as the Yellow Pine, that have demonstrated the existence of bodies of ore of considerable size, have sunk comparatively deep shafts and are blocking out ore ahead. Others are following the method in general use in the eastern zinc districts, of making only a temporary opening and following the orebody through its various meanderings.

The Yellow Pine, the largest mine of the district, is square-setting. The lime walls are hard, but their general nature is such that the management considers this system best adapted to them. The mine is opened by an incline, on an angle of 35° to 40°, to a depth of 930 ft. on the slope. Levels are driven every 100 ft. The fissure deposits have an average strike of N 30° W with easterly dip, and the bedded deposits strike nearly due north with westerly dip. Some of the stopes attain considerable size—up to 100 ft. in width and 300 to 400 ft. in length. While it has been considered advisable to support these stopes by means of square sets, light timbers only are required, 6x8's and 8x8's being commonly used. After a stope is worked out, the timbers are drawn and it is filled with waste.

The mine is connected with the mill at Goodsprings and with the Salt Lake route at Jean by a narrow-gage railroad operating a Shay and a gasoline locomotive. The Boss has opened up by means of tunnels, five of which have been driven or are in course of construction. The lowest will reach the vein at a vertical distance of 550 ft. The Boss uses no timber at all in stoping. The narrower deposits are worked without support, as the walls will stand while the ore is being removed. The larger deposits are worked by underground glory-holing.

The Sultan, next to the Yellow Pine the largest producer of the district proper, is working two glory holes by a typical milling system. One tunnel has been run in to a point 60 ft. below the surface and a raise driven to the orebody, which at the time these notes were made had been worked from the surface 100x20x30 ft. The other tunnel is connected by a 175-ft. raise to a glory hole 50x60x40 ft.

At the Anchor a short tunnel has been driven in and a shaft and winze sunk to 450 ft. below the surface. The ore is in a replacement on an average dip of 38° and a maximum width of 32 ft. It is mined by a typical overhead stoping system, stulls alone being used to support the walls.


OPEN CUT AT MONTE CRISTO MINE

Many "gopher" methods are employed. At the Monte Cristo, leasers are taking out a high-grade, 37% zinc ore carrying less than 1% lead, by means of the opencut shown in the illustration.

About a mile up the cañon from the Monte Cristo and well up the mountainside, where a wagon road is hardly to be considered, is the Barnes, Hickman & Flesher lease on the Palace and Porter group, belonging to the Yellow Pine. This lease is following several bunches of high-grade zinc ore by means of short tunnels and opencuts. Shipments to the loading platform at the Monto Cristo is by means of burro train.

The lime, in which practically all of the development work is carried on, does not make for high costs. Among the companies operating systematically there is uniformity in the cost of the various kinds of development. Even at the larger mines much handwork is done, especially in the stopes. The Yellow Pine sank its main two-compartment shaft 5½x9½ ft. in the clear, the last lift of 116 ft. at a cost of $20 per ft., including timber. At the Anchor its single-compartment shaft, 5x7 ft., was sunk 200 ft. from the first tunnel level for $11 per ft. The Yellow Pine was sunk with two shifts, one drilling and one mucking. Progress varied considerably, from 30 to 75 ft. per month. The work was done both by hand and with 3¼-in. piston machines, 9 to 16 holes constituting a round. At this mine the drifts are an average of 4x7 ft. in cross-section and have been driven both by hand and with Temple-Ingersoll air-electric drills. Four to 16 holes are used to a round, and as high as 9 ft. has been broken with a round of four holes. This, of course, is unusual. Drifting costs at the Yellow Pine are $5 to $5.50 per ft., a fair average for the entire district, in which they run from $4.50 to $6.50.

With the exception of the Yellow Pine, costs of stoping and timbering are not available. These are $3.15 and $0.29 per ton respectively. It is probable that the other mines of the district are accomplishing this work at a lower figure, since the Yellow Pine is the only one in which it is necessary to resort to square-setting the entire deposit.

MILLING METHODS ADOPTED

The milling of the ores of the Goodsprings district presents an interesting variety of practice. The Yellow Pine has the only wet mill hereabouts, and it is probable that dry milling is more extensively applied here than in any other locality. Most of the mills are not concentrators, strictly speaking, but are separators, which separate one class of ore from another, making a variety of products, all of which are shipped and none rejected.

The Yellow Pine mill, which has a capacity of 100 tons per 24 hr. does not differ markedly from any other ore-dressing mill. The ore is fed over a grizzly to a jaw crusher, thence to rolls, impact screens, jigs and tables. Three products are made—lead concentrates, zinc concentrates and zinc slimes. The first two are trammed direct from the mill to the narrow-gage cars, but the slimes are settled in ponds before being shipped. The accompanying table gives an idea of the result of this system of treatment.

RESULTS OF TREATMENT OF ORES

Class	Pb, %	Zn, %	Ag, Oz.
Mill head	10.2	31.8	5.4
Lead concentrates	53.2	13.75	28.1
Zinc concentrates	4.4	33.2	2.5
Zinc slime	7.3	35.1	4.0

Milling costs during 1915 were $1.46 per ton. Two general systems of dry treatment are in vogue, the Plumb jig and the Stebbins table—both doing satisfactory work. The usual practice is to put the ore through a crusher and rolls, thence to impact screens or trommels, which return the oversize to the rolls and send the undersize to the concentrator. The various products are removed by screws or belts or by tramming. All machinery is kept tightly housed, and suction fans are used to draw off the dust; but, as has always been the case with the dry mills, the best that can be done in that respect is to alleviate the unpleasant condition to some extent.

The dry mills are mostly of limited capacity and have been in operation but a comparatively short time, so there is not much definite data as to their operation. One of them, the Anchor, using a Stebbins table, takes heads carrying 24% zinc and 35% lead and makes 34% zinc and 67% lead concentrates. The zinc concentrates carry 6% lead, but the lead concentrates are practically clean. The mill dust will average about the same as the heads.

The work described is on the separation of a lead-zinc ore in which no rejection is made. In treating a straight lead ore, tailings are rejected and disposed of by tramming. A saving of 65% is effected, 35% going into the tailings and dust, mostly the latter, from which it is hoped to recover it.

About 20 mines in the district are making a gross output of 6,000 tons a month, the average at present prices being about $65 a ton in lead and zinc. The Yellow Pine is the largest shipper. During 1915, with the mill out of commission for two months during which time only crude zinc ore was shipped, this company mined 18,400 tons. About 15% was shipped crude and the remainder milled. Gross receipts were $850,000, of which $700,000 was profit.

Next to the Yellow Pine the largest producer is the Potosí, which is employing 60 men and shipping 1,200 tons of crude zinc ore per month, although this mine is not considered within the Yellow Pine district proper.

THE ANCHOR DRY-CONCENTRATING MILL

Next to the Potosí is the Sultan, working 35 men and producing 860 tons per month. This mine is of interest in that it was opened only a year ago, commencing operations with three men, and has always paid its own way.

The other mines have still smaller outputs, some of the leases shipping a car or less a month. As an example of what some of the smaller mines are doing, the Bullion might be cited. This company is shipping monthly about 120 tons of lead concentrates carrying 62% lead and 6 oz. silver; 35 tons crude lead assaying 70% and 30 tons crude zinc assaying 38%. While the tonnage is not high, such values, coupled with the present high prices of the metals, make the output mount up in worth.

There seems to be plenty of ore in sight in the district. Mining and treatment conditions are not unfavorable, so it is reasonable to expect that the district will continue to produce while its metals command a fair price on the market.

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Protected Thermoelements are discussed by Arthur W. Gray, in scientific paper No. 276 of the U. S. Bureau of Standards. It is pointed out that usually the wires of thermoelements are either entirely unprotected or else merely have portions adjacent to the junctions in glass or porcelain tubes. Believing that this is insufficient, Mr. Gray describes a type of mounting developed and used by the Bureau of Standards

Tungsten-Molybdenum Ore Concentration*

An examination of ore from Callie Soak, Poona, Murchison Goldfields, of Western Australia, showed that it consisted of a mixture of molybdenite, scheelite and a smaller amount of wolframite in a gangue of quartz, mica and kaolin. The ore was too close-grained for hand sorting, although other portions of the lode might be suitable for grading in this way. An analysis of the ore showed 2.02% molybdenite and 9.07% tungstic oxide. The mineral composition was approximately 2% molybdenite, 10% scheelite, 1½% wolframite and 86½% gangue.

For marketing, concentrates should run at least 90% molybdenite in the case of molydenum ores and for tungsten ores, at least 60% tungstic oxide. Since all the minerals are heavier than quartz and the other gangue, water concentration appears reasonable. Molybdenite, however, has the property of floating on water, and this prevents successful gravity concentration, since it is almost impossible to overcome completely this floating effect. An attempt was made to concentrate the molybdenite by gravity, but it was a failure. Scheelite and molybdenite are extremely fragile, particularly when in the granular condition, and considerable loss is to be expected by sliming. The method of operation finally decided upon was first to remove the molybedenite by flotation, then to obtain the scheelite and wolframite from the residue by gravity concentration.

SERIES OF EXPERIMENTS CARRIED OUT

Two series of experiments were carried out, one on a portion crushed to pass an 80-mesh screen, the other on a portion crushed to pass 30-mesh. Satisfactory results were obtained only from the latter, as may be seen by Table 1.

TABLE 1. TESTS ON 80- AND 30-MESH CRUSHING

Size of Ore	Kind of Concentrates	Weight of Concentrates of Ore	Assay Value	Recovery on Original Ore
80-mesh....	Molybdenum	1.71%	37.8% MoS_2	31.9%
	Tungsten	12.9 %	36.3% WO_3	51.7%
	Molybdenum crude	6.01%	20.8% MoS_2	61.9%
	Molybdenum refloated	1.01% (A)	75.0% MoS_2	37.5%
30-mesh.....	Molybdenum treatedon 90-mesh screen	0.87% (B)	92.9% MoS_2	39.8%
	Tungsten	12.60%	57.5% WO_3	79.9%

Of the 80-mesh sample, a great deal was much finer. A 100-gram sample was taken and the ore sprinkled on the surface of water in small quantities. The molybdenite-bearing scum was decanted through a filter, the residue stirred briskly, and the extra molybdenite brought to the surface by this means was also filtered off. Total concentrates weighed 1.71 grams and assayed as shown in the table. This material is unprofitable on account of not only the low grade of concentrates, but also poor extraction. No oil was used in these tests, and this may in part account for the poor extraction. At the same time the large amount of clayey slime present reduces the molybdenite value of the concentrates by simple adulteration. It seems also to give a poor extraction by incasing the molybdenite particles with fine dust, thus fouling or clogging them and preventing them from floating freely. The residue, after the removal of molybdenite, was panned down in the usual way to obtain the tungsten. There was again a good deal of sliming, and much of the scheelite was lost in this way. The weight of concentrates was 12.9 grams and assayed as shown. Here, too, both the grade and recovery are unsatisfactory, a result largely due to the overgrinding of the ore.

Of the 30-mesh material, much of it was ground too much—half of it would pass a 60-mesh screen. This lack of uniformity in the crushed product is undesirable, and it is believed that with more uniform crushing even better results could have been secured. Owing to the diversity and hardness of the ingredient minerals, more than ordinary care is required in crushing ore of the kind. This extra care will be more than paid for in the greater effectiveness of the subsequent treatment and the ensuing higher grade of extraction. The crushing plant should not be fed with excessive quantities of ore at one time, for if it is, overcrushing will surely result. Every endeavor should be made to obtain uniformity in size of ore particles, in this case between 30- and 40-mesh. Some sliming is of course unavoidable, but it can be reduced to a very small amount.

In testing, 100 grams of the sample were taken, as before, and the molybdenite removed first. This time the effect of oil and acid were investigated in addition to simple flotation on water. The separation was carried on in three stages. First, using water flotation alone, the ore was sprinkled on the surface and the scum decanted off. Vigorous stirring and blowing of air through the pulp caused very little more sulphide to rise. Oil was then added in different proportions, from 1 in 10,000 to 1 in 1,000, the whole being vigorously agitated in a closed vessel with each addition. The amount of scum formed each time was noted, and when the proportion of oil added had reached the latter figure, it was found to be sufficient. Further addition of oil did not extract any more molybdenite. The total scums from oil flotation were set aside. Possibly with a richer ore more oil would have been required, the amount being determined by experiment. The oil used was the ordinary commercial phellandrene, obtained from the eucalyptus tree.

RESULTS OF ACID AND OIL TREATMENT

An acid treatment was then combined with the oil, and the ore residue was shaken vigorously with oily water, 1 in 1,000, and varying amounts of sulphuric acid were added in proportions of 1 in 10,000 to 1 in 1,000. The use of acid is not warranted, because as will be seen from Table 2, the additional recovery of sulphide is so small. The acid did no harm, but was unnecessary so long as air was carried into the pulp by agitation or blowing. The weights of various extracts were as shown in Table 2.

TABLE 2. WEIGHT OF CONCENTRATES RECOVERED

Treatment:	Weight of Concentrates, Grams
Water alone	2.785
Water and oil	2.948
Water, oil and acid	0.276
Total	6.009

Each concentrate contained a good deal of slime in addition to molybdenite, but as the aim was primarily to obtain high recovery, even at the risk of producing lower-grade concentrates, it was found impossible to avoid this. The assay results, as already given, was 20.8% of molybdenite, equal to an extraction of 61% of the total molybdenite in the ore. This recovery was rather disappointing, but was the best obtainable, although too low for market as it stood. About 79% of slimy gangue constituted the valueless portion. Two methods were then adopted to improve the result: First, an additional water-oil flotation and agitation and, second, a simple screening through a 90-mesh screen, rejecting the portion passing through. The latter gave best results. Recovery was slightly higher and the grade much better with sizing than with the flotation treatment, though in both cases the actual percentage of recovery was low. Its simplicity makes the second method of increased value, and it will be observed that it is only about 6% of the ore crushed that would need screening. Since screening operations are troublesome, the smaller the quantity of material to be dealt with in this way the better. The results of these two tests are included in Table 3. For every ton of ore treated by flotation and followed by sizing of concentrates, about 181 lb. of high-grade molybdenite concentrates would be produced.

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*Abstract of an article by A. J. Robertson, in Bulletin No. 64 of the Geological Survey of Western Australia.

It is not possible to get high-grade molybdenite concentrates by a single treatment. Slime is always formed in some amounts and will always collect with the molybdenite, either from suspension in the water or by actual floating on the surface film. The effect of slimes on concentrate grades was brought home more forcibly by the following experiments: A sample of crushed ore, at 30-mesh, was sized into three portions and the molybdenite in each lot was floated off by water alone and collected. The results, almost self-explanatory, are shown in Table 3. Here it is obvious that there is one advantage of preliminary sizing. It entails better recoveries in each case than obtained by direct treatment of the unsized ore.

TABLE 3. EFFECT OF SLIMES ON CONCENTRATE GRADE

	Sized Portion, Grams	Recovery	Grade of Concentrates
30-90 mesh	62.3	Good	About 70% MoS_2
90-150 mesh	10.7	Good	About 40% MoS_2
150 and finer	26.5	Good	About 5% MoS_2
Loss dust	0.5	80-90%	....
Ore taken	100.0		

TABLE 4. DISTRIBUTION OF VALUES

Per Ton of Ore:	Molybdenum £	s	d	Tungsten £	s	d	Total £	s	d
In ore	10	0	0	13	10	0	23	10	0
In concentrates	4	0	0	10	16	0	14	16	0
In tailings	6	0	0	2	14	0	8	14	0

It is also to be noted that the grade of concentrates falls off as the fineness increases. Since it would not pay to size the ore in a treatment plant in this way, the aim should be to crush to uniform size (30-mesh found most suitable) avoiding sliming by careful crushing.

Means of Recovering the Tungsten

For the recovery of tungsten the remainder of the 30-mesh sample left after removal of molybdenite was concentrated by panning. Concentrates free from slimes and weighing 12.6 grams were easily obtained. As both assay value and percentage recovery indicate, it can be taken as satisfactory. A great part of the loss is attributable to overcrushing. Every ton of ore treated would yield about 270 lb. of tungsten concentrates, running about 60% tungstic oxide (WO_3). The complete distribution of values indicated by the experiments on ores crushed to pass a 30-mesh screen are therefore as shown in Table 4. These results have been obtained by flotation of the molybdenite with oil at atmospheric pressure and simple gravity concentration of the scheelite and wolframite. The recovery of the latter presents no difficulties and should be carried out successfully on ordinary concentration tables, provided care be taken to avoid grinding the more fragile scheelite into slime.

Two other methods are in use for the concentration of molybdenum ores—flotation without oil at atmospheric pressure and flotation with oil under partial vacuum (the Elmore process). The former has proved successful in Queensland, while the latter is claimed to have yielded extractions of 90% on Norwegian ores.

Since the ore is worth only £4 per ton for molybdenite as against £11 for tungsten, it would probably not be worth while making an elaborate treatment for the recovery of molybdenite. The more economic process would be to treat it directly for its tungsten content and catch the chance molybdenum that comes off without making any extensive provision for doing it. Should it be possible to crush without making so much slime, a better recovery of molybdenite would be obtained and would prove a payable proposition.

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Manganese Ore in 1915

Manganese ore production in the United States in 1915, as reported by the United States Geological Survey, was 9,651 long tons, the largest since 1901 and more than three times the production in 1914, which was 2,635 tons. This output was made by 34 operators in 10 states, of which the four most important, in order of output, were Georgia, California, Virginia and Arkansas. In addition, Alabama, Arizona, Colorado, Tennessee, Texas and Utah produced small amounts of ore. The imports of manganese ore for 1915 were 313,985 tons, compared with 283,294 tons for 1914. Of the ore imported in 1915, 268,786 tons, or 85% of the total, came from Brazil—more than twice the quantity received from that country in any preceding year. The imports from India were 36,450 tons, or about one-fourth the average of the preceding 10 years. No ore was received from Russia.

The production of manganiferous iron and silver ores for 1915 was 798,404 tons, which was almost twice the output in 1914.

The shortage of high-grade manganese dioxide ores caused by cessation of exports from Russia has become a serious menace to the dry-battery and flint-glass industries. Prices as high as $85 a ton are freely offered, but as only a few deposits in the United States can supply ore of this grade, little domestic ore has come to the market. There is record of a marketed production of 550 tons from mines in Arizona, California, Colorado, Utah and Virginia during 1915, whereas the annual demand ranges from 20,000 to 25,000 tons. Ore of this grade was imported during 1915 from Japan and Cuba.

*

The Adverse Possession of Mining Property

In a suit to recover possession of a lode mining claim in Utah, it was decided by the supreme court of that state that there can be no such adverse possession of land as may ripen into title through mere occupancy under claim of ownership where title has not passed out of the United States and where claimant is not seeking in good faith to acquire regular title from the Government. (Utah Copper Co. vs. Eckman, 152 Pacific Reporter, 178.)

Another point decided in the same case depends upon the Utah statute which provides that mining property shall be taxed at the price paid the United States therefor, unless the surface or some other part of the real estate be used for nonmining purposes, in which case that part is to be taxed at its value for such purposes. Under this section the court holds that a person who has been in possession of the surface of a mining claim under assertion of ownership for the statutory period which ripens adverse possession into legal title, and who has in the meantime improved the surface, may be assessed for taxation to the value of the surface and its improvements, and that his payment of such taxes will support his claim of title to such part of the property as against the owner of the mining claim.

Electric Headlights for Mine Locomotives

The increasing use of electric locomotives underground makes imperative the use of headlights that will satisfactorily illuminate the pitchy darkness often prevalent. This affords a source of protection to the employer that he cannot afford to ignore; often preventing possible litigation that might otherwise be experienced through injury to employees.

A thorough investigation by the General Electric Co.'s engineers into the requirements of mine illumination, of which the headlight unit is a most important part, has occasioned the design of headlights for locomotives, descriptions of which follow:

Fig. 1 shows an arc headlight composed of a solid cast-iron frame with hinged cast-iron door of very rugged construction, weighing 69 lb., the pick-up distance of which is from 1,000 to 1,200 ft. ahead with the standard electrode and 1,300 to 1,500 ft. with the high-efficiency electrode.

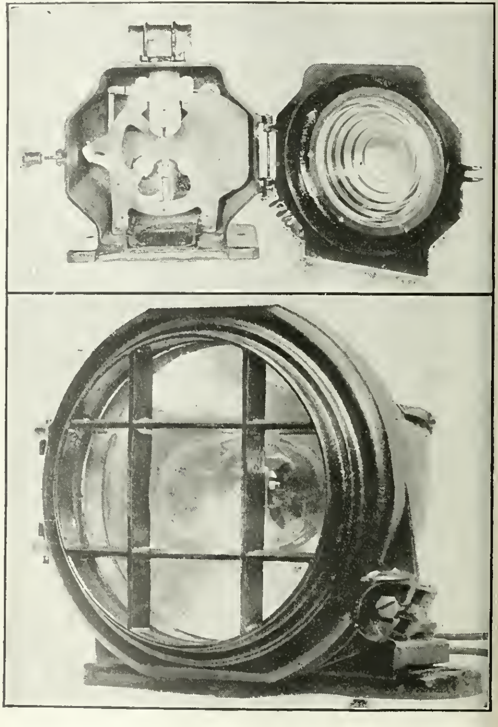
This type has been designed primarily for use in the long hauls where the loaded and unloaded trains are operated at comparatively high speeds. There is, however, another field for a lower-powered headlight, and for this reason a unit has been designed, operating substantially on the same principle as that already described, but with a lower rating for use on locomotives making the short hauls and gathering.

This headlight is provided with a two-compartment casing, weighs 35 lb. and has a pickup distance of from 500 to 700 ft. in front of the locomotive.

In the majority of instances in mining practice, locomotives are provided with a double-end equipment, consisting of two headlights, a single rheostat and two snap switches with fused cutouts, the negative leads of the headlight being grounded, while the positive leads are connected to the supply side of the rheostat and the feeder side of the rheostat is connected directly to the trolley circuit. There are conditions, however, which make it desirable to use a single headlight, where there is not room to mount two, one at each end of the locomotive. The use of a single headlight makes it necessary that the beam be directed in either direction toward which the locomotive may travel. For this reason a headlight with a turret has been developed.

It is desirable on low-voltage lines (250 to 220 volts) that the overhead construction and rail-bonding be in good condition, otherwise the line drop in remote sections of the mines will be excessively high and the line voltage correspondingly low. Good overhead construction and returns add to the efficiency of all mining equipment, including the locomotive headlight.

For a number of years past many mine locomotives have been equipped with incandescent headlights, a novel form of which is shown in Fig. 2, in which electrical and lighting efficiency as well as economy of occupied space has been considered. This headlight is composed of a solid cast-iron casing with hinged door, removable cast-iron cover and a sub-base. In general mining practice the 105- to 125-volt lamps are more commonly used. The pick-up distance for this headlight when used with the 110-volt, 72- and 94-watt lamps is from 500 and 600 ft., so that with this particular lamp, in many cases, the headlight can be used on the long hauls, while with the lamps of lesser wattages the headlight can be as well adapted for the short hauls.



LUMINOUS ARC AND INCANDESCENT HEADLIGHTS

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The Production of Tungsten Ore in Argentine according to Consul General W. Henry Robertson, Buenos Aires, has been controlled largely by one company, the Hansa Mines (Ltd.), a German concern which is reported to be affiliated with the Krupp interests of that country. Up to about six months ago it operated the only mine in this Republic, located at Concaron, in the Province of San Luis. This one mine can produce approximately 50 tons a month, when operating at full capacity. Until the outbreak of the war its entire output was shipped to Germany. The total Argentine exports of tungsten ore from 1909 to 1913, inclusive, amounted to 3,319 metric tons. Of this amount, 3,309 tons went to Germany and 10 tons to Great Britain. The exports to the latter country were in 1909 and 1910. Since then, up to 1915, Germany has been the only purchaser.

Stope Surveying at Mount Lyell*

SYNOPSIS—A novel scheme for stope surveying, made necessary by the extremely irregular character of the ore deposit and the absence of definite boundaries. The contour-line method is used in plotting the openings, and a careful system of frequent measurement is followed.

The method of stope surveying as practiced at the Mount Lyell company's mines has been evolved out of the exigencies created by special conditions. It presents some novel features and has proved effective for all requirements. All stope-measurement work is brought under one complete system, to which office methods are standardized. Before proceeding to deal with the subject, a brief description of the physical characteristics of the orebodies of each mine and the method of stoping will serve to show cause for departure from ordinary survey practice.

The orebodies of the North Lyell mine occur on or near the conglomerate-schist contact, and being probably the result of replacements of both rocks, they rarely present any definite walls. It is usual for the payable material to merge into the respective country rocks, and the limit of the occurrence is defined rather by assay value than by any distinct natural boundaries. The general configuration of these orebodies, therefore, is highly erratic both in horizontal and vertical section, so that in order to obtain an accurate record of any occurrence, the measurement of the actual contour at short vertical intervals is essential.

Stoping is carried out on a modification of the rill system, perhaps more properly described as arched-back or "dome" stoping. Mullock[1] rises are placed in as convenient positions as the erratic configuration of each orebody will allow, and around these rises the back is kept well-arched, both longitudinally and transversely. The larger stopes are divided into arbitrary sections in which ore-breaking and mullocking are carried out in rotation, so that the whole excavation is seldom open for measuring at any one particular time. Stacking or square-setting on the mullock rill is employed where unfavorable ground is cut, and discontinued as the back becomes stronger. Square-sets, closely followed by mullock, are used for picking up the level above, one or more floors being adopted, the number depending on local conditions. Fig. 1 typically illustrates the peripheral changes these orebodies exhibit between levels. The first outline shows the ground floor at the 1,000-ft. level, then follow contours at intervals of 10 ft. up to 60 ft. The last is the ground floor plan at the 850-ft. level.

The Mount Lyell Mine

In the Mount Lyell mine the orebody is a lenticular mass of pyrites occurring at the junction of schist and conglomerate, the latter forming the foot wall of the deposit. It is irregularly eliptical in contour, and pipelike, or columnar, considered vertically. Taken generally, it is sharply defined against the inclosing rocks, and there is not the gradual shading into either schist or conglomerate that obtains with the North Lyell orebodies. Occasional inclusions of schist are found, however.

Extraction has been carried out by opencutting down to No. 5 level, the portion below this being worked by underground methods. Exploration work having established the dimensions of the body, it was possible to carry out stoping operations to a predesigned scheme of pillar-and-stope mining. The pillars are 25 ft. in thickness, and the stopes are beaten out over floor areas varying up to 15,000 sq.ft.

Stoping is done exclusively on the arched-back method, each stope having a centrally situated rise connected to the mullock-pass system. The back is cut out dome-shaped from the commencement of overhead breaking. The picking-up of the level above thus begins around the rise, and the depleted area enlarges as the domed roof ascends until the whole of the ore is stoped to the pillars or walls. About six feet of back is broken between successive mullockings, yielding a quantity of ore varying in the different stopes up to 15,000 tons.

At both the North Lyell and Mount Lyell mines the ground floors are timbered wholly or partly with square-sets. In the latter case gallery sets are stood to provide access to ore passes and for through traffic. The periodical surveys of these ground floors are performed by the ordinary methods observed in most mines.

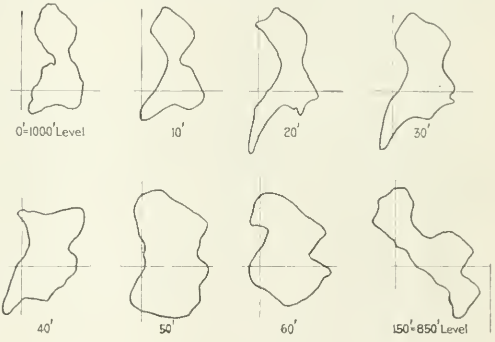

FIG. 1. OUTLINES OF STOPE SECTIONS

The measurement of the overhead portion of these stopes, however, at the outset presented difficulties resultant on the scheme of stoping adopted. The highly irregular shape of many of the stopes, combined with the steep slope of the mullock rill, made the problem of effecting comprehensive surveys something beyond the practical scope of ordinary stope-survey methods. Under these circumstances the taking of parallel cross-sections at equal distances was found to be too unwieldy in practice and insufficient for requirements.

The system inaugurated, which has been since successfully followed, is one of "contour surveying." By it field and office work are simple and, for the extent of ground covered, rapidly performed, the suitability of the resulting contour plans, both as records and for working guidance, being pronounced. It is of paramount importance that the shape of the domed arch should be carefully studied, especially in relation to outside factors that do not appear in an actual inspection of the stope. Exploratory work has frequently to be undertaken in stopes as they are carried up, and the accurate piecing together of all information gained is necessary to provide facilities for stoping where the orebody develops some local eccentricity. It is of the utmost importance to have on record the precise shape and the geological features of the orebody from the ground floor upward as a guide for laying out any subsequent work that may be necessary. In many of the larger stopes the picking-up stage is reached at the top of the dome before the lower portion has left the ground floor, and owing to this large vertical range a considerable amount of fresh information becomes continuously available, from which necessary variations in the original scheme for working the lower portion can be made.

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*An article by G. F. Jakins and L. J. Coulter, published in "Proceedings of the Australian Institute of Mining Engineers," N. S., No. 19, 1915.

[1] Country rock, or waste.

Stopes are measured before each mullocking and also at half-yearly intervals, for the purpose of computing extractions and ore reserves, and it is not common practice to measure stopes for ascertaining extracted quantities over shorter periods. Contractors are paid on truck tallies, and actual tonnages for cost purposes, etc., are allocated from four-weekly weighbridge receipts. The system of ore transport also admits of intermediate quantity checks. It is only on rare occasions that it is found necessary to make measurements for progress payments.

Performance of Field Work

The field work performed in a contour survey consists in observing a number of points on the walls and back of the stope, so that their position and height above floor level can be fixed on a plan and contour lines interpolated. Field measurements are effected by using both the horizontal and vertical circles of the theodolite in conjunction with the measuring tape, the surveyor requiring two assistants—a rodman and a tapereader.

Connection to the overhead portion of a stope is made from the level below by a direct horizontal and vertical traverse wherever practicable. This can generally be done in a stope where the lower portion has not left the ground floor. The instrument is set under the nearest permanent level station, and a traverse run to the most convenient point for sighting up into the stope. At this point the instrument is set, and its height above floor level measured. The rodman then drives the first peg on the mullock rill and gives the surveyor a plumb-line sight for bearing. The rod is next held on the peg, a reading taken, and the vertical angle recorded. The tape is then stretched from the instrument to the observed point on the rod and the chainage booked. The notes are entered in diagrammatic form (Fig. 2).

Here 108° 46′ is the bearing from station 1 on the level to station 2 in the stope. The height of the instrument is 4.7 ft. above floor level, and 27.6 ft. is measured on an inclination of 23° 40′ to a point 2.8 ft. above station 2.

From station 2 the rodman arranges for a third station in the stope, and this is traversed to from station 2 in a similar way, and so on until sufficient stations are placed in the stope from which to make the required observations. In these traverses angles are booked to the nearest minute, and chainages and heights to the nearest tenth of a foot. Angles of elevation are marked + and depression —. The first set of observations is taken from station 2, and in the following way: The instrument is set up for both limbs and placed in meridian by setting the back bearing, sighting station 1, and plumbing. The rodman clips the ring of the tape and a lighted candle to the end of the rod and holds it against any selected point on the wall.[2] The tapereader holds the box at the intrument and calls the measurement, paying out or winding in as is required. The bearing and vertical angle are read, and the rod is then moved toward the instrument in the same vertical plane to another point, which is observed in a similar way. After this additional points are taken as considered necessary, still on the same bearing.

The notes are booked in sketch form (Fig. 3).

The rodman then moves to another point along the wall, and further observations are taken on a new bearing, and so on until a radiating set of sections has been completed around station 2. The instrument is then moved to station 3, where the procedure is repeated, and so on until the survey is finished.

The angles in these observations are booked to the nearest 10′ and distances to the nearest half-foot, it being needless refinement to attempt greater accuracy on a rough surface such as a stope presents. The angles are read directly from the plates, without employing reading glass or vernier scale. In this way shots are very rapidly taken, and a stope requiring, say, three observing stations can be measured with ground-floor connection easily in 1½ hr. A surveyor generally reckons 15 to 20 min. for each station, at which he will take from 40 to 60 points after setting up his instrument.

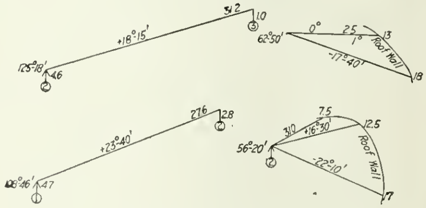

FIG. 2. NOTEBOOK DIAGRAMS. FIG. 3

Selecting Proper Stations

Judgment has to be shown in selecting stations that will give a good command over the area to be observed. Stations involving measurements to points more than 40 ft. distant are generally inadvisable, and the survey is better effected by inserting an extra one. The surveyor should avoid picking up small local crevices and bumps, which are unimportant in themselves and needlessly distort the contour lines. On an average, adjoining sections should intercept the walls about 6 ft. apart, and each section should not be followed back too close to the instrument, else a surfeit of information will be collected round the station. Only sufficient points should be taken to insure a good general survey of the roof.

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[2] A convenient type of rod for this work consists of two pieces of 1-in. "tamping stick," each 5 ft. 6 in. long. These can be fitted together to make an 11-ft. rod by slipping the end of one piece into a ferrule fitted on the other. The rod is painted in feet with alternate black and white rings. The end of the rod is fitted with a clip to hold the candle, and the ring of the tape is also fastened to it. The tape used is an ordinary 66-ft. metallic box-band.

In a stope where the whole working has left the ground loor, a satisfactory connection can sometimes be obtained by sighting up an inclined ladderway; or use may be made of an underlay winze from the level above. Occasionally a line may be established up in the stope itself along a timbered gangway, etc., which may be left open enough to afford connection for several successive surveys.

Where such means are not available and the stope is a large one, two ladderways are selected, one at each end of the stope. If possible, a wire is hung in each from the top and connected to the permanent traverse on the ground floor. When the ladderways are too crooked to admit of this being done, a combination of plumbing and traversing has to be effected, generally with the aid of wall plate and diagonal eyepiece, care being taken during such work to make permanent any points likely to be of service in subsequent surveys.

The two points thus established in the stope above are included in the stope traverse, which is conducted on an observed magnetic meridian, and afterward corrected by calculation with the bearing between the wires on the level below. Such a case is shown in Fig. 4. In measuring this stope two ladderways were used, and wires *A* and *B* were suspended and observed from stations 12 and 16 on the ground floor. The instrument was then taken into the stope, and set on station 1, where a magnetic-needle observation was taken for a meridian on which all bearings read in the stope were temporarily based.

On the completion of the survey the bearing on the level between *A* and *B* was calculated via stations 12 to 16, information from the office coördinate book being used to facilitate the computation. The bearing between *A* and *B* was then calculated via stations 1 to 6 in terms of the temporary stope meridian, and the correction to all stope bearings entered in the notes, so that the adjustment could be made in plotting.

In this work the length *AB* in both traverses is also computed and gives a useful check on the accuracy of the stope traverse. Another good check is obtained on the vertical heights as measured up one ladderway, through the stope by medium of instrument and tape, and down the second ladderway. Any difference of floor level at *A* and *B* being known, the vertical coördinates of the stope traverse can be then balanced. As these calculations can be effected in a few minutes with a slide rule, the surveyor generally prefers to so balance his work before he leaves the stope. Wire connections may be similarly made through vertical winzes from the level above.

Where a small portion only of a stope is open and requires measurement, a single-wire connection is made from the floor level, or level above, to the stope. A magnetic observation is taken in the stope for meridian and adopted for the survey. If ordinary precautions are taken against local attraction, this meridian can be relied upon within 20′, and is sufficiently close for the small area to be surveyed.

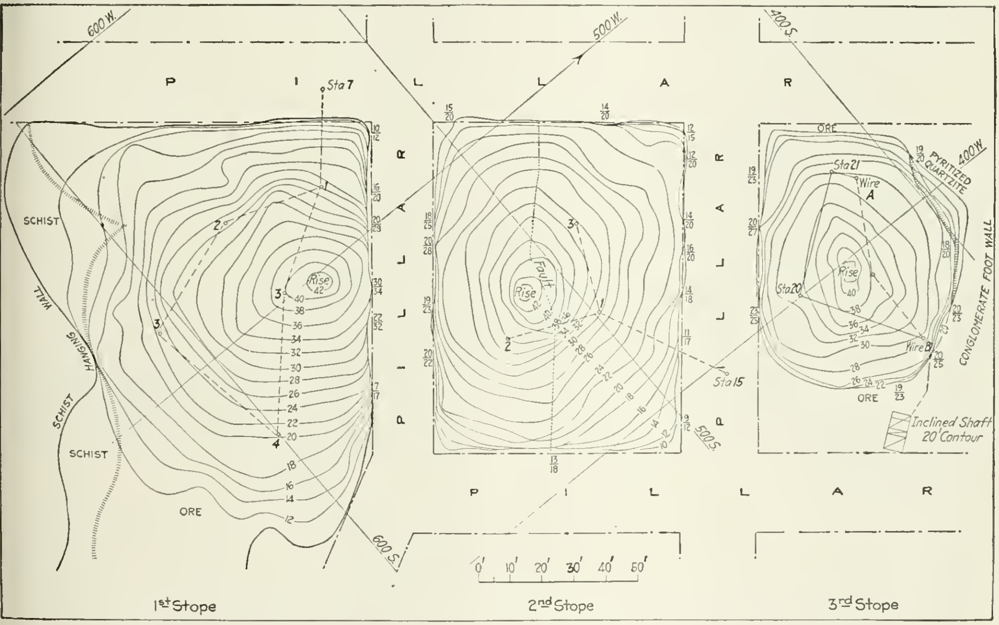

FIG. 4. PLAN SHOWING CONTOUR OF STOPE ROOFS, NO. 7 LEVEL, MOUNT LYELL MINE

In Fig. 5 is shown contour plans of stopes across the Mount Lyell orebody. In Nos. 1 and 2 stopes direct traverses were made into the stopes from crosscuts through the pillars on the ground floor. The arrangement of the observing stations is also shown. In the case of No. 2A stope a two-wire connection was made, a single observing station being sufficient for the measurement. In No. 1 stope the schist hanging will exposed is marked, while in No. 2A stope a flat portion of the foot wall is shown between the 18-ft. and 22-ft. contours.

Field notes are kept on the loose-leaf system and filed in the office in special books kept for each stope. All calculations of connections are made and tabled in the fieldbook. Before going underground to make a survey, the notes of any previous connections likely to be of service are transferred from the office file to the fieldbook. One connection can sometimes be used for several surveys, or the connection of an old survey may be slightly modified or extended to serve a subsequent one.

Contour plans are drafted on tracing linen to a 10-ft. scale, and contour lines are shown 2 ft. apart vertically. The office work of a contour survey begins with the reduction of the field measurements into horizontal and vertical components, and this reduction may be effected either graphically or by calculation. The former method has been superseded by the latter, with marked advantages. In view, however, of the fact that the method of calculation involves the use of the slide rule to be practicable, it may be interesting to describe the graphic method, which successfully dealt with these reductions before the slide-rule method was adopted.

The graphic method consists in first preparing a separate graph plan on 10-ft. scale, on which all measurements are plotted in one vertical plane. The coördinates are then scaled and transferred to the contour plan on their several respective bearings.

The graph plan is first prepared by ruling it with parallel horizontal lines to correspond with the 2-ft. contour intervals. Then, to instance the method of procedure, if we take the notes given in Figs. 2 and 3, station 1 is first placed on the graph, with the height of the instrument 4.7 ft. above floor level. The line from 1 to 2 is then set off on an elevation of 23° 40′ and length 27.6 ft. with protractor and scale, the position of 2 being obtained by measuring down 2.8 ft. from the end of this line. The height of the instrument over 2 is then marked, and the line 2 to 3 set out in a similar way. The sections taken from 2, Fig. 2, are then plotted.

The second method of reducing the survey measurements to horizontal and vertical coördinates—that is, by calculating the actual heights and distances—is to be preferred, provided the results can be conveniently attained and entered in the field notes. The time involved in plotting the graph is saved, and the draftsman plots direct from the field notes all information gained by the survey. In addition to the convenience of this, he is better able to reconcile the different results gained in the survey, and a more reliable plan is likely to result. A means has, however, to be selected so that these computations can be quickly and easily performed. Mathematical tables must be set aside as too combersome for such a purpose, but a diagram may be brought within range of practicability in spite of its complicated appearance. Such a diagram may be prepared by marking angles from 0° 90° by lines radiating from an origi and setting out slope distances by arcs centered at it The vertical and horizontal components of any radiu on any vertical angle may be then obtained by readin the corresponding ordinate and abscissa, the diagra being ruled with horizontal and vertical lines to facilitat the operation.

The most efficient means, however, is the slide rul In this work reductions are easily made with the rul and entered in the notes at the rate of 250 observe points or 500 calculations per hour. In actual practic it is found that mistakes are singularly rare and ar almost invariably detected in plotting, so that, while i was formerly the custom for the draftsman to chec the surveyor's reductions, the plot is now regarded a sufficient safeguard against error. It must be pointe

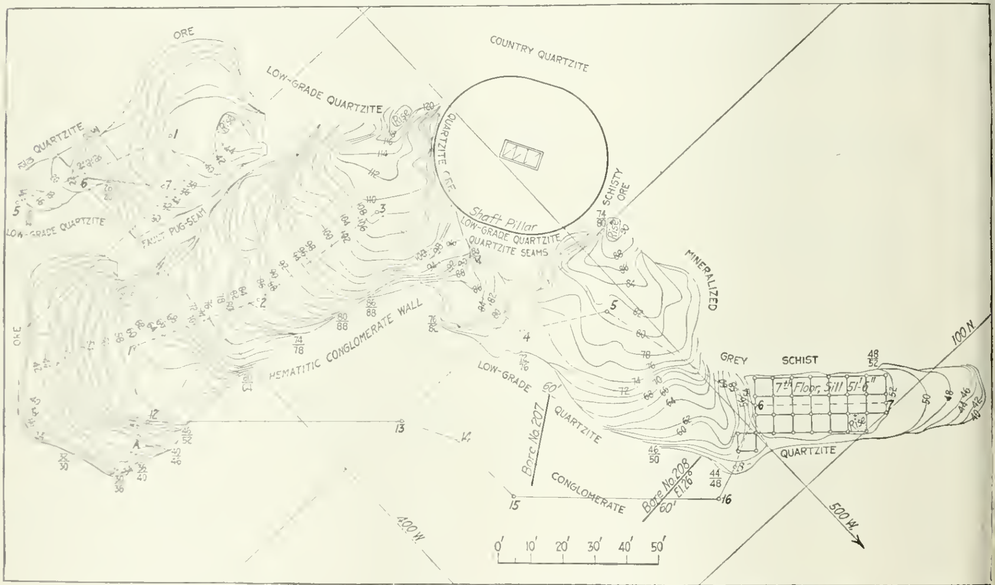

FIG. 5. CONTOUR PLAN OF LARGE STOPE, 850-FT. LEVEL, IN NORTH LYELL MINE

out that the measured lines are short, and the limits of accuracy observed in the field are 10′ and 6 in., so that any attempt at greater accuracy than 6 in. in the reduction of these measurements is unnecessary.

The plotting of the contour plan proceeds as follows: The stope traverse is drawn in the ordinary way, except that horizontal components of slope measurements are found in the notes. The protractor is then set over each station in turn, and the observed points with their vertical heights above floor level marked. The area thus becomes covered with a number of level points, from which the contour lines are interpolated.

The preparation of a contour plan thus made takes from one to five hours, according to the area of stope measured and the detail required apart from the contour lines. The total time saved over the graphic method is one-third. This of course includes all reductions made by the surveyor.

In preparing a contour plan the use of colored inks based on a conventional system has distinct advantages in presenting a plan clear in detail. For instance, floor-level traverses are shown red, stope traverses black, contour lines sienna, underfoot contours blue, and so on. Before the finished contour plan is filed, it is used for the preparation of the following plans and sections: A representative longitudinal and transverse section is struck and added to a plan showing a series of such sections arranged in composite chronological order. This is useful in presenting a general idea of the doming and the progress of exploitation of the stope. A plan is then prepared, for the underground foreman, of any stope in which one or more fixed boundaries, such as pillars, have to be observed. The foreman's working guide to a pillar generally consists of two or more ore passes which are reared against it. The positions of these passes are noted each survey and entered on the tracing, which also shows the position of the pillar, so that any tendency toward encroachment or want of alignment may be ascertained and corrected.

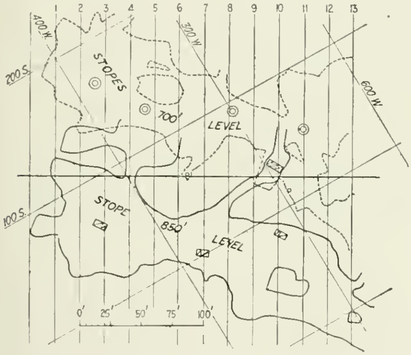

FIG. 6. SURVEY OF STOPES ON TWO LEVELS

The contours at 10-ft. intervals above floor level are reduced by pantograph to 30-ft. scale and plotted on a special set of plans kept for superimposing on the working-level plans, for general information and for model-building purposes, etc. Each contour, bearing its survey date, is dotted until it reaches the wall of the orebody, continuing along it in a full line. Ore reserves are computed from a series of sections along parallel lines through the orebody between two levels. The direction of these lines is made as transverse to the body as its known irregular shape will allow. The layout of a typical set of sections is shown in Fig. 6, which deals with a portion of an orebody between the 850- and 700-ft. levels. The lines are 20 ft. apart horizontally, and numbered in rotation. The drawing shows how the work is carried out.

The finished contour plan is finally filed in the booklet of plans of that particular stope. It is inserted in correct coördinated position over the plan compiled from the previous survey, with which it can be closely compared through the transparent linen. Any alterations in form of the orebody that is being developed can thus be studied and information obtained for laying out any exploratory work deemed necessary, or for varying the existing scheme of stoping. The method is capable of considerable variation and is flexible.

The special fitness of such a working plan continually presents itself as providing means for considering stopes in a concrete manner with much greater convenience than is possible with a series of detached contours or sections.

Mine Equipment as Part of Realty

By A. L. H. Street*

A development company holding an option to purchase a Montana lode-mining claim hired an electric hoist from plaintiff at an agreed monthly rental of $50, and the hoist was installed at the mine and used. The development company having forfeited its right to purchase the claim, the mining property was sold to defendant, who refused to surrender the hoist, claiming that it had become a part of the real estate purchased by defendant. Suit brought to recover possession lately terminated in plaintiff's favor, as shown by the decision handed down by the Montana Supreme Court in the case of Montana Electric Co. vs. Northern Valley Mining Co. (153 Pacific Reporter, 1017).

The court holds that the question whether mining equipment installed at a mine becomes a part of the real estate or retains its character as chattel property is primarily to be determined by the intention of the parties to the contract under which the installation was made. Here it is held that intention to make the hoist a part of the real estate was negatived by the understanding that it should be returned to plaintiff when the period of hiring terminated. The fact that the hoist was placed upon a substantial foundation and an engine house constructed over it did not prevent it from being removable as a chattel, it appearing that that could be accomplished without material injury to the realty.

Whatever may be the rights of an innocent purchaser of a mine to assume that equipment affixed to the land was intended to become a permanent part thereof, it is held that in this case defendant was deprived of any such rights by reason of the fact that notice was imparted to defendant's promoter and chief stockholder and principal officer before defendant bought the mining property, disclosing plaintiff's interest in the hoist.

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*Attorney at law, 829 Security Building, Minneapolis, Minn.

Arizona Production in 1916

The mines and smelteries of Arizona have been working at a pressure so high in 1916 that they are probably making record productions of all metals. If they continue to work at the present rate during the year, they will make an output of over 600,000,000 lb. of copper, against about 450,000,000 lb. in 1915, according to reports received by the United States Geological Survey from Victor C. Heikes, of the Salt Lake office. The probable corresponding increase in the output of precious metals and in that of lead and zinc will, at the greatly increased prices, make the total value of the output in 1916 nearly double that of 1915, which was about $88,000,000.

Thus Arizona not only retains first place as a copper producer, but is producing at a rate nearly double that of any other state. Aside from a general effort to take advantage of an unusually active market, several factors have aided this increase, such as the settlement of the strike at the Clifton-Morenci mines in January. The International smelter, which treats Inspiration ore, contributes the greatest part of the increase, for this plant is supplying about one-fourth of the total copper. Marked increases and improvements were made at the United Verde, Miami, Calumet & Arizona and Old Dominion mines, and the Sasco plant in Pima County was again blown in. The railroad to Ajo was completed, and work has been begun there on a 4,000-ton leaching plant. There is great activity in the production of gold, especially in Mohave County, and the high price of zinc has stimulated production at the Tennessee, Union Basin and Kingman zinc properties. The mill at the Union Basin mine was enlarged, and work at the San Xavier mine in Pima County was resumed.

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Government Reports Elaborate Concrete Strength Data

As Technologic Paper No. 58, the United States Bureau of Standards, S. W. Stratton, director, has just issued a most extensive resumé of the properties of concrete. The title of the bulletin is "Strength and Other Properties of Concretes as Affected by Materials and Methods of Preparation." and it has been prepared by Rudolph J. Wig, engineer-physicist, G. M. Williams, assistant engineer-physicist, and E. R. Gates, assistant physicist, all of the Bureau. The book, which contains 172 pages, including 38 tables and 44 diagrams, may be obtained from the Bureau of Standards or the Superintendent of Documents, at Washington.

The data presented include the results of some 20,000 tests. Compressive and tensile tests were made upon mortars at different ages, including about 240 different sands and stone screenings, and compressive tests were made on concretes composed of 60 aggregates, including limestones, gravels, granites, cinders and trap rock, as well as tests of the physical properties of the sands, stone screenings and coarse aggregates. These data furnish information on the range of strength values which were obtained with different aggregates in various consistencies, with variation in workmanship of fabrication, in the method of placing, and in subsequent exposure.

The results of such an elaborate series cannot be given here, but as an indication of the scope of the series there are appended, from *Engineering News*, the conclusions arrived at by the authors. The tabulations and diagrams themselves form one of the most valuable contributions to the knowledge of concrete so far made public. The conclusions are as follows:

PORTLAND-CEMENT MORTAR MIXTURES

Sand as a type of fine aggregate cannot be said to be superior to limestone screenings.

The proper gradation of the fine aggregate for maximum strength in a mortar appears to vary for different materials.

The results of the tests of the mortars included in this paper would indicate that for most materials the highest strengths are obtained with those having a gradation of particles approaching a straight line. There are materials however, having a gradation varying widely from a straight line, which give high strength in mortars.

The quality of a sand cannot be judged from its gradation alone. Any limitation arbitrarily placed upon the proportions of the particles of various sizes will probably eliminate some very satisfactory materials.

No fine aggregate should be rejected because of its "silt" content determined by washing or assuming the materia passing the No. 200 sieve as silt, as it may be advantageous even in relatively large quantities or detrimental in smal quantities, depending upon its form, character and distribution.

Mortars having high density usually have high strength

The quality of sands to be used in cement mortars cannot be determined from their "uniformity coefficients."

There is no difference in the strength developed by rounded and sharp-grained sands.

The quality of sands cannot be determined from their specific gravity and porosity.

Sands having a gradation approaching Fuller's curve for maximum density do not have as great strength as sands having a gradation approaching a straight line.

The only satisfactory method of determining the value of a fine aggregate in mortar mixtures is to test it in the mixture in the proportion to be used, exposed to the same conditions as in the proposed structure.

Common usage has demonstrated that certain sands are satisfactory, and therefore no tests of these materials are necessary excepting to identify them.

The relative value of several fine aggregates to be used in concrete cannot be determined by testing them in mortar mixtures. They must be tested in the combined state with the coarse aggregate.

PORTLAND-CEMENT CONCRETE MIXTURES

(A) Relation of Type of Aggregate to Compressive Strength—No type of gravel or stone aggregate can be said to be generally superior to any other type used as coarse aggregate in concrete mixtures. Certain limestones are superior to certain gravels, and some gravels are better than other limestones. The range of qualities in any of these types is very great, and the strengths of concretes made up of several different materials of the same type may vary as much as several hundred per cent. with all other controllable factors uniform.

(B) Relation of Workmanship to Compressive Strength—Undoubtedly greater uniformity is generally obtained by machine mixing than by hand mixing. The method of mixing is of little importance so long as it results in a homogeneous mass. Using proper methods and with the expenditure of sufficient labor, results indicate that as good concrete can be obtained by hand mixing as by machine mixing, although i probably would not be economical.

With all other factors constant the results included in this paper show that differences in manipulation of the mixture by the workmen of several experienced concrete contractors may cause a maximum average variation in the compressive strength of the resulting concrete of 70% or more.

(C) Relation of Consistency of Mixture to Compressive Strength—The quantity of water added to the mixture in preparing concrete affects materially the compressive strength at all ages. With the proper quantity of water the strength may be several hundred per cent. greater than that obtained with a large excess of water.

The most satisfactory consistency from the standpoint o strength and durability is a quaking or mushy mixture, and the error should be on the side of using too little rather than too much water, providing it is properly spaded or worked into place in the forms. This statement does not apply to the very dry mixtures used in the manufacture of concrete blocks etc. In the case of these products the mixture should contain the maximum quantity of water which will permit o the immediate removal of the molds. This latter mixture has less water than the quaking consistency described above.

(D) Relation of Density to Compressive Strength—With the same aggregates and the same proportion of cement to total volume of aggregate the mixture having the greatest density will have a high and usually the highest compressive strength.

Density is no criterion of compressive strength of two mixtures of an aggregate if the ratio of cement to total volume of aggregate is not the same.

Density is no criterion of compressive strength of two mixtures of the same proportions of cement to total aggregate if different aggregates are used, although when the aggregates are quite similar they may be comparable.

(E) Effect of Various Exposures on Compressive Strength—The character of the exposure of the concrete after molding materially affects its compressive strength. If the original water is permitted to evaporate from the concrete and all water is subsequently excluded, the compressive strength may be reduced 40% or more. Concrete should preferably be kept wet for several days or weeks after it is deposited if the maximum strength is to be attained.

(F) Effect of Exposure to Steam on Compressive Strength—Steam greatly accelerates the hardening process and will increase the strength of concrete only a few days old by several hundred per cent., depending on the temperature and duration of exposure.

(G) Relation of Gradation of Aggregate to Compressive Strength—There is no definite relation between the gradation of the aggregate and the compressive strength which is applicable to any considerable number of different aggregates.

The gradation curve for maximum compressive strength, which is usually the same as for maximum density, differs for each aggregate.

The so-called maximum density curve, which is a combination of the straight line and ellipse does not represent the curve for maximum density excepting for the particular materials used in the tests from which it was derived, or very similar materials.

No equation for a gradation curve, which can be applied to a number of different aggregates, can be prepared from the results included in this paper.

Maximum density and maximum strength are usually obtained with a concrete in which the ratio of fine to coarse aggregate is not less than 1 to 3. This mixture is usually quite stiff and therefore more difficult to handle than a mixture containing a larger percentage of fine aggregate.

Excessive fineness does not necessarily result in a totally unsatisfactory sand for concrete. A seashore sand having 99% passing a 50-mesh sieve, when mixed with a good coarse aggregate and cement, was found to give a satisfactory concrete.

(H) Relation of Proportions to the Compressive Strength—With the relative volume of fine and coarse aggregates fixed the compressive strength of a concrete increases directly as the cement content but not in a proportionate ratio. An increase in the ratio of cement to total fine and coarse aggregates when the relative proportions of the latter are not fixed does not necessarily result in an increase in strength. For example, a concrete mixed in the proportion of 1 part cement to 9 or 10 parts of total fine and coarse aggregates combined so as to give a maximum density may have greater strength than a concrete mixed in the proportion of 1 part cement to 6 parts total of the same fine and coarse aggregates, which are not combined to give a maximum density.

GENERAL CONCLUSIONS FROM THE TESTS

1. No standard of compressive strength can be assumed or guaranteed for concrete of any particular proportions made with any aggregate unless all the factors entering into its fabrication are controlled.

2. A concrete having a desired compressive strength is not necessarily guaranteed by a specification requiring only the use of certain types of materials in stated proportions. Only a fractional part of the desired strength may be obtained unless other factors are controlled.

3. The compressive strength of a concrete is just as much dependent upon other factors, such as careful workmanship and the use of the proper quantity of water in mixing the concrete, as it is upon the use of the proper quantity of cement.

4. The compressive strength of concrete may be reduced by the use of an excess of water in mixing to a fractional part of that which it should attain with the same materials. Too much emphasis cannot be placed upon the injurious effect of the use of excessive quantities of water in mixing the concrete.

5. The compressive strength of concrete may be greatly reduced if, after fabrication, it is exposed to the sun and wind or in any relatively dry atmosphere in which it loses its moisture rapidly, even though suitable materials were used and proper methods of fabrication employed.

6. The relative compressive strength of concretes to be obtained from any given materials can be determined only by an actual test of those materials combined in a concrete.

7. Contrary to general practice and opinion the relative value of several fine aggregates to be used in concrete cannot be determined by testing them in mortar mixtures. They must be tested in the combined state with the coarse aggregate.

8. Contrary to general practice and opinion the relative value of several coarse aggregates to be used in concrete cannot be determined by testing them with a given sand in one arbitrarily selected proportion. They should be tested in such combination with the fine aggregate as will give maximum density, assuming the same ratio of cement to total combined aggregate in all cases.

9. No type of aggregate such as granite, gravel or limestone can be said to be generally superior to all other types. There are good and poor aggregates of each type.

10. By proper attention to methods of fabrication and curing, aggregates which appear inferior and may be available at the site of the work may give as high compressive strength in concrete as the best selected materials brought from a distance, when the latter are carelessly or improperly used.

11. Density is a good measure of the relative compressive strength of several different mixtures of the same aggregates with the same proportion of cement to total aggregate. The mixture having the highest density need not necessarily have the maximum strength, but it will have a relatively high strength.

12. Two concretes having the same density but composed of different aggregates may have widely different compressive strength.

13. There is no definite relation between the gradation of the aggregates and the compressive strength of the concrete which is applicable to any considerable number of different aggregates.

14. The gradation curve for maximum compressive strength, which is usually the same as for the maximum density, differs for each aggregate.

15. With the relative volumes of fine and coarse aggregate fixed, the compressive strength of a concrete increases directly, but not in a proportionate ratio as the cement content. An increase in the ratio of cement to total fine and coarse aggregates when the relative proportions of the latter are not fixed, does not necessarily result in an increase in strength, but may give even a lower strength.

16. The compressive strength of concrete composed of given materials, combined in definite proportions and fabricated and exposed under given conditions can be determined only by testing the concrete actually prepared and treated in the prescribed manner.

17. The results included in this paper would indicate that the compressive strength of most concretes, as commercially made, can be increased 25 to 100% or more by employing rigid inspection which will insure proper methods of fabrication of the materials.

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The Canada Copper Corporation, Ltd., which is the holding company of the British Columbia Copper Co., with mines in the Boundary District and a smeltery at Greenwood, B. C., states in its annual report for 1915 that the profit from operations during the last five months of 1915, the only part of the year during which the smeltery was operated, was $66,033, from which is deducted general expenses incurred during the non-operating period amounting to $23,378, an amount payable under the power contract of $67,572, making a total of $90,951, thus showing a deficit for the year of $24,917.

Since the first of 1916 the sale of the Emma mine has been negotiated for a sum of $55,000, which goes into the company treasury.

As of Dec. 31, 1915, it is estimated that there are 9,075,000 tons of reasonably assured ore and 2,000,000 tons of probable ore of an average grade of 1.75% copper, and 20c. recoverable in gold and silver. This estimate increases approximately 60%, the probable ore reserves of the company over last year's estimate.

Attention is called by the general manager to the fact that the profits from the Greenwood smelting plant for the five months of operation are largely due to the extraordinarily high price of copper, and he continues, "On account of the rapid depletion of the company's ore reserves in the Greenwood district, the period of smelting activity is limited, unless a profitable custom ore business can be developed or new ore found. The high price of the metals has stimulated mining and it is considered not unlikely that the market for custom ores will further improve during the coming year.

Details of Practical Mining

Dip and Strike Calculations from Drill-Hole Data

By George E. Burton*

The following calculation is used to obtain the dip and strike of a stratum of rock from the data acquired in three drill holes:

Let *MM'* (Fig. 1) represent the surface of the ground, and *Y*, *Z* and *X* be three vertical drill holes which encounter the same stratum of rock at points *C*, *A* and *B* respectively. Let point *C* have the lowest sea-level elevation, point *B* the highest, and point *A* intermediate between the two. Draw *AB*, *BC* and *AC*.

Pass the plane *EFC* through the point *C* perpendicular to the drill holes *Z* and *X*, cutting *Z* at point *E* and *X* at point *F*. Draw *EF*, *EC* and *FC*. Draw *AH* parallel to *EF*. Extend *AB* until it intersects the plane determined by the points *E*, *F* and *C* at *D*. Draw *DC*; the bearing of the line *DC* is the strike of the stratum *ABC*, since it is the line of intersection of the plane *ABC* with the horizontal plane *DFC*.

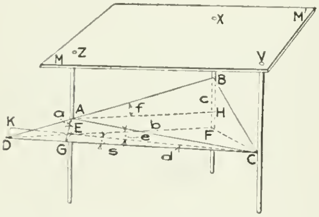

FIG. 1. THREE HOLES CUTTING STRATA AT DIFFERENT ELEVATIONS

The bearing of the line *EC* is known, so to calculate the bearing of the line *DC* it is necessary only to find the angle *ECD*.

Draw *EG* perpendicular to *DC*. Draw *AG*, then angle *AGE* measures the dip of the stratum as it measures the dihedral angle *B-DC-F*, and this dihedral angle is formed by the intersection of the plane of the stratum *DBC* with the horizontal plane *DFC*. Therefore, to find the dip of the stratum it is necessary only to find the angle *AGE*.

In the right triangle *ABH*, *AH* and *BH* are known, and angle *BAH* can be found from the formula,

$$Tan\ BAH = \frac{BH}{AH}$$

But angle *BAH* = angle *ADE* (alternate interior angles).

In the right triangle *AED*, *AE* and angle *ADE* are known, and *DE* can be found from the formula,

$$Cot\ ADE = \frac{DE}{AE}$$

In the triangle *DEC*, *DE* and *EC* are known, and the angle *DEC* = 180° — angle *FEC*. Since angle *FEC* is known, angle *DEC* can be found. We have given, then, an oblique triangle with two sides and the included angle known.

From *D* let fall a perpendicular in the horizontal plane cutting the line *EC* (extended) at point *K*. In the triangle *DKC*:

$$Tan\ ECD = \frac{DK}{KE + EC}$$

$$Sin\ (180° - DEC) = \frac{DK}{DE}$$

$$DK = DE\ sin\ (180° - DEC)$$

but

$$180° - DEC = \text{angle } FEC$$

therefore

$$DK = DE\ sin\ FEC$$

$$Cos\ (180° - DEC) = cos\ FEC = \frac{KE}{DE}$$

therefore

$$KE = DE\ cos\ FEC$$

Substituting in $Tan\ ECD = \frac{DK}{KE + EC}$

$$Tan\ ECD = \frac{DE\ sin\ FEC}{DE\ cos\ FEC + EC}$$

Substituting knowns for unknowns in the foregoing equation,

$$Tan\ ECD = \frac{AE\ cot\ BAH\ sin\ FEC}{AE\ cot\ BAH\ cos\ FEC + EC}$$

$$Tan\ ECD = \frac{AE \times \frac{AH}{BH} \times sin\ FEC}{AE \times \frac{AH}{BH} \times cos\ FEC + EC}$$

In order to simplify the formula, let

$AE = a$, the difference in elevation between the stratum in hole *Y* at *C* and in hole *Z* at *A*;

AH or $EF = b$, the surveyed distance between holes *Z* and *X*;

$BH = c$, the difference in elevation between the stratum in hole *Z* at *A* and in hole *X* at *B*;

$EC = d$, the surveyed distance between drill holes *Z* and *Y*;

Angle $FEC = e$, surveyed horizontal angle at hole *Z*;

Angle $BAH = f$, the angle included between a line drawn in the plane of the stratum connecting holes *Z* and *X* and a line drawn from the point of intersection of this line with hole *Z*, perpendicular to hole *X*;

Angle $ECD = s$, angle to be added to or subtracted from the bearing of the horizontal line connecting holes *Z* and *Y* to determine the strike of the stratum;

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*Assistant director, Oklahoma Geological Survey, Norman, Okla.

Angle $AGE = D$, angle of dip of the stratum. Then

$$Tan\ S = \frac{a \times \frac{b}{c} \times sin\ e}{a \times \frac{b}{c} cos\ e + d} = \frac{\frac{ab\ sin\ e}{c}}{\frac{ab\ cos\ e + ed}{c}}$$

$$Tan\ S = \frac{ab\ sin\ e}{ab\ cos\ e + cd}$$

the angle to be added to or subtracted from the bearing of the line EC to determine the strike of the stratum.

In the right triangle CEG, EC (d) and angle ECG (s) are known, and EG can be found from the formula $tan\ S = \frac{EG}{d}$. $EG = d\ tan\ S$.

In right triangle AEG, AE (a) and EG ($d\ tan\ S$) are known, and the angle AGE (D) can be found from the formula (for finding the dip of the stratum), $tan\ D = \frac{a}{d\ tan\ S}$.

There are two special cases to the foregoing: Case 1, where all three drill holes encounter the stratum at the same sea-level elevation, in which case the stratum is level and there is no dip or strike; case 2, where two of the drill holes encounter the stratum at the same sea-level elevation, in which case the strike is the bearing of the horizontal line connecting these two drill holes and the dip can be calculated.

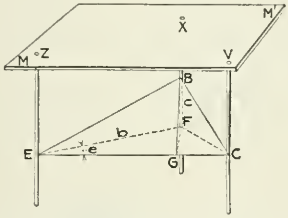

FIG. 2. THREE HOLES, TWO OF WHICH ARE AT THE SAME ELEVATION

Let MM' (Fig. 2) represent the surface of the ground, and let the vertical drill holes V and Z encounter the same stratum of rock at point C and E, which have the same sea-level elevation, also let drill hole X encounter the stratum at point B, which has either a higher or a lower sea-level elevation than points E and C.

Pass the plane EFC through the line EC perpendicular to drill hole Z and cutting hole X at point F. Draw FG perpendicular to line EC and connect B and G. The bearing of the line EC is the strike of the stratum. The angle BGF (D) is the angle of dip as it measures the dihedral angle B-EC-F, and this dihedral angle is formed by the intersection of the plane of the stratum EBC with the horizontal plane EFC.

In the right triangle EGF angle e and the hypotenuse b are known, and leg FG can be found from the formula, $sin\ e = \frac{FG}{b}$. $FG = b\ sin\ e$.

In the right triangle BFG, c and FG are known, and angle BGF (D) can be found from the formula, $tan\ D = \frac{c}{b\ sin\ e}$ which is the formula for finding the dip of the stratum.

Relation of Wheelbase to Radius of Curve*

The tendency of car wheels to climb the rails on a curved mine track must be taken into account in planning haulage systems. The question therefore arises as to what should be the relation between the car wheelbase and radius of track curvature in order to reduce to a minimum the danger that the car will jump the track. For example, suppose the car wheelbase is 28 in. and it is desired to find the minimum safe radius of track curve, keeping in mind the extra expense involved in driving a long curve underground.

Assuming that the rigid four-wheeled truck common on mine cars and illustrated in the accompanying diagram, showing truck, is to be used, it may be stated that when such a truck strikes a curve in the track, the flange of the forward outside wheel A grinds along the gage line of the outer rail, by reason of which the truck $ABCD$ is continually shifted to a more or less radial position on the curve. It has been found by many experiments with small models that the rear axle of the truck, marked CD in the figure, assumes a radial position provided the gage of the track is widened sufficiently to permit it to do so. But if the gage is not widened sufficiently, the curvature of the track forces the rear axle out of the radial position, causing the rear inner wheel C to chafe that rail. The natural or ideal position of the truck on the curve is shown at $ABCD$ in the figure.

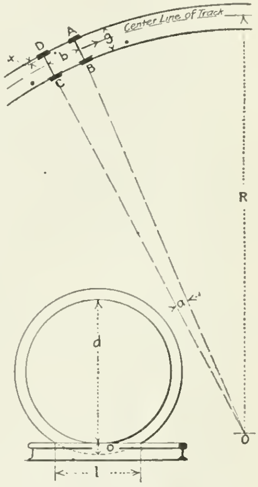

DIAGRAM SHOWING TRUCK ON CURVE

It is readily seen that any effort of the forward outer wheel A to force the rear axle CD from its radial position, by reason of the track gage not being sufficiently widened, increases the tendency of the wheel A to climb the rail. The ideal condition is realized when the track gage is so widened that the rear axle CD of the truck coincides with the radius of the curve when the flange of the wheel A is in contact with the gage line of the outer rail.

In the lower part of the accompanying figure is shown a car wheel having a diameter d and resting on a section of rail, the flange of the wheel having a width o, as indicated in the figure. It is necessary to explain here that in the plan given only that portion of each wheel is shown extending below the rail tread, corresponding to the length of the chord l in the lower diagram.

When estimating the necessary increase in gage of track for sharp curves, in order to realize the ideal condition to which we have referred, it is necessary to calculate the half-length of the chord l by the formula

$$\tfrac{1}{2}l = \sqrt{o(d + o)}$$

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*"Coal Age," June 24, 1916.

The flanges of mine-car wheels are usually $1\frac{1}{8}$ in. deep, making the value of the half-chord for an 18-in. wheel

$$\tfrac{1}{2}l = \sqrt{1\tfrac{1}{8}(18 + 1\tfrac{1}{8})} = 4.6\ in.$$

For sharp curves this half chord must be added to the wheelbase b and their sum divided by the radius of the curve, all being expressed in inches, which gives the sine of the angle BOC included between the radii drawn to the centers of the two respective axes of the truck. Then multiply the versed sine of this angle (1 — cos) by the radius of the curve expressed in inches, and the product will be the amount x that it is necessary to increase the track gage in order to realize the ideal condition.

For example, assuming 18-in. wheels and a 28-in. wheelbase, the radius of the curve being, say 50 ft., we find the sine of the angle included between the two radii

$$Sin\ BOC = \frac{28 + 4\ 6}{50 \times 12} = 0.05433$$

The corresponding cosine of this angle is 0.99852 and its versed sine 1 — 0.99852 = 0.00148. Multiplying this by the radius of the curve expressed in inches gives for the distance x that the gage must be increased,

$$x = 50 \times 12 \times 0.00148 = 0.888,\ say\ \tfrac{7}{8}\ in.$$

Care must always be taken that the tread of the car wheels is sufficiently wide to span the rails when the gage is increased this amount.

The driving of a long curve, though expensive, will often save much trouble and decrease the cost of operation to an extent that will far outweigh the first cost. In general it may be stated that the minimum radius of curve increases with the track gage and speed of hauling. Where it is possible to adopt a 50-ft. radius when hauling at a speed of, say 6 mi. per hr., with a 2½- or 3-ft. gage, in mule or light-motor haulage, a minimum radius of 60 or even 75 ft. should be adopted for hauling at a speed of 8 or 10 mi. per hr. over a 3½- or 4-ft. gage. In special cases, particularly with mule haulage and a narrow gage, the minimum radius may be reduced to 40 ft. without incurring serious trouble. When employing large locomotives a radius less than 100 ft. should not be used.

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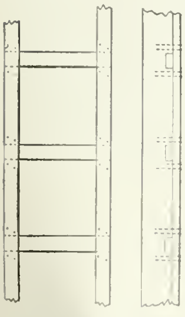
A Ladder for Wet Raises

By Charles A. Mitke[*]

The accompanying illustration shows a ladder for use in wet raises, suggested by John Hughes, a foreman in the Copper Queen. There are a number of cases where acid water eats up the nails in the ladder rungs, causing the rungs to fall off, making them dangerous when anyone attempts to go up or down. This arrangement eliminates such danger because the strip on each side of the ladder holds the rungs and prevents any of them from falling out. Of course the strips are also nailed, but there would be less chance of all the nails on the strip failing than in the usual arrangement in which the rungs are nailed on instead of being countersunk.



LADDER WITH COUNTERSUNK RUNGS

Rail Clamp for Steam Shovel

By L. D. Davenport[*]

Fig. 1 shows the ordinary rail clamp used in many of the openpit mines on the Mesabi Range, to block the wheels of steam-shovel trucks. A tie is ordinarily used for a block and is placed between the clamp and the wheels. These clamps fit loosely over the section rail and are tightened by driving steel wedges between the clamp and the ball of the rail. The improved clamp shown in Figs. 2 and 3 has been in use for several years in one of the Hibbing district openpits and has proved entirely satisfactory. The important feature of this clamp is the cam which rests on the ball of the rail and is tightened by the pressure of the block against it, doing away with the wedges used on the ordinary type. The handle on the top of the cam offers a safe and easy means of handling the clamp.

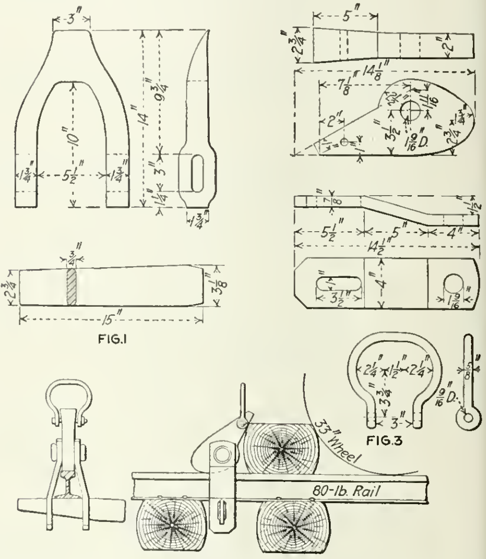


FIG.1

FIG.3

FIG.2

DETAILS OF RAIL CLAMP USED TO HOLD STEAM SHOVEL

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Slag as a Road Base

An article appearing recently in *Engineering News* called attention to the use of slag as a base for brick roads in portions of Pennsylvania adjacent to the steel plants. Formerly either stone or slag was specified, but at present slag alone is named.

This seems to suggest an economical source of base for roads in the vicinity of smelteries. Where granulation is employed, the slag could be used for the subgrade and also in the concrete surface. Where the slag is delivered to waste in a molten condition it can be broken up when needed and used similarly to broken stone for macadam roads.

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[*] Copper Queen Consolidated Mining Co., Bisbee, Ariz.

[*] Oliver Iron Mining Co., Hibbing, Minn.

Details of Milling and Smelting

A New Method of Expressing Protective Alkalinity

By H. H. Howry*

The following is what I believe to be a new method of expressing protective alkalinity in cyanide solutions. It seems to have some points that make it preferable to the old way of expressing it as so many pounds of CaO per ton of solution. This method and the accompanying chart were worked up by me last December and have been in use here since. The protective alkalinity is expressed as a percentage value.

From the equations,

$$2KCN + H_2SO_4 = 2HCN + K_2SO_4$$

and

$$CaO + H_2SO_4 = CaSO_4 + H_2O$$

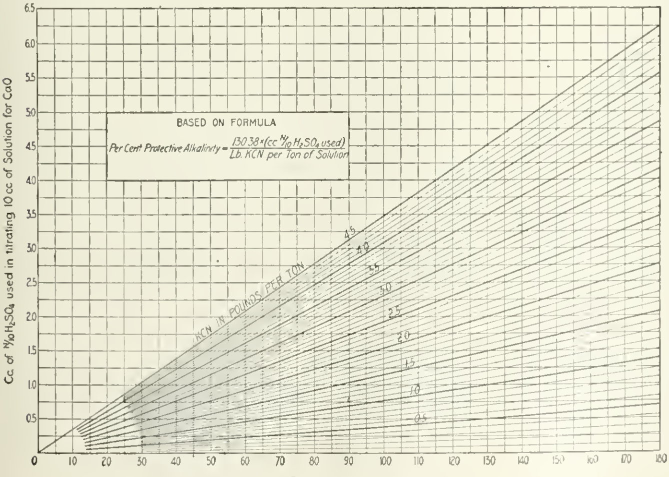
we get a factor for changing alkalinity due to CaO and to its equivalent alkalinity due to KCN. This factor is CaO = 2.32245KCN. This theoretical factor checks experimentally fairly closely if phenolphthalein is used as indicator; if methyl orange or other indicators are used, the carbonates, etc., in the water throw the result off a good deal.

If we use N/10 H_2SO_4 for titrating and take 10 c.c. of solution, then every c.c. of H_2SO_4 used represents 0.5614 lb. of CaO per ton of solution. Hence our formula for protective alkalinity becomes

$$\textit{Per cent. protective alkalinity} =$$

$$100 \times 2.32245 \times 0.5614 \times \frac{\textit{c.c.}\ N/10\ H_2SO_4\ \textit{used}}{\textit{lb.}\ KCN\ \textit{per ton}}$$

A concrete example of how to use the accompanying chart may not be amiss. Ten c.c. of solution is titrated for KCN by the familiar $AgNO_3$ titration with KI indicator. After excess $AgNO_3$ is indicated, an excess of potassium ferrocyanide is added to prevent any zinc present from precipitating as zinc hydrate. Then the N/10 H_2SO_4 titration with phenolphthalein indicator is performed. Suppose that our solution titrated 2.5 lb. KCN per ton and that it required 2.0 c.c. N/10 H_2SO_4 to destroy the red color. Go up on the left edge of the chart to 2.0 c.c. H_2SO_4, then horizontally across to meet the diagonal 2.5 lb. KCN line, then from the intersection of these two lines go down vertically to read 104% protective alkalinity. This method gives, in my opinion, a much clearer idea of the relative protective alkalinities in solutions of various cyanide strengths than does the usual method of expressing it as merely so many pounds of CaO per ton of solution. If, as is the case here, NaCN is used in place of KCN, the formula and chart still hold, provided the cyanide present is expressed in terms of KCN.



THE PROTECTIVE ALKALINITY CHART

⁂

Separating Wolframite from Tin

By Alexander Grossberg*

Wolframite in small quantities has been known for some time to exist in the tin ores from the "Inca" vein of the "Salvadora" property of Simon T. Patiño, at Uncia, Bolivia. Before the war started, the sales (in Europe) of tin concentrates produced in the mills here were made in such a way that the tungstic-acid content was paid for in part and therefore there was no necessity for separating this metal under the existing prices. Since the beginning of the present war, however, the high prices of tungsten ores, the nonpayment for tungstic-acid content in tin concentrates and the depreciation of the tin concentrates due to the presence of tungstic acid made it necessary as well as profitable to separate this metal from the tin.

The milling plant at Uncia has as one of its units a good Humboldt-Wetherill magnetic-separator installation for the treatment of a highly pyritic middling product, so that, on account of the magnetic condition of the wolframite contained in the ores, this plant was naturally turned to the separation of this mineral from the tin concentrates.

The tin concentrates, as produced in the mill, vary in size from 8 mm. to that which passes 200-mesh, and as the greater part of the tungstic-acid content has been shown to exist in the "coarse," this is ground to pass a 2-mm. screen and the whole is then passed over two Humboldt-Wetherill magnetic separators where the materials are subjected to a separation.

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*Mill foreman for the United States Gold Corporation, Sugar Loaf, Colo.

*Superintendent of mills, Uncia, Bolivia.

The separators are run at 110 volts with 4 amp. on the first magnet and 12 amp. on the second. The first magnet removes a product consisting of traces of tungstic acid, about 50% of magnetic pyrite and about 5% of tin. The second magnet removes practically all the wolframite along with some feebly magnetic pyrite that has not been removed by the first magnet. The tin is unaffected and therefore passes off from the feed belt ready to be sacked for shipment.

The first-magnet product is sent to the roasting plant in order to recover the tin contained. The second-magnet product contains around 50% tungstic acid and 20% of pyrites. This product is given a surface roast to convert the feebly magnetic pyrites into a highly magnetic product, the roasted mixture then being passed over the same magnet as the original concentrates. In the latter case, however, the first magnet is worked with 2 amp. During this operation the first magnet removes practically all the iron sulphide along with traces of tungstic acid and the second magnet makes a shipping product containing about 60% tungstic acid, thus producing a satisfactory commercial material.

The mill at the present time produces about 20,000 Spanish quintals of tin concentrates per month from which is recovered approximately 110 Spanish quintals or 5.5 tons (short), of wolframite of the grade mentioned.

The cost of producing the 60% wolframite concentrates is approximately 12.56 Bolivianos ($4.77 at actual exchange) per Spanish quintal. This is of course very high, being due in great measure to the location of the separator plant with reference to the drying floor for tin concentrates, which makes a great deal of hand-transportation necessary and this item runs up the cost considerably. Changes are being made which will cut down these costs about 50%. The mine gives promise of continuing the production of wolframite for some time to come. In general, the country promises to be an important source of this material in the future.

⁂

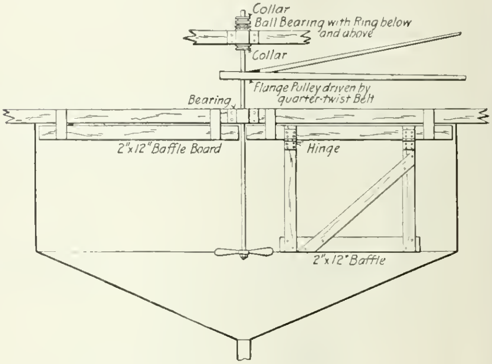
Propeller Slimes Agitator

By Roscoe Wheeler*

The installation of the Devereux propeller system of agitation, mentioned in the *Journal* of May 6, 1916, has been successfully continued at the milling plant of the Hedley Gold Mining Co. The efficiency of the propeller for agitation purposes depends largely on the fineness of the slimes and the breaking of the vortex formed around the vertical shaft. This vortex, if allowed to exist, retards the velocity of the pulp, thus decreasing the scouring action.

The vortex is broken by baffle boards 2 in. thick by 12 in. deep suspended from the lower chord of the truss and extending from a few inches from each side of the vertical shaft to within 3 in. of the inner side of the tank. To allow agitation while the tank is filling and to prevent the pulp from surging, another baffle board is suspended by hinges from one of the former baffle boards and on one side only of the vertical shaft. The rope holding this baffle in vertical position while tank is filling is slackened as soon as the tank is full, thus allowing this baffle to lie flat on the surface of the charge and not interfere with the scouring action below. From Trautwine, page 577, a velocity of ¼ ft. per second will wear away ooze and mud; ½ ft. per second will wear away clay; 1 ft. per second will wear away sand.

With the 5-ft. propeller revolving from 80 to 100 r.p.m., maximum hp. = 12, the 34-ft. diameter, conical-bottomed tank has handled from 80 to 165 tons of dry slimes. Then 138 tons of dry slimes plus 296 tons of solution, or 31.8% of solids to 68.2% of solution, is an ordinary charge and is agitated thoroughly with 80 r.p.m. The 4-ft. propeller revolving 80 to 100 r.p.m. maximum hp. = 10, in the 30-ft. diameter, conical-bottomed tank will handle 138 dry tons of slimes (41.4%) plus 238 tons of solution (58.2%) when revolving 80 r.p.m. Either tank will handle slime charges with any proportion of solution used in ordinary cyanide work, and the power does not exceed that stated. There is no deposit of slimes alongside the staves, the whole charge being in rapid motion.


Collar
Ball Bearing with Ring below and above
Collar
Flange Pulley driven by quarter-twist Belt
Bearing
2"x12" Baffle Board
Hinge
2"x12" Baffle

THE PROPELLER SLIMES AGITATOR

As extraction is effected by a series of agitations and decantations, one might expect trouble in starting. Thus far none whatever has occurred, even after two days' time between agitations. With the throwing in of the handle of the motor starter, the propeller begins setting the charge in motion, and by the time the tank is full all slime is moving rapidly.

The cost of these propellers is said to be less than half that of any other agitators going into new as well as remodeled plants. The system is dependent upon power from one source only—air is not needed. Its simplicity and adaptability permit it to be installed in plants containing tanks of any style, height or diameter.

⁂

The Best Electrolytic Tin Deposits are obtained from a stannous-ammonium oxalate bath with peptone as an addition agent. A good composition, according to Frank C. Mathers and Barrett W. Cockrum ("Trans." Am. Electrochem. Soc., Washington, D. C., meeting) is: 5% stannous oxalate, 6% ammonium oxalate, 1.5% oxalic acid and 0.25% peptone. The stannous oxalate may be made by precipitating a solution of stannous chloride with oxalic acid. The solution must be stirred at intervals and is run at 3.6 amp. per sq.ft. at room temperature.

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*Mill superintendent, Hedley Gold Mining Co., Hedley, B. C.

The Assayer and Chemist

Improved Test for Molybdenum

By George A. James*

The test for molybdenum originated by Schoenn and improved by Masche consists in treating a portion of the substance with a small quantity of sulphuric acid on a porcelain or platinum surface and evaporating to near dryness.

By the addition of water in minute quantities, such as results from breathing on the mass, the appearance of a distinct blue coloration indicates molybdenum. This result is not always easily obtained with molybdenite unless the sulphur is oxidized with nitric acid, and in the case of wulfenite it sometimes fails entirely.

An improvement, I have found, that accentuates this reaction and prevents its disappearance, is the addition of some glacial acetic acid. When this is slightly heated, the blue color appears immediately and persists.

In connection with this subject I would call attention to the frequent appearance of wulfenite with gold ores, which in the pan hangs back with the gold, for which it is often mistaken. To test this, a portion is treated with nitric acid and a drop of sulphuric acid and heated until white fumes appear. On the addition of glacial acetic acid, the typical blue reaction appears strongly. If another portion is treated with acetic acid, the addition of potassium bicromate will give a strong yellow precipitate.

⁂

Analysis of Aluminum Alloys

In a paper at the recent meeting of the Institute of Metals (London, Mar. 29, 1916), W. H. Withey describes a new method of analysis for aluminum alloys that allows the use of large quantities of the composition. To the filtrate, after removal of the copper-tin group by sulphureted hydrogen in acid solution, tartaric acid is added and the solution then made alkaline. The tartaric acid then holds up aluminum when H_2S is passed in, while zinc and nickel are quantitatively precipitated. Manganese is only partly precipitated. After the H_2S treatment, the solution filtered from sulphur is made ammoniacal and the magnesium precipitated with sodium phosphate. The precipitate is redissolved. The precipitate is next dissolved in dilute nitric acid, and any manganese which is usually present determined by a calorimetric method and calculated into the equivalent weight of manganese pyrophosphate, which is then deducted from the magnesium pyrophosphate obtained. The manganese is separately determined in another sample.

The method recommended for the analysis of the alloys of aluminum and zinc consists in adding to the solution an excess of caustic soda. The hydroxides first precipitated are thus dissolved, and on passing sulphureted hydrogen the zinc is precipitated. The precipitate is dissolved and the zinc after the removal of traces of aluminum is determined as phosphate.

The method seems almost as great a step as was the ferric-hydrate precipitation for the metalloids in the analysis of metallic copper.

⁂

Pouring Assay Melts Upon A Flat Plate

By G. H. Clevenger*

The conventional conical iron molds have been universally used by assayers for the reception of assay melts, and while the method of pouring upon a flat iron plate is by no means new, strangely enough a description of it does not appear in the literature on assaying.

Upon the completion of fusion the lead button rests on the bottom of the crucible, with the molten slag above. During the time the crucible remains in the furnace after this stage is reached, the most favorable conditions exist for the complete separation of the lead from the slag by settling. When the fusion is poured into a conical mold, the slag largely leaves the crucible first, then the lead, and following the lead the small amount of remaining slag. At the moment the molten slag strikes the conical mold there is necessarily a slight chilling effect, which causes the thin layer of slag in contact with the iron mold to become viscous, if not actually solid. Into the slightly chilled large mass of slag falls the lead button, which at once sinks to the bottom of the mold, where it finds a resting place on the thin layer of highly chilled slag. As the molten lead falls through the slag, opportunity is afforded for the entrainment of small particles of lead. However, with properly proportioned charges, if sufficiently hot when poured, there is little tendency for the slag to retain shot lead. When the solidified melt is removed from the mold, the sides of the button are found to be incased in a thin layer of slag, and the top of the button is more or less firmly attached to the large mass of slag. The union between slag and button at this point is sometimes so strong that in re-

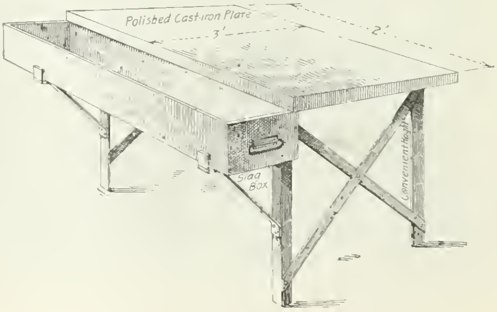

FIG. 1. STAND AND FLAT PLATE

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*Assayer and chemist, 28 Belden Place, San Francisco, Calif.

*Associate professor of metallurgy, Stanford University, California.

moving the slag a thin layer of the button is taken with it. In any event a considerable amount of hammering is necessary to free such a button from the adhering slag.

Use of a Flat, Polished Iron Plate Found Advisable

It is evident that if a method of pouring were used in which the relative position of the lead and the slag was not changed during pouring, there would be less likelihood of particles of the lead being entrained in the slag, and moreover, a button would be obtained which would be much more free from slag. I have found that pouring upon a flat iron plate largely accomplishes this end, as well as presenting certain other advantages. After experimenting with plates set at different angles, as well as with special plates having depressions of various shapes for the accommodation of the button, it was found that a flat cast-iron plate, which of course must be smooth and preferably polished, gives the best results. The plate can be mounted upon a gas-pipe or angle-iron rack of convenient height, as shown in Fig. 1. At one end is a pair of brackets which support a sheet-iron box into which the rejected slag is swept by a counter brush. Before using for the first lot of fusions, the plate should be slightly heated. In the absence of other means, this may be readily accomplished by pouring a sufficient amount of gasoline on it to more or less cover the surface, igniting and wiping off with a rag the thin film of water that remains after the gasoline burns. After the first fusions have been poured, no further attention need be paid to the temperature of the plate, as the succeeding pourings keep it sufficiently warm. When pouring, the crucible should be held in such a position that the slag may be observed as it flows from the crucible. After the major portion of the slag has left the crucible and the lead becomes visible, the crucible should be drawn slightly toward the operator, so that when the lead runs out, it does not fall directly into the mass of the slag, but strikes the edge of the partly solidified slag next to the operator, which acts as a dam, breaking the force of its fall. A little practice with this apparently difficult manipulation makes one entirely proficient in its operation. The appearance of a set of melts poured upon a flat plate is shown in Fig. 2. A plate of moderate size, say 2x3 ft. will accomodate 24 melts.

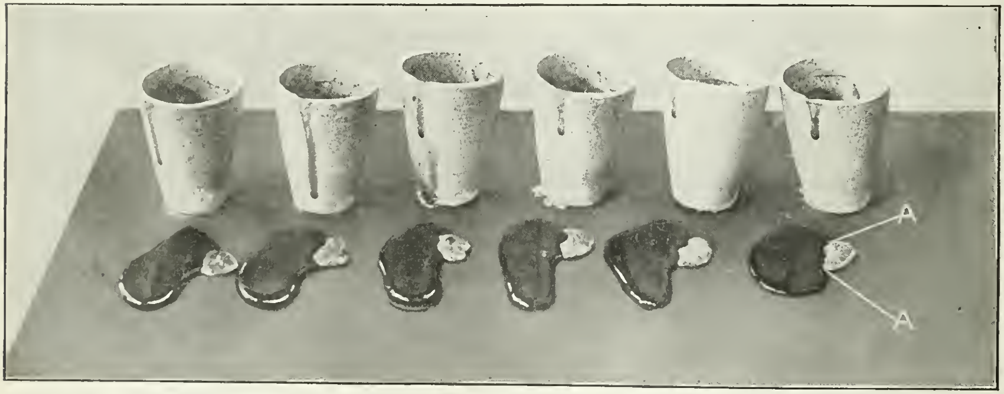

FIG. 2. ASSAY MELTS ON FLAT PLATE, SHOWING SEPARATION OF BUTTON AND SLAG

In a surprisingly short time both the lead and the slag are solidified. The button may therefore be picked up for cupellation almost at once, whereas with the conical mold a considerable time is necessary for the lead and the slag to solidify, and then not infrequently, the assayer in his haste will disturb the melt before the lead is solid. Even after the slag is solid and apparently the whole mass in the mold is solid, the lead may still be liquid, because of its lower melting point. The buttons resulting from pouring on a flat plate when the operation is properly conducted are in one mass, and in general are perfectly clean and free from slag with the exception of the little rim or margin of the button *AA* in Fig. 2, which is directly in contact with the slag. All that is necessary to prepare the buttons for cupellation is to bend them over so that they can be placed in the cupel. Time spent in forming the perfect cubes with carefully flattened corners by hammering, which is a tradition of assaying, is merely wasted, as there is no slag to remove—hence little hammering is required. Another difficulty that is sometimes encountered with the conical mold, that is not apparent with the flat plate is the sticking of the slag and button to the molds. When the slag once begins to stick to a mold, this difficulty gradually becomes worse until the mold is thoroughly cleaned and scoured. If through accident the slag should contain beads of lead, these are far more apparent in the thin cake of slag when held up to the light than in the more compact mass of slag resulting from the use of the conical mold, and can be separated and recovered easily.

A somewhat greater degree of skill is necessary in pouring upon a flat plate, and furthermore, the pouring requires a slightly longer time than when using the conical mold, but the other advantages more than compensate for these slight drawbacks.

◆

The Recently Adopted Atomic Weight of Cadmium, 112.4, is disputed by de Coninck and Gerard, according to the "Chemical Trade Journal," who obtain a figure 112.32 as the mean of five closely agreeing determinations. Their method is said to have been to calcine to carbonate and reduce the residual oxide with hydrogen, weighing the final metallic cadmium.

Steel Production in 1915

The production of steel in the United States in the year 1915 is given by "Special Bulletin No. 3" of the American Iron and Steel Association as in the accompanying table, in gross tons. Comparisons being made with the results for 1913 and 1914:

	1913		1914		1915	
	Tons	%	Tons	%	Tons	%
Basic openhearth	20,344,626	65.0	16,271,129	69.2	22,308,725	69.4
Acid openhearth	1,255,305	4.0	903,555	3.9	1,370,377	4.3
Bessemer	9,545,706	30.5	6,220,846	26.4	8,287,213	25.8
Crucible	121,226	0.4	89,869	0.4	113,782	0.3
Electric	30,180	0.1	24,009	0.1	69,412	0.2
Miscellaneous	3,831	....	3,622	...	1,527	..
Total	31,300,874	100.0	23,513,030	100.0	32,151,036	100.0

Of the total production last year, 31,284,212 tons was in the form of ingots and 866,824 tons in direct casting. Included in the basic openhearth steel is 1,781,491 tons made by the duplex process; that is partly treated in bessemer converters and finally purified in the openhearth furnace.

The total steel output in 1915 was the largest ever recorded. It was greater than that of 1914 by 8,638.006 tons, or 37.9%, and exceeded the large output of 1913 by 850,162 tons, or 3.6%. The total steel production of the United States first reached 20,000,000 tons in 1905; in the ten years since then it has varied as follows:

1906	23,398,136	1911	23,676,106
1907	23,362,594	1912	31,251,303
1908	14,023,247	1913	31,300,874
1909	23,955,021	1914	23,513,030
1910	26,094,919	1915	32,151,036

From present indications the current year will show a considerable increase.

The production of all kinds of iron and steel rolled into finished forms in 1915 is shown in the accompanying table, in gross tons:

Products	Iron	Steel	Total
Rails	....	2,204,203	2,204,203
Plates and sheets	20,253	6,057,441	6,077,694
Nail and spike plate	4,984	26,945	31,929
Wire rods	2,236	3,093,671	3,095,907
Structural shapes	1,858	2,435,145	2,437,003
Merchant bars	657,107	3,474,135	4,131,242
Bars for reinforced concrete work	.....	353,408	353,408
Skelp, flue, and pipe iron or steel	262,198	2,037,266	2,299,464
Long angle splice bars, tie-plate bars, etc	54,678	480,937	535,615
Hoops	300	281,459	281,759
Bands and cotton-ties	200	437,787	437,987
Rolled sheet piling, not including fabricated	....	24,026	24,026
Railroad ties	....	42,269	42,269
Rolled forging blooms, forging billets, etc	570	649,975	650,545
Exports of blooms, billets, sheet bars, etc	1,231	561,187	562,418
All other finished rolled products	289,218	938,237	1,227,455
Total	1,294,833	23,098,091	24,392,924
Total, 1914	1,167,776	17,202,420	18,370,196
Total, 1913	1,678,257	23,112,986	24,791,243

The increase in the total over 1914 was 6,022,728 tons, or 32.8%. The total, however, has been twice exceeded, in 1912, when it was 24,656,841 tons, and in 1913, with 24,791,243 tons.

The Bulletin gives numerous details of the production, some of the more important being given herewith. Of the structural shapes 2,031,407 tons were heavy sections and 405,596 tons light. Sheets and plates included 954,852 tons universal plates, 1,923,199 tons sheared plates, 1,836,786 tons black sheets and 1,362,857 tons tin-mill sheets. Rolled blooms and billets for forging are included in the table, also blooms, billets and sheet bars sold for export, but not blooms or billets sold to mills in this country to be finished.

Of the total production of rolled forms in 1915, there was 94.7% rolled from steel and 5.3% from iron, against 93.6 and 6.4% in the preceding year.

The production of alloy steel was the largest ever reported, the total in 1915 being 1,021,147 tons, of which 643,791 tons was basic openhearth, 267,353 acid openhearth, 41,111 tons bessemer, 40,948 tons crucible and 27,941 tons electric steel.

During the year there were 134 works making steel ingots, besides a number making steel castings, but not ingots.

⁂

Japanese Mining Expansion

Actuated by the greatly increased demand for iron and steel in Japan, the Department of Agriculture and Commerce investigated sources of ore supply. The following is a brief excerpt of the report presented to a committee of the Diet.

The main source of ore supply within the empire proper is the Kamaishi mine, whose deposit of magnetic ore is estimated at 35,000,000 tons. Deposits of similar ore are estimated to total between 5,000,000 and 6,000,000 tons from mines in the provinces of Rikuchu, Echigo, Iwaki, Iwashiro, Kozuke, Yamato, Harima and Mimaska. Deposits of red iron ore, estimated to total about 30,000,000 tons, are located in the provinces of Echigo, Rikuchu, Tosa, Hyogo, Rikuzen and Izumo. Brown iron-ore deposits, believed to total 10,000,000 tons, bring the estimated aggregate total to about 80,000,000 tons for the islands alone.

Continental Asia Iron Deposits

The principal ores of Chosen are the brown and red ores, of which the main deposits are in the region of the Tatung River and are estimated to contain about 10,000,000 tons. Other deposits so far discovered in Chosen are believed to contain not less than 20,000,000 tons, bringing the total for the country to 30,000,000 tons.

In Manchuria various kinds of ore of rather poor quality are known to exist in the region of Anshantien, whose total quantity is estimated at 260,000,000 tons. The famous Penshiho mines produce mainly magnetic iron ore, and the total deposit is estimated at about 80,000,000 tons of good ore.

TABLE 1. IMPORTS OF METALS INTO JAPAN DURING 1915

	1915	1914	1913
Iron and steel, yen	34,419,985	39,933,882	56,763,882
Other metals, yen	20,372,762	11,562,165	14,016,807

Specifications of Some of the Metals Included in the Above Total

	1915		1914		1913	
	M Tons	Yen	M Tons	Yen	M Tons	Yen
Lead	15,682	3,245,457	16,139	3,118,895	15,658	2,817,477
Zinc	8,471	3,137,437	8,201	1,868,853	13,531	3,390,962
Tin	1,195	1,992,651	1,328	2,085,479	1,201	2,377,486
Brass and bronze	.....	1,719,995	...	450,770	....	817,863
Nickel	956	1,601,413	1,010	1,592,997	946	1,421,473
Aluminum	488	424,257	481	390,972	311	233,706
"Other Metals"	......	7,040,400	.....	1,051,503	...	1,042,833

In China the main iron-producing regions are in the Yangtze Valley, but ore is also known to abound in the Shantung, Shansi, Honan, Kiangsu and Fukien provinces. The largest iron mine in the Yangtze Valley is the Taiyeh, estimated to contain 100,000,000 tons. These Chinese deposits need further exploration to afford bases for estimates of tonnage, and when the investigation is completed it is believed the iron resources will be shown to be vast.

With available resources in iron already known to total 550,000,000 tons, the report to the Japanese Diet comes to the conclusion that while the deposits in Japan are small and insufficient for the development of iron works which Japan requires, the other supplies are sufficient to justify expansion of the works.

In this connection it will be of interest to append tables compiled from the investigations of the Department of Finance, showing, as they do, Japan's expansion of mining under the stimulus of war-time conditions. [Apparently these tables are somewhat censored.—Editor.] It is interesting to note that imports of metallic iron and steel decreased 22,000 yen in value from 1913 to 1915, or 39%, while simultaneously ore imports increased 29,000 tons, or about 10.4%. Exports of iron and steel are not given.

Imports of all metals other than iron and steel increased in value from 1913 to 1915 over 6,000,000 yen, or 45%, while the value of ore imports advanced from 269,980 yen in 1913 to 2,064,659 yen in 1915, a gain of 661%.

It will be noted that imports of brass and bronze increased in value from 817,863 yen in 1913 to 1,719,995 yen in 1915, a 110% gain. Simultaneously exports of brass and bronze increased in value from 213,080 yen in 1913 to 1,659,522 yen in 1915, a gain of 678%. Apparently the domestic consumption of about 600,000 yen's worth of metal in 1913 decreased in 1915 till the value of the exported and imported metal is nearly equal.

TABLE 2. IMPORTS OF ORES INTO JAPAN DURING 1915

	1915		1914		1913	
	M Tons	Yen	M Tons	Yen	M Tons	Yen
Iron ore.....	309,174	1,812,311	299,241	1,729,068	280,246	1,585,211
All other ores*...		2,064,659		574,374	..	269,980

* There is no specification given for the item "All other ores," which has been greatly increased during the last year. The advance most probably is due to the large import of antimony-ore from China.

Imports of several metals, possibly including copper, are apparently lumped in Table 1 under the caption, "Other Metals." The value of these, it will be observed, increased from 1,012,833 yen in 1913 to 7,040,400 yen in 1915, a gain of 575%.

Tables 3 and 4, giving Japanese exports, best reflect the rapidly grown war-time prosperity of Japanese mines.

The most significant items of these tables are those relating to metallic copper and antimony, zinc ore and ores of tungsten, manganese, etc. The tonnage of copper ingots exported increased 36%, of antimony 439%, and the value of tungsten, manganese, etc., lumped in Table 4, 900%. Exports of zinc ore, it will be seen, decreased from 27,383 tons in 1913 to 6,128 tons in 1915, a loss of 78%, understood after reference to the brass and bronze figures already given.

TABLE 3. EXPORTS OF METALS FROM JAPAN DURING 1915

	1915		1914		1913	
Copper:	M Tons	Yen	M Tons	Yen	M Tons	Yen
Ingots and slabs.	57,411	41,264,301	44,124	27,196,617	42,136	28,183,904
Plates and sheets		1,445,548		1,028,785	....	239,586
Wire		453,449	..	242,211	.....	181,821
Zinc:						
Ingots and slabs.	5,395	3,993,980			.....	..
Antimony..	8,614	7,707,122	4,307	1,117,456	1,602	468,054
Iron tubes..		198,924		48,388	......	67,410
Old iron		253,029		323,011	......	331,619
Nickel.		6,496	...	15,367	......	14,942
Brass and Yellow Metal:						
Plates and sheets		1,659,522	.....	245,775	......	213,080
Wire......		256,215		107,286	......	108,922
All others		3,181,857		724,988	......	701,281
Totals		63,420,745		31,059,884	.	30,510,619

TABLE 4. EXPORTS OF ORES FROM JAPAN DURING 1915

	1915		1914		1913	
	M Tons	Yen	M Tons	Yen	M Tons	Yen
Zinc..	6,128	360,774	14,155	470,251	27,383	943,271
Tungsten.........	483	460,042				
Antimony..	396	134,182				
Manganese.......	2,999	161,509	...	129,043	......	1,366
Molybdenite......	7	55,678				
Others..	..	126,447				
Totals..........	....	1,298,632		599,294	. ..	944,637

Increased Platinum Production

The production of crude platinum in California and Oregon in 1915, according to the United States Geological Survey, was 741.91 oz., an increase of 171.91 oz. over the output in 1914. California mines produced most of this quantity; only one mine in Oregon reported production in 1915. The Rambler mine, Albany County, Wyo., produced platinum-bearing copper concentrates which were shipped to Eastern refiners. No platinum ore was shipped from the Boss mine, Clark County, Nev.

According to reports received from the platinum refiners, 8,665 oz. of new metals of the platinum group was recovered, of which at least 1,587 oz. is believed to be of domestic origin. Secondary metals derived from the refining of scrap and sweeps to the amount of 42,970 oz. were sold in 1915.

Notwithstanding the embargo placed upon the exportation of platinum by all the allied governments, the United States imports of platinum and allied metals during the year 1915, as compiled by the Bureau of Foreign and Domestic Commerce, Department of Commerce, were only 10% below the 1914 imports, amounting in all to over 69,000 oz.

Figures showing the world's production of platinum and allied metals are at best estimates made from the most reliable information obtainable. The table gives the best estimates from information available at this time:

ESTIMATE OF WORLD'S PRODUCTION OF CRUDE PLATINUM

Country	1912	1913	1914	1915
Borneo and Sumatra........	200	200	*	*
Canada	30	50	30	100
Colombia	12,000	15,000	17,500	19,000
New South Wales..........	778	1,275	1,248	†56
Russia	300,000	250,000	241,200	124,000
United States	721	483	570	742
	313,729	267,008	260,548	143,898

*No basis for estimate. †No figures from Tasmania available at time report goes to press.

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Cheaper Gasoline Predicted

Officials of the Standard Oil companies are quoted in the New York "Times" as saying that the worst has passed in the skyrocketing of gasoline prices and that a reduction is to be expected soon. The hope, according to an official who has to do especially with gasoline, is based on two factors: First, that the Standard Oil laboratories have found out how to extract more gasoline from crude oil, and second, that the gasoline-producing quality of much of the oil from the southwestern field is improving.

It was explained that the present high price of gasoline was due to a combination of causes which, it was shown, it was not easy for the layman to comprehend. In the first place, there is the war. Most of the sources of production in Europe are not producing at this time. The Dardanelles being closed, the Allies cannot get gasoline from the Russian fields, and Russia isn't selling it to anyone else. The Russians and Austrians have been battling over the Austrian oil fields, and production is at a standstill there. That makes a large demand upon the American supply.

Again, the German, Austrian and Turkish markets for the byproducts of crude oil other than gasoline are cut off. That makes an over-production of byproducts, the loss of profit on which must be borne in large part by users of gasoline.

Another factor in the great advance which has set the present record price was that, two months or so ago, when the heavy production season was beginning, the production of the Cushing fields in Oklahoma fell almost 50% and what oil continued to flow did not produce the same amount of gasoline as before.

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The Chrome Iron-Ore Situation

Several chrome-ore miners have recently asked the *Journal* for quotations on ore. Other correspondents have required quotations on ferrochrome. In the attempt to satisfy these inquiries a curious state of reticence on the part of consumers, dealers and brokers was encountered. Apparently the larger buyers could not—or possibly would not—furnish the desired information, only three of the smaller buyers out of a dozen showing any disposition to encourage investigation.

Prices of crude ore have advanced considerably since the beginning of the war, which has so seriously disturbed the former condition of water transportation and regular deliveries. If apprehensive is the proper adjective to describe the buyer's state of mind, one need look no further than "Mineral Resources of the United States" for 1915, under "Chromic Iron Ore in 1915," to discover some ground for that feeling.

With the domestic production aggregating 3,281 long tons of crude ore and imports totaling 76,455 tons, the apparent consumption was 79,736 tons. No statistics are available to show the distribution among the tool-steel, armor-plate and projectile manufacturers, the brick makers, and the chemical manufacturers of bichromates of soda and potash. Some of the ore brokers interviewed, as stated, claimed—and their claim is here merely recorded—that the ore consumption in the brick industry constitutes the big end of the business. The United States Geological Survey's report merely states that the price of brick fluctuated during 1915 from $50 to $90 per thousand for standard sizes. It states that there was a continuous advance in the price of bichromates due to the unprecedented demand for the American products growing out of war conditions. The foreign demand is large as is also the domestic demand in the textile industry on account of the lack of German dyes and the consequent growth of our infant dye industry.

The point is that the ore producer knows of these advances in price and doubtless believes he is as much entitled to a share in the war profits as the more fortunate producers of tungsten ores, hence the present spectacle of the ore producers holding back for higher prices.

Apprehension on the part of ore brokers and consumers, and their consequently assumed air of mystery, is probably due in a large part to the uncertainty and irregularity of deliveries of foreign ores. Of the 76,455 tons of crude ore imported in 1915, only the 10,087 tons produced in Quebec, Canada, were shipped from a port comparatively near the eastern waterfront of the United States. Of the remainder, New Caledonia and other points of French Oceania shipped 28,031 tons, while nearly all the rest came from Africa—22,800 tons from British South Africa and 11,230 tons from Portuguese Africa—the only other notable shipment, of 4,305 tons, coming from Greece. The latter is apparently not seriously embarrassed by the blockade of the Allies, since one of the largest manufacturers of chrome brick reports expecting a shipment of ore "sometime in four or five weeks." We understand that the bulk of the ore imported comes in sailing vessels, which doubtless means that it is ballast on the return voyages.

One of the former conditions adversely affecting the development of American mines was the freight rates between California and the Atlantic States. With the former rates of $13.60 to $15 per ton reduced to $11 per ton since Jan. 11, 1916, however, the California and other Western producers are now on a better footing to compete with foreigners in the Eastern market. The beneficial effect of this freight reduction on the American producers is readily seen in the fact that California, since recent months, is no longer the sole state producing any appreciable quantity, ore from Grants Pass and Riddle, Ore., having recently appeared on the market.

With war-time conditions demanding the greater part of the ores mined in New Caledonia and Rhodesia for France and England, a brisk demand for the Quebec product in the United States sprang up during the last six months of 1915. The Quebec deposits are said to be considerably smaller and more pockety than those of California, the average grade of the latter running 40 to 50% as compared with about 30% for the Canadian product. Freight rates from Black Lake, Quebec, to Perth Amboy, N. J., are about $3.15 per ton, as compared with the rate of $11 from California.

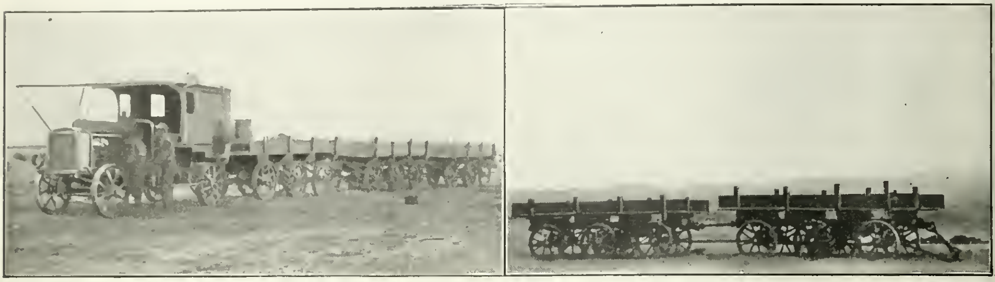
The average price of chromite in 1915 was about $18 per ton at Ontario points. On the Pacific coast 1915 prices ranged from $11 to $18 per ton f.o.b. point of shipment for 50% ore. An additional 50c. per ton for each per cent. over 50 was allowed.

SITUATION OF AMERICAN OPERATORS

With foreign deliveries of crude ore uncertain and water freights subject to considerable variation due to war's vicissitudes, the Western ore producers should become more important in the market so soon as their mine developments allow them to reach the point of cheap mining. Obviously it would be a far-sighted policy on the part of the consumers to encourage all possible development by allowing prices justified by the times and increased profits on the finished articles. Spasmodic buying from Americans, at widely varying prices and only at times when forced by failure of foreign deliveries, can hardly be expected to benignly affect the domestic business. In other words, the Americans "hold the bag" on any such procedure.

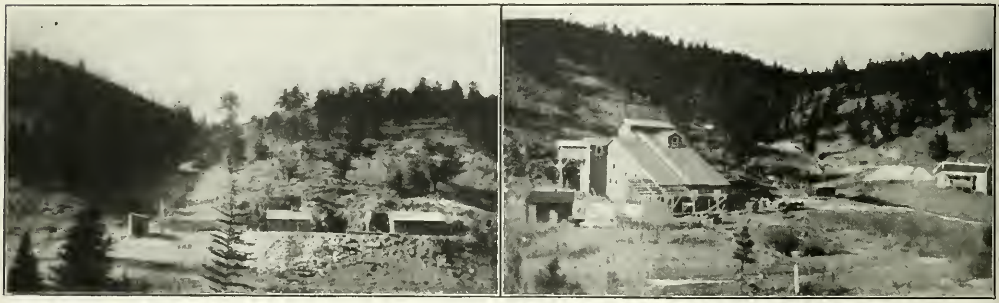
Eastern prices are now said to range from $25 to $35 per ton for 50% chromic-acid ore, in full cargoes of about 7,500 tons. As a matter of fact, these are the prices that prevailed throughout 1915. It is easy to suspect, therefore, that mystery on the part of the buyers, in refusing to give quotations, cloaks an occasional willingness to increase prices to domestic producers—whenever forced to by nondelivery of expected foreign shipment. A more liberal policy patterned after that of the tungsten buyers would doubtless result in a more rapid development of the American chrome-iron mines, swiftly resulting in cheaper mining and greater stability to the market. Few American industries have ever profited in the long run from a policy of mystery and silence. Greater publicity would certainly result in a better understanding by all parties concerned.

Photographs from the Field

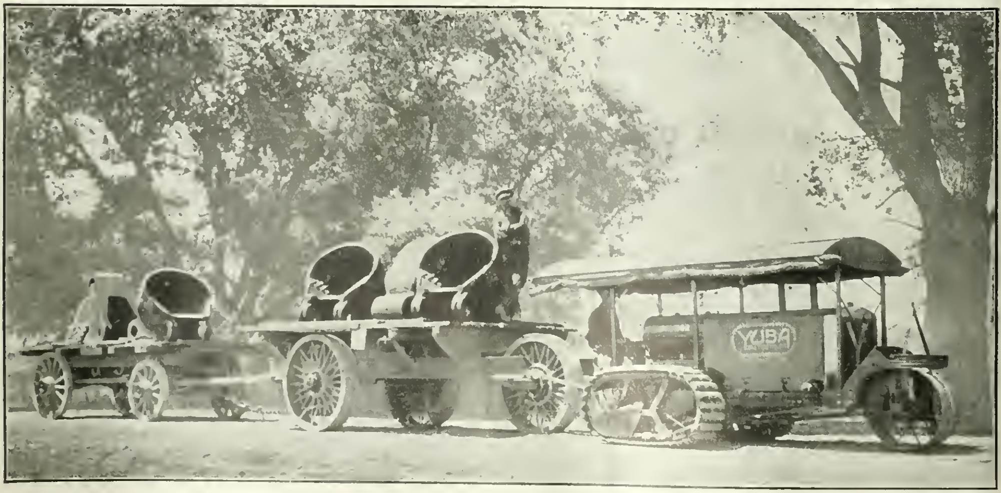


WHITTALL TRANSPORTATION SYSTEM USED IN DEATH VALLEY, CALIFORNIA

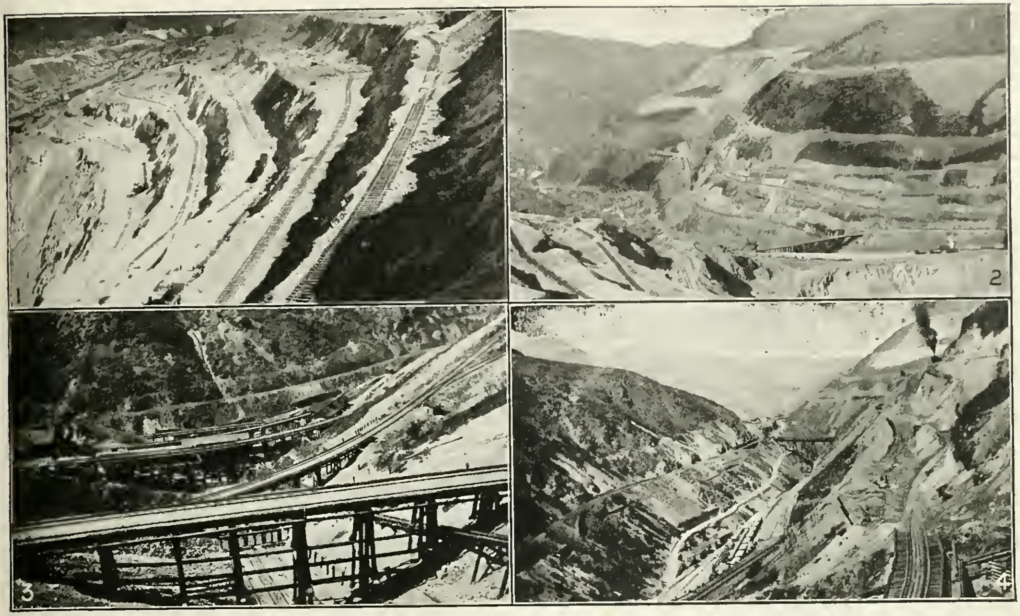
In this system, the power is generated in the leading truck and transmitted by a shaft extending throughout the train, each wagon thus being positively driven



THE BOULDER TUNGSTEN PRODUCTION CO.'S PROPERTY IN BOULDER CO., COLO., SHOWING THE PORTAL OF THE NEW ADIT AND THE MILL NOW IN OPERATION



MODEL 18 YUBA TRACTOR HAULING THE LARGE BUCKETS FOR NEW YUBA DREDGE



VIEWS OF THE OPERATIONS OF THE UTAH COPPER CO., BINGHAM CAÑON, UTAH
Practically all equipment is working at one-third over its rated capacity. To mine and transport this ore, 107 mi. of track have been laid, 57 of which are at the mine

EXCAVATIONS FOR MILL OF UNITED EASTERN MINING CO., OATMAN, ARIZ.—SHAFT HEAD IN BACKGROUND

Correspondence and Discussion

Microscopical Study of Ores

The comment in the editorial section of the *Journal* of June 17 regarding the recent book by Dr. Joseph Murdoch on "Microscopical Determination of the Opaque Minerals" is, on the whole, so favorable and sympathetic that complaint would be quite unfitting, even from one who has followed the preparation of this book with so deep an interest as I. However, the remark that, as contrasted to use in skilled hands, "the novice will find all kinds of pitfalls and his conclusions as to genetic relations of minerals may prove valueless" seems to me to call for comment.

It is possibly true that we who are now so thoroughly accustomed to the methods presented in the book may have underestimated the difficulties in using them that may be experienced by others. As to that, discussion would be idle, since time alone will afford the answer. But it should be noted that the claim to simplicity that I made for the book in its preface extends not farther than the limits of the book's scope, in regard to which the concluding phrase quoted above might convey an impression quite misleading.

The single and sole object of this book is the identification of the opaque minerals, and with unimportant exceptions only such matter is included, on topics like preparation of the material and methods of examination, as is essential to proper application of the scheme of identification proposed. Discussion of genetic relationships, geological significance and modes of occurrence of the minerals has purposely been avoided, partly because the establishment of a scheme of identification was in itself a sufficient task and partly because knowledge regarding these other matters is not yet sufficiently extensive or firm to justify a contribution concerning them of any such formality and pretentions as a textbook.

Without doubt some users of Murdoch's book will draw false or valueless conclusions as to the genetic relations of the minerals they may be investigating, but it will hardly be maintained that these conclusions are more likely to be erroneous after the minerals involved have been accurately determined than when their identity was a matter of more or less guesswork; on the contrary, deductions are likely to be much more reliable if based on exact knowledge of the units that constitute the problem; namely, the minerals of the ore. The possible implication that this may be a dangerous book to put in the hands of beginners resembles the fear that use of a dictionary may lead to incorrect speech because it deals only with words and not with the construction of sentences or paragraphs.

To the suggestion that microscopic examination of the ore minerals should be accompanied by similar study of the associated gangue minerals I assent wholeheartedly, though tempted in this conection to ask what could be done had not Sorby, Michel-Levy, Rosenbusch and others provided realiable means for identification of the transparent varieties under the microscope. I fear I must agree, also, with the view that the literature of this relatively new science of mineralography, or microscopical study of the ore minerals, holds an unfortunate proportion of contradictions, misconceptions and trivialities. Yet such shortcomings are inevitable in any new field of research and in this particular subject, at least, are to be attributed rather to the sudden appeal and fascination it has exerted upon students and investigators, especially of the younger generation, than to any inherent lack of reliability and value in the subject itself. With time and sincere, careful effort, false byways of the present will be first revealed in their true light and then obliterated, but it is hardly to be doubted that, though they may have temporarily delayed direct progress, they will have stimulated the development of substantial avenues leading toward the true goal. In any case means for accurate determination of the mineral species cannot fail to be helpful.

Perhaps I may be permitted to add the conviction that if all students of mineralography were to observe a restraint similar to that practiced by Dr. Murdoch, who worked steadily on his one subject for four years before entrusting his results to print, there might be less occasion for criticism and correction, and less justification for the distrust with which some unfortunately now regard this truly valuable method of investigation.

Cambridge, Mass., June 23, 1916. L. C. GRATON.

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Preparedness

The editorial entitled "The Scarcity of Ships" calls attention to our lack of shipping facilities with which to carry on and increase our trade with the South American countries. Before the war there was greater European trade than North American. In Argentine Europe was much better known than the United States. Ten travelers went to Europe where one went to North America. The war stopped the operation of the principal line of steamers, the Hamburg-South American line, and those Argentinos and Brazilians who had heretofore gone to Europe turned to this country for their travel and studies. The trade between the United States and the East Coast increased.

Recently the Argentine government has made new laws that greatly favor the investment of foreign capital there and should be of great assistance to those American mining men who have given up in disgust the attempt to develop the mineral resources of the eastern slope of the Andes. The English law regarding the investment of English capital outside of the Empire further removes England from the field of competition. Conditions look favorable toward the development of American industry and mining in Argentine.

Americans realize that the mutual trade relations are strengthening, but do they realize that there are others in the field of competition? The Argentinos, while perfectly friendly to North Americans, are also perfectly friendly to any foreigner who will develop their country honestly. I know of several instances where prominent bank officials have sent their sons to North American banks for periods of several years to learn the language and banking customs and then have given them responsible positions upon their return home. They are doing their share toward inter-American trade. But they are doing the same in England and until recently in Germany. Are we making an equal effort to further these conditions?

I have just been talking with a person fresh from a visit to the prison camps in England, France and Germany. I have had a hazy impression of life in a prison camp as being spent by the Germans in smoking and drinking beer, where available, by the English in playing cricket and by the French in drinking wine and making curios. This, however, is not the case. In all the camps a goodly portion of the men were engaged in study. Their books were on many topics; history, geography, political economy and languages—all received attention. The majority of the language texts were Spanish. Spanish is the language of Argentine.

If Europe in time of war can prepare for peace, can't America in time of peace prepare for continued peace and increased trade relations? How many Americans now are looking forward to trade relations with Argentine during the next decade? How many of these know Spanish and the laws, history and customs of that land? How many of those who don't are making any effort to? Argentinos are coming halfway to meet foreigners, be they English, French, German or American. English, French and German are preparing to meet them halfway. Are Americans doing their part to be in the lead?

A short time spent daily on the study of Spanish I feel would amply repay the average mining engineer within the next decade. F. W. FREDERICKS.

New York City, June 20, 1916.

Misuse of Belt Dressing

With reference to the article on "Misuse of Belt Dressing," in the *Journal* of May 13, 1916, p. 858, I agree with the writer in some respects, but not in all. When he says, "The use of belt dressing should be abolished because it is unsafe, unnecessary and wasteful," I disagree with him in every point. The use of belt dressing is not unsafe, unless practiced unsafely. Dressings need not be applied when a belt is in motion; even if so applied, with a stick at the end of which is a pad saturated with the dressing, there is absolutely no danger, especially if the beltman puts on the dressing at the point where the belt leaves the pulley—not where it approaches it.

The use of belt dressing is not unnecessary. For the same reason that machinery needs oil, a belt needs a certain amount of lubricant. In other words, a belt needs dressing. It is possible to run belts dry, without dressing, but it has been proved that belts treated with a proper dressing will last longer, pull greater loads and give greater efficiency.

Dressings are not wasteful. The following instance, among many will illustrate this point: An old 12-in. leather belt in the Union dry dock (Erie R.R., Buffalo, N. Y.) was first treated in 1896. By its use it was possible to add several new machines to the belt's load. It is figured that $63 was spent for belt dressing, but the treatment of this one belt was worth $640.

As for efficiency and pulling qualities of dressed vs. undressed belts, I need only refer to tests that have been made in the laboratories of Cornell University under the supervision of Prof. R. C. Carpenter. I personally assisted Robert Thurston Kent in making another series of tests on treated vs. untreated belts. The later tests were static. The former were on belts in motion. The reason belting manufacturers do not recommend belt dressings is that most of them make a brand of their own that they do not call a dressing. They call it a "light oil to keep the belts soft and pliable," as Mr. Prescott says. That is just what a good dressing should do. That is what F. R. Taylor recommended for belts and what all authorities recommend. Clean belts, clean pulleys and freedom from dust are all highly desirable in belt drives. They are obtainable with the proper dressing. I would therefore recommend the proper dressing rather than advise the complete elimination of all kinds of dressings.

New York, June 20, 1916 N. G. NEAR.

Americanizing British Mines

My attention has been called to the résumé in the *Journal* of May 13, 1916, of an article "Americanizing British Mines," published in the *Financial Times* of London. I have not yet seen either of the original articles, but I should certainly like to disassociate myself from any such imputations as British engineers are charged with. The solidarity of the mining profession as a whole is one of its brightest features, and as far as I know, there is little if any jealousy existing between British and American engineers, who take pride, on both sides, in the achievements and success of their professional friends and colleagues. I quite agree with your remark, that "right-minded men do not consider engineering ability in terms of nationality," although they naturally take a broad British-Imperial view of their obligations on the one side and an American view, no doubt, on the other side of the Atlantic; in each seeking to uphold the prestige and interests of their own country.

The question whether we are reaping the fruits of short-sightedness in not having turned out more mining engineers and metallurgists from our schools, seems to me, however, to be open to some question. The point of view from which I look at the matter myself is that it is a pure waste of time and valuable energy to educate—at great expense—a larger number of young men for any particular profession that there are suitable openings for them to fill; and it is extremely doubtful whether at the present time—whatever may be the state of the case later on—the mining profession is not a bit overcrowded.

Prior to the reorganization of the Royal School of Mines (with which, by the way, the name of an American engineer, Hennen Jennings, must always be gratefully and prominently associated) America doubtless got the lead of us in education. A. G. CHARLETON.

London, June 16, 1916.

Tacitus, the Historian

In the department "By the Way" in the *Journal* of May 27, you give my ancient friend Tacitus, the historian, a little greater antiquity than he is entitled to. Instead of writing "Some time in the B.C.'s," as you have it, he was born in the reign of Claudius Caesar, about 53 A.D. and his "History" from which the quotation was taken was written in the reign of Nerva or Trajan.

Patton, Calif., June 6, 1916. LOUIS JANIN, JR.

Editorials

The Proposed Tax on Copper

In commenting last week upon the proposed Federal tax on copper, we did not have the text of the measure before us and therefore had to be cautious. It was inconceivable to us at that time that copper alone among the metals should be taxed, yet mention of no other was made in the press dispatches. However, they prove to be correct. Out of the entire long list of crude commodities copper is singled for special taxation!

That Congress should have such a conception is dumfounding. Why copper and why not iron, lead, zinc and the rest? Why not coal and petroleum? Why not wool, leather, wheat, corn and cotton? The one thing that baldly stands out is the unfairness of this project. Here we have class legislation with a vengeance. Copper producers are right in standing aghast at the enormity of the idea.

But this is not the worst of it. The proposed act reads, "Every person smelting copper ore, refining metallic copper or alloying copper shall pay . . . an excise tax . . . (on) the gross receipts . . . from the sale or disposition of refined copper or copper alloys and from the sale or disposition of crude or unrefined copper if sold or disposed of for any purpose except for refining or alloying."

We interpret this as meaning that the miner does not have to pay anything unless he smelts and refines. The smelter does not have to pay anything unless he sells his pig copper for casting purposes. The refiner has to pay (of course he will throw back upon the smelter) and the brass maker has to pay again for the refined copper that he uses. If the profit be less than 10%, nobody has to pay. This lets out the careless, little fellow. Of course it is only the small class of big fellows at whom Congress in its present spirit is aiming. The thing is bungling and monstrous.

Alas! Class legislation is the governing idea in the new revenue bill as a whole. The income tax is doubled in rate without there being any reduction in the exemption limit. This tax is thus kept distinctly as a class tax. It falls upon a very small percentage of the population of the country and chiefly upon the people of a few states. The proposed tax on copper is even more narrowly limited. There is talk among the producers of spreading it among consumers generally, but how is that going to be done when half of our copper production must be sold in foreign markets in competition with the copper of the rest of the world?

We find no fault with the principle that taxes must be raised. We advocate military preparedness, and that is going to cost money, which must be supplied by the people, but let them do it on a basis of equality. We do find fault with plans for unequal taxation, for class taxation, that are made the cloak for all kinds of governmental extravagance. We grumble about a tax on copper to provide money to build marble post offices in Yahoo and shack-towns and to dredge creeks in the prairies. We object to the expenditure of public money to maintain and aggrandize the jobberies—the bureaus—in Washington that spend vast sums to prepare bulletins gravely to inform us that the Dutch have taken Holland, to print the mouthings of quasi statesmen at enormous expense and to carry on a variety of enterprises that broach upon the scandalous.

Now that Congress has learned how easy it is not only to spend other people's money, but also to get it, how long is it going to be before the income tax is quintupled and a tax on copper is levied and quadrupled? And what is going to be the economic result if the earnings of profitable industry be sucked away to be wasted?

This copper tax may not be felt so keenly when copper is above 20c. as it will at the normal of about 15c. and under. Consider a producer whose cost is 12c. and whose output is 67,000,000 lb. at 15c. Gross output, $10,050,000; net output, $2,010,000; excise tax, $191,500; rate, 9½%. When the price for copper gets down to 14c., the determination of the 10% profit under the clause that grants exemption will begin to be interesting.

* * *

Origin of Mississippi Lead and Zinc Deposits

The zinc and lead deposits of the Mississippi Valley are simple in their structural relations and in their mineralogical composition. Nevertheless the most divergent views as to their genesis have been expressed, and the literature dealing with them is exceptionally voluminous. During the last 20 years the dominant views attribute these ore deposits to the action of surface waters, but there are two camps of geologists opposing each other as to the manner of operation of these waters.

Buckley and Buehler, both well qualified to judge, hold regarding the Joplin region that the ores have been leached by descending waters from the Pennsylvania shale and deposited by reaction between descending and ascending waters. Van Hise, Bain, Tangier Smith and Siebenthal, representing the United States Geological Survey, believe the zinc ores were leached from underlying strata by ascending waters and that they were deposited near the impervious cover of the shale. Other authors—for instance, F. L. Nason and W. P. Jenney—have not hesitated to look for the source of the metals in the underlying pre-Cambrian crystalline rocks, and once in a while other observers, noting the evidence of an epoch of brief but intense deposition, venture to advance the view that these deposits, usually considered free from magmatic taint, have in fact been formed by attenuated solutions rising from deep intrusions. J. E. Spurr suggested this for the lead deposits of southeastern Missouri, L. V. Pirsson recently suggested the same in regard to these deposits in general, and W. L. Uglow finds corroboration of this view in some Canadian occurrences, all of these articles appearing in *Economic Geology*.

The most noteworthy contribution to this much-debated question is found in Siebenthal's recent bulletin on the "Origin of the Joplin Deposits." Unquestionably his results mark a great advance in our knowledge, and the theory of deposition by ascending saline-alkaline waters more or less charged with carbon dioxide and hydrogen sulphide has received the strongest kind of support. Siebenthal elucidates convincingly the artesian circulation of the region, shows the importance of the impermeable barriers of the Devonian and Pennsylvanian shales, indicates the probability of derivation of the metals from the Cambro-Silurian strata and points out how the dissolved zinc bicarbonate is held in solution by the carbon dioxide in spite of the presence of hydrogen sulphide until the former gas escapes.

Even more important than this is the definite proof furnished that the ascending waters of the region, where tapped by artesian wells, contain iron, zinc, lead and copper in solution, which metals are precipitated in reservoirs and tanks as a black slimy deposit of sulphides. It is shown that a metal content of such waters is not confined to the Joplin region, but also is present in other regions of the great interior valley. This discovery is one of the most important contributions in recent years to the knowledge of this class of ore deposits.

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Copper and Spelter Decline

The decline in the prices for copper and zinc have produced the usual dissatisfaction, although the level for each of these metals is still very high, especially of copper. Some people deceive themselves by refusing to admit that there has been any decline, or offer the excuse that the decline has been on very small business and comfort themselves with the belief that no considerable quantity of metal can be obtained at the prices quoted.

A cataclysmic decline usually happens on very small sales. When in 1907 copper fell from about 25c. to below 12c., the sales on the way down were relatively trifling and the volume of business did not attain large proportions until the bottom had been reached. We are not looking for any such decline in copper now as happened in 1907. There was lately some large business pending, which failed to be consummated owing to inability of buyers and sellers to agree upon price.

It is really a pity that the establishment of prices has to be a matter of trading. There ought to be some means of enabling spelter producers to take consumers by the scruff of the neck and compel them to pay 15c. per lb. for the average output. But so long as buyers are independent and will not buy unless they want to, what can be done?

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The Readjustment

Reports are becoming more and more frequent of concerns that have completed their foreign orders for shells, shrapnel and other ammunition and are not only receiving no new orders, but do not want them. Some of these concerns say they do not want to bother with any more war orders, and others report that they are so busy with manufacturing for domestic peaceful purposes that they would not take any more ammunition business anyhow. One inference to be drawn from this is that the European governments have now organized their industries so that they are able to produce their own supply of ammunition; another is that American industry is returning to its normal basis. We are now going through a period of readjustment. The tension has been relieved, the excitement has disappeared, but domestic business is proceeding at a high rate and probably will continue to do so for a long time to come. Although we shall be supplying Europe with fewer shells and less explosives, our raw material and many of our manufactures will still be required in quantities as large as heretofore. For example, Great Britain and France may now be able to make their own ammunition, but they will have to buy American copper just as they have been doing.

The recent slackness in copper and lead and the small recession in the prices for those metals simply reflect this readjustment. At a little lower, but still very remunerative level, there will probably be a revival of business. The matter of spelter is of course different, for the excessive price for that metal so stimulated new production and diminshed peaceful consumption that a different kind of readjustment is in prospect.

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The Mexican imbroglio seems to have been cleared up for the time being. Carranza has become as sweet as sugar, notifying the Washington Government of the approach of bandits toward the border, urging the American authorities to head them off and offering assistance to do so. In the meanwhile appeals are being addressed to American mining men to please come back and reopen their mines and metallurgical works. Whence, forsooth, is there going to be any income for the Mexican government if mines and oil wells do not produce? Thus we have a temporary adjustment of affairs, with our troops guarding our border, but if we know Mexican conditions, it will not be long ere new outrages are perpetrated that will again command our popular attention and lead to the intervention which is the only thing that will put the Mexican house in order.

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The arrival of the German commercial submarine "Deutschland," which surprised us last Sunday, has produced new complications in diplomacy, although in principle she is nothing but a successful blockade-runner, the escape of which in no wise invalidates the British blockade of Germany. The "Deutschland" brought a cargo of dyestuffs, which is the most concentrated salable commodity that Germany offers. It will be more interesting to learn what sort of a cargo she will try to take back. Will it be copper, nickel, rubber, or something else? An inkling may be obtained from her manifest as to what Germany needs most.

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The idea that prevails in the British Empire that the boosting of the price for spelter was a German plot to make the Allies pay highly for an essential commodity may now be set against the idea prevalent in the United States that the recent slump in spelter is the result of British manipulation to force the American producer to sell cheaply. One idea is as sensible as the other.

BY THE WAY

The applicant for the position was asked by the business man if he had a college diploma. According to *Puck,* the applicant replied: "No sir, but I have several mining-stock certificates that might be offered in evidence that I have been through the school of experience."

⁂

In August, 1914, 200 mechanics of the gold mines of the Transvaal proceeded to England to undertake munition work; these volunteers were provided with free return passage and their billets are guaranteed to them on their return. They have given an excellent account of themselves.

⁂

Some years ago the citizens of a county in a Western State in a burst of enthusiasm constructed a 100-mile railway, according to *Engineering and Contracting.* In due course of time an attempt was made to unload the property on Eastern capitalists. They sent out an engineer to investigate. He reported that the railway had been built either 100 miles too long or 100 years too soon.

⁂

Dispatches from Rome announce that a violent earthquake on July 6 caused the loss of many lives, variously estimated at from 100 to 300, in the sulphur mines of the district of Caltanissetta, Sicily. It is stated that the victims were in three sulphur mines, which the earthquake caused to cave in. This is the only instance, which we can recall, of an important mine disaster resulting from an earthquake.

⁂

"Smoke farming" and the like do not always pay. With war prices prevailing for potash for two years, the orange growers in southern California are just beginning to realize what a handsome thing the Riverside cement company was doing for them in letting its potash-containing dust fall on the near-by orange groves. All they needed to have done was to "hose down" the trees and they would have had their potash delivered on the ground for practically nothing, instead of the prohibitive $300 to $500 per ton when bought in the market. The orange grower's complaint about the cement-plant dust became so serious that the company endeavored to buy up near-by groves at $1,000 or so an acre, but the suits and threatened injunctions from outlying groves continued, and so the cement company put in a Cottrell precipitation plant. The company is reported to have recovered last year potash which was sold for approximately $100,000.

⁂

The prospectus of the Virginia Mines Development Co., Inc., indicates new possibilities in the mining and metallurgical field. Virginia, once the mineral treasure house of the United States, is again called upon—this time for the modest sum of $15,000,000 gold and substantial quantities of platinum. "The development through tunnels, drifts and stopes has proceeded sufficiently to warrant estimates by the mining engineers of the company that from less than one-third of this zone and down to the 500-ft. level only, the recoverable values should reach upward of $15,000,000." Geologically the report continues: "The ore formation is of slate and schist which has been eroded down to the present levels. The eroded material forms placer beds in which numerous gold-bearing veins and schists occur." "Selections made without special care show an average gold content of $51.88 per ton." Mining and metallurgical efficiency will evidently be high, since but $2 per ton is allowed for both these factors. A 500-ton cyanide plant, its initial cost in the neighborhood of $500,000, is assumed. A dividend of $12 per share is suggested for a period of 16 years as an inducement to the purchase of stock. This large orebody is assumed to be in Goochland County, Va.—some proposition!

⁂

Dr. Miller Reese Hutchison, chief engineer for Thomas A. Edison and himself an inventor, has given to the New York *Times* his own experience in the matter of motor-fuel substitutes which make him inclined to be skeptical of "green gasoline," the cent-a-gallon substitute for real gasoline, a discovery of Louis Enricht, of Farmingdale, L. I., which was erroneously reported to have been bought by the Maxim Munitions Corporation Co.

"Here is the story of an inventor I repeated to Hudson Maxim when he asked me what I thought of the whole thing," said Dr. Hutchison. "I received a message asking me to get over to the Navy Yard in Brooklyn as fast as I could to see a new invention which was going to revolutionize the whole theory of gasoline motor-fuel. It seems that a man had made a discovery, persuaded Washington to allow him to try it out in the navy yard, and it was the day of the experiment. When I got to Brooklyn I found a little group of naval officers and a few engineers gathered about to watch a civilian undertake to run a gasoline engine with a mixture which he said was plain water and a certain simple chemical.

Every precaution was taken to guard against any sort of fraud. The man took about two gallons of pure water, then poured in a tube of his 'discovery,' put the mixture in the engine, cranked up and away she went. I tell you it got all our goats to see the wheel spin and hear the exhaust, realizing it was nothing but water which was presumably burning in the cylinders. I was so much interested that I set to work in my own laboratory that night to see if I could get any idea of just what I had witnessed that day. I had smelled the exhaust to be sure that the engine was not burning gasoline, and that gave me the idea that an acetylene solution must have been used." Dr. Hutchison rigged up a contrivance from an automobile gas-lighting tank. He found that by using acetone to take up the acetylene and then dissolving the acetone in water he had a mixture which he believed would do. The next day he went back to the navy yard, poured his solution into some water and put it into the same engine. It started with the first cranking and went just as it had on the previous day.

"You see," said Dr. Hutchison, "the water in each case was merely the vehicle to get the explosive into the cylinders. There was nothing taken from it or added. It was as if a man took the ashes from his furnace and saturated them with oil. They would burn, but then the ashes would be left as before, and unless you put in some more oil you could not get another fire out of them."

Dr. Hutchison was asked if what he had discovered was not a substitute for gasoline. "Why, yes," he said; "so is picric acid, for that matter, but you should have seen those cylinders when our experiment was over."

Mining Law Revision

At the meeting of the Alaska Mining and Engineering Society at Juneau, Alaska, on May 20, the subjoined resolutions were adopted.

Whereas, A serious endeavor has been made to correct defects in the 50-year-old mineral-land laws of the United States and Alaska, in order that they will be in harmony with the various changes resulting from the general advancement in the mineral industry and can therefore adequately meet present-day requirements; and

Whereas, Various professional and scientific organizations, such as the American Institute of Mining Engineers, the American Mining Congress, the Mining and Metallurgical Society, the Idaho State Mining Association, the Montana Society of Engineers, the California Metal Producers' Association, the Spokane Mining Men's Club, the Nevada Mine Operators' Association, the Colorado Scientific Society, together with representatives from several chambers of commerce and from operating mines, have harmoniously united in an effort to secure the passage of a bill by Congress "to provide a commission to codify and suggest amendments to the general mining laws"; and

Whereas, There appeared before the Committee on Mines and Mining of the House of Representatives engineers from the above organizations, acting as authorized delegates, and who command the respect and confidence of their respective societies, and whose motives, honesty and sincerity of purpose are not to be questioned; and

Whereas, The Hon. James Wickersham, Delegate from Alaska, who also appeared before the House Committee on Mines and Mining, chose to attack the personalities of these engineers, as well as their honesty and motives, and through his abuse and ribaldry brought the people of Alaska into ridicule and contempt; now, therefore, be it

Resolved, That the Alaska Mining and Engineering Society assembled at Juneau go on record as expressing its earnest disapproval of the tactics adopted by the Hon. James Wickersham, and to express also a feeling of humiliation at being represented in Congress by one whose chief method of argument against the bill was personal abuse.

Resolved, That we, as engineers of Alaska, are convinced that the efforts of the engineers appearing before the House were honest and sincere and that the passage of the bill would have resulted in good, not only for the entire country, but for Alaska in particular.

Resolved, That it is the sense of the Alaska Mining and Engineering Society that the House committee made a grave mistake in failing to act favorably upon the bill, as to the best of our judgment a commission organized as provided by the bill will be the most efficient and prompt means of revising the mining laws beneficially.

Resolved, That due publicity be given to these resolutions and that they be sent forthwith to the various societies, engineering papers and public officials chiefly concerned.

The mining men of Alaska and in the Northwestern States, especially, are taking great interest in the matter of mining-law revision.

The secretary of the Mining and Metallurgical Society of America has issued the following letter:

The most important work before the society at the present time is that of securing certain alterations in the Federal land laws as they affect mineral locations.

The attempt made at various times to secure a congressional commission to investigate the subject and to make recommendations to Congress, culminating in the strongest possible presentation to Congress last winter by a combination of American organizations interested in mining, failed to secure the desired result.

It is now the belief of our representatives in Washington that the changes can be secured only by presenting to Congress a bill which shall embody the changes desired.

Acting on this belief, a set of specific recommendations was introduced and discussed at the meeting of the New York Section on Apr. 19. The recommendations and the discussion were published in Bulletin No. 96.

Copies of the recommendations have been sent to all organizations that have shown any interest in the subject, and they are now receiving consideration by these organizations.

Communications should be addressed to Mr. H. V. Winchell, chairman of the Mining Law Committee, 505 Palace Building, Minneapolis, Minn., or to the secretary of the society, 115 Broadway, New York.

Foreign Trade in Copper

Exports of copper from the United States in May and the five months ended May 31 are reported by the Department of Commerce as below, in pounds:

	May	Five Months
Ore and concentrates, contents	356,547	1,611,507
Blister and black copper		3,015,015
Refined—ingots, bars, etc.	71,620,384	278,882,117
Plates and sheets	572,316	6,752,603
Wire	1,952,143	9,730,118
Old and scrap	7,866	35,928
Total copper, lb.	74,509,256	300,027,288
Copper manufactures, value	$1,656,843	$6,381,295

The weight of ore exported in May was 8,728 tons; of concentrates, 418 tons; showing an average of 36.4 lb. copper to the ton of ore and 93.5 lb. copper to the ton of concentrates.

Imports of copper into the United States in May and the five months ended May 31 are reported by the Department of Commerce as below, in pounds:

	May	Five Months
Ore and concentrates, contents	13,404,142	62,106,537
Matte, contents	1,294,414	9,677,561
Unrefined—blister copper, etc.	22,744,599	117,323,903
Refined—bars, plates, etc.	7,902	2,506,392
Composition, copper chief value	165,907	399,041
Old and scrap	901,011	4,492,824
Total copper, lb.	38,517,975	196,506,258
Copper manufactures, value	$2,157	$17,965

Actual tonnage of copper-bearing material imported in May was 50,946 tons ore, 10,577 tons concentrates and 1,621 tons matte. Net exports of copper in all forms were 103,521,030 lb. for the five months.

*

Brunswick Consolidated Headframe

At the Brunswick Consolidated mine, Grass Valley, Calif., a new headframe 85 ft. in height from the collar of the shaft to the center line of the sheaves, was erected during 1915. It is all steel excepting guide posts and platform floor at the sheaves and is set upon concrete piers. According to the 1915 annual report it was erected at a cost of $5,873. Details of the cost of construction are:

LABOR		
Chief engineer	$147.00	
Draftsman	144.50	
Grading	60.00	
Concrete foundations	412.25	
Carpenter work, framing, etc.	307.75	
Electrician	36.00	
Machinist	3.00	
Contractors (erecting)	676.41	
		$1,786.91
MATERIAL		
Sheaves	$384.43	
Lumber	60.31	
Freight	26.71	
Sundries	27.57	
Structural steel, fabricated	3,587.37	
		4,086.39
Total cost		$5,873.30

*

Production of Copper in Russia in 1915

According to the *Russian-American Journal of Commerce*, the production of copper in Russia in 1915 was 29,800 short tons, compared with 36,430 short tons in 1914. There was an increased production in the Urals, but a decrease in the Caucasian and Siberian works, the output of which was only 9,544 tons in 1915, as compared with 16,275 tons in 1914.

PERSONALS

H. C. Harbrecht has gone from Champaign, Ill., to Oatman, Ariz.

H. H. Harpham, recently in Mexico, has gone to Los Angeles.

Y. C. Kuang, recently in New York, is now at Hongkong, China.

H. F. Janson, recently at Houghton, Mich., has gone to Copper Cliff, Ontario.

J. M. Boutwell is in Peru, preparing a geological report on the Cerro de Pasco mines.

R. C. George has been appointed general manager of the Wisconsin Zinc Co., succeeding H. S. Snow.

Thirty-five Students in the Colorado School of Mines have gone to Texas in the Colorado State Militia.

H. T. Durant, a well known British metallurgist, is lieutenant in the 13th Battalion of the Hampshire Regiment.

William N. Norris, lately at Princeton, N. J., is now with the New York & Honduras Rosario Mining Co., San Juancito, Honduras.

H. Cecil, of New York, who is extensively interested in mining claims in the Gold Lake district of Manitoba is visiting the camp.

Ralph Arnold, consulting geologist and petroleum engineer, announces the removal of his New York office to the Equitable Building, 120 Broadway.

J. B. Tyrrell, of Toronto, Ont., is spending some time in British Columbia. His address while there will be Vancouver Hotel, Vancouver, B. C.

George E. Farish, 25 Broad St., New York, has moved his western office from Denver, Colo., to Nevada Bank Building, 14 Montgomery St., San Francisco, Calif.

L. M. Banks has gone from Chloride, Ariz., to Denver.

F. W. Traphagen, professor of metallurgy in the Colorado School of Mines, has resigned that position and is now president of the Colorado Metal Mining and Reduction Co.

N. O. Lawton has completed the exploration work he has been doing in Hancock County, Tenn., and has gone to South Strafford, Vt., to examine some copper properties there.

Dr. William B. Phillips has resigned his position as president of the Colorado School of Mines. It is understood that he will undertake the development of some mining property in Texas.

Extensive examinations are being made in Southwestern Oklahoma by the Associated Geological Engineers; the field parties being headed by Prof. **Clyde T. Griswold** with occasional visits by **F. G. Clapp.**

C. H. Poirier, of the Porcupine Vipond, Porcupine, Ont., and **M. W. Summerhayes**, of the Porcupine Crown, have been selected as engineers to value the McIntyre, McIntyre Extension and Jupiter properties to ascertain the basis for a merger.

Dr. Henry M. Howe, emeritus professor of metallurgy in Columbia University, has been appointed honorary vice-president of the Iron and Steel Institute of Great Britain. This distinction is held by only two other persons, Giorgio E. Falck, of Italy, and D. Tschernoff, of Russia.

George H. Crosby, Jr., son of George H. Crosby, of Duluth, has wedded Miss Elsa Bieberman, daughter of Louis Bieberman, also of that city; they will make their home in Crosby, Minn. Mr. Crosby has just graduated from the Sheffield Scientific School at Yale, and will follow his profession of mining in the Cuyuna range.

Harrison A. Dunn was reported in the "Journal" of June 17 as being imprisoned in the City of Mexico. In response to inquiry respecting him we interested Mr. Manning, director of the U. S. Bureau of Mines, and he reported that on July 4 the Department of State wired the American representative in the City of Mexico to renew representations in behalf of Mr. Dunn. On July 10 the State Department reported that it had heard from its representative that the prospects for the release of Mr. Dunn were good but that no definite action had been yet taken. Mr. Dunn's friends will be glad to know that his case is receiving energetic attention. Mr. Dunn is well known as a mining man, being a graduate of the Michigan College of Mines in 1909.

OBITUARY

Alvin R. Kenner was drowned at Olympia Park, near Grass Valley, Calif., on July 5. He graduated from the Colorado School of Mines in 1907. He had been superintendent for the Rio Plata Mining Co. of Mexico for several years and had recently left Mexico. He was in Grass Valley on business for the company.

The estate of **Barton F. Sewell,** formerly vice-president of the American Smelting and Refining Co., who died in January last, has been valued by the state appraiser at $1,441,881. The property is bequeathed to his wife and children, with a few legacies to friends. The greater part of the estate is in stocks and bonds of the Braden Copper Mines Co., of which he held 118,058 shares of stock and $615,351 in bonds.

SOCIETIES

University of Illinois—The Graduate School of the University has recently made an appropriation for a geological expedition to Hudson Bay during the summer of 1916. The work will be in charge of Prof. T. E. Savage and Dr. F. M. Van Tuyl, of the department of geology, who will be in that region from the latter part of June to the middle of September. It is planned to examine the outcrops and make detailed collections of fossils along most of the larger rivers south of the Churchill on the west side of the bay, in an effort to obtain more definite information concerning the Paleozoic succession and the ancient sea connections in that part of the continent. Evidences of recent elevation of the shore line, and other features will also be studied.

INDUSTRIAL NEWS

Lidgerwood Manufacturing Co. has moved to new quarters at 63-65 Columbia St., Seattle, Wash.

The Asbestos Protected Metal Co. of Pittsburgh announces that hereafter it will be represented in Cincinnati, Ohio, and surrounding territory, by E. G. Irwin, located in the Union Trust Building.

Jeffrey Manufacturing Co., of Columbus, Ohio, has opened a new branch office in the Commonwealth National Bank Building, Dallas, Tex., and also one in the Railway Exchange Building, St. Louis, Mo.

The E. H. Moyle Engineering and Equipment Co., Los Angeles, Calif., has moved its office to 508 East Ninth St., where it will show and demonstrate goods, and also make laboratory and metallurgical tests.

The Vulcan Soot Cleaner Co., of Du Bois, Penn., states that their New York representative, the De Ved-Kissick Co., has recently obtained what is claimed to be the largest order on record for the type of apparatus manufactured by that company. Soot cleaners are to be installed on 50 boilers of the B. & W. type, totaling 30,000 hp. rated capacity, at the Marion plant of the Public Service Electric Co., of New Jersey. The same company has recently equipped their 1,375-hp. boilers for the new Essex plant with Vulcan cleaners Other large orders have been received recently from the Calumet & Hecla Mining Co.; Youngstown Sheet and Tube Co. North American Chemical Co. and others.

Westinghouse Electric and Manufacturing Co., East Pittsburgh, Penn., has received the following orders recently from the Chile Exploration Co.: For two 450-hp., self-starting, 3-phase, 50-cycle, 500-volt synchronous motors for compressor service, with shoe rails, dampers and starting auto transformers for 100% power factor operation, two 10-kw., 125-volt, 1,080 r.p.m. exciters and two starting panels, to be installed at Antofagasta, Chile; from the Utah Copper Co. and its allied interests, for 211 vertical agitator motors for separating copper from low-grade ore and tailings by the use of the flotation system; from the Tacoma Smelting Co., 10 complete equipments, consisting of motor-generators, transformers and switchboards for precipitating smelting fumes by the Cottrell process; from the Butte & Superior Copper Co., for a flywheel motor-generator, direct-current hoisting equipment. Similar equipments have also been sold to the United Verde Co., Jerome, Ariz., and the Hercules Mining Co.

TRADE CATALOGS

Herringbone Gears. Fawcus Machine Co., Pittsburgh, Penn. Catalog. Pp. 16. 9x12 in. Illustrated.

Surveying Instruments Buff & Buff Mfg. Co., Jamaica Plain Station, Boston, Mass. Catalog. Pp. 124, 6x9 in.; illustrated.

Chute Gates for Ore, Coal, Ashes, etc. C. W. Hunt Co., West New Brighton, N. Y. Catalog No. 15-3. Pp. 28. 6x9 in. Illustrated.

Duplex Power Driven Air Compressors. Ingersoll-Rand Co., 11 Broadway, New York. Form 3312. Pp. 20. 6x9 in. Illustrated.

Telephone Apparatus and Supplies. Western Electric Co., 463 West St., New York. Catalog No. 3. Pp. 404. 6½x9½ in. Illustrated.

Duplex Direct-Connected Air Compressors. Electrically Driven. Ingersoll-Rand Co., 11 Broadway, New York. Form No. 3026. Pp. 40. 6x9 in. Illustrated.

Trill Indicators. Trill Indicator Co., Corry, Penn. Catalog. Pp. 56. 6x9 in. This contains description and illustrations of the latest types of engine indicators and accessories made by this company, with information on taking and reading indicator cards. Twenty-two pages are devoted to instruction and general hints on the use of the indicator, including the drawing of the theoretical cards, determining the clearance of the indicator card, and to characteristic and faulty diagrams, pointing out the faults, and mode of correction. The indicating of compound engines and gas engines is also discussed in an interesting and illuminating way. This catalog should be most valuable to any engineer using an indicator.

NEW PATENTS

United States patent specifications listed below may be obtained from "The Engineering and Mining Journal" at 25c. each. British patents are supplied at 40c. each.

AMALGAMATOR. Percy A. Robbins, Timmins, Ont. (U. S. No. 1,190,012; July 4, 1916.)

CONVEYORS—Automatic Brake for Conveyors. William Brasack, Fairmont, W. Va., assignor to Fairmont Mining Machinery Co., Fairmont, W. Va. (U. S. No. 1,187,247; June 13, 1916.)

CRUSHING MACHINE. Axel G. J. Rapp, Chicago, Ill., assignor to Link-Belt Co., Chicago, Ill. (U. S. No. 1,187,549; June 20, 1916.)

EXCAVATING—Tooth for Dippers of Excavating Machines. Edward L. Pemberton, New Haven, Conn., assignor to American Manganese Steel Co., Augusta, Me. (U. S. No. 1,188,480; June 27, 1916.)

FLOTATION—Ore Concentrator. George B. Eberenz and James I. Brown. Cripple Creek, Colo. (U. S. No. 1,187,822; June 20, 1916.)

HEAT TREATMENT—Method of Heat Treatment. William J. Wrighton, Philadelphia, Penn., assignor to Leeds & Northrup Co., Philadelphia, Penn. (U. S. No. 1,188,128; June 20, 1916.)

LAMP—Miner's Acetylene-Gas Lamp. John Sutch, Oliver Sutch and Alexander Bell, Castlegate, Utah. (U. S. No. 1,189,014; July 27, 1916.)

MINE-CAR WHEEL. Carl Clausen, Bisbee, Ariz. (U. S. No. 1,190,111; July 4, 1916.)

PRECIOUS-METAL RECOVERY—Apparatus for the Recovery of Precious Metals from Metalliferous Earths. Peter N. Ramsey, New York, N. Y. (U. S. No. 1,187,927; June 20, 1916.)

REVERBERATORY IRON-MELTING FURNACES, Method of Operating. John Albert Swindell, Pittsburgh, Penn. (U. S. No. 1,188,111; June 20, 1916.)

ROASTING—Apparatus for Treating Ores. Charles W. Singer, Linden, Wis., assignor to Campbell Magnetic Separating Co., a corporation of Arizona. (U. S. Nos. 1,188,566 and 1,188,567; June 27, 1916.)

ROASTING—Stirring Device for Mechanical Roasting Furnaces. Jasef Claude. Frankfort-on-the-Main, Germany, assignor to Metallbank und Metallurgische Gesellschaft A. G., Frankfort-on-the-Main, Germany. (U. S. No. 1,187,504; June 20, 1916.)

SEPARATOR—Vacuum Ore Separator, Harry H. Baer, Orrville, Ohio. (U. S. No. 1,186,874; June 13, 1916.)

SMELTER FUMES—Recovering Noxious and Other Materials from Smelter Fumes. Clarence Barrett, Salt Lake City, Utah, assignor of one-half to George Morrow, Salt Lake City, Utah. (U. S. No. 1,188,237; June 20, 1916.)

SLAG LAUNDER LINING. William A. Leddell, Morenci, Ariz. (U. S. No. 1,189,842; July 4, 1916.)

TITANIFEROUS PRODUCTS and Method of Producing the Same. Louis E. Barton, Niagara Falls, N. Y., assignor to the Titanium Alloy Manufacturing Co., New York, N. Y. (U. S. No. 1,189,229; July 4, 1916.)

NEW PUBLICATIONS

HANDBOOK AND DESCRIPTIVE CATALOG OF THE METEORITE COLLECTIONS IN THE UNITED STATES NATIONAL MUSEUM. By George P. Merrill. Pp. 205, illus. Bull. 94, U. S. National Museum, Washington.

THE FELDSPARS OF THE NEW ENGLAND AND NORTH APPALACHIAN STATES. By A. S. Watts. Pp. 181, illus. Bull. 92, U. S. Bureau of Mines, Washington.

COAL-MINE FATALITIES IN THE UNITED STATES, 1870-1914, with Statistics of Coal Production, Labor and Mining Methods, by States and Years. Compiled by Albert H. Fay. Pp. 370, illus. Bull. 115, U. S. Bureau of Mines, Washington.

THE ANALYSIS OF PERMISSIBLE EXPLOSIVES. By C. G. Storm. Pp. 88, illus. Bull. 96, U. S. Bureau of Mines, Washington.

STRENGTH AND OTHER PROPERTIES OF CONCRETES AS AFFECTED BY MATERIALS AND METHODS OF PREPARATION. By R. J. Wig, G. M. Williams and E. R. Gates. Pp. 172, illus. Technologic Paper No. 58, U. S. Bureau of Standards, Washington.

GEOLOGY AND UNDERGROUND WATER OF LUNA COUNTY, NEW MEXICO. By N. H. Darton. Pp. 188, illus. Bull. 618, U. S. Geological Survey, Washington.

MINERAL PRODUCTION OF CANADA DURING THE YEAR 1914. By John McLeish. Pp. 362. Canada Department of Mines, Mines Branch, Ottawa.

AN INVESTIGATION OF THE LAWS OF PLASTIC FLOW. By Eugene C. Bingham. Pp. 45, illus. No. 278, Scientific Papers of the U. S. Bureau of Standards, Washington.

TESTS OF REINFORCED CONCRETE FLAT SLAB STRUCTURES. By Arthur N. Talbot and Willis A. Slater. Pp. 128, illus. Bull. 84, Engineering Experiment Station, University of Illinois, Urbana, Ill.

MINERALOGIC NOTES, SERIES 3. By Waldemar T. Schaller. Pp. 164, illus. Bull. 610, U. S. Geological Survey, Washington.

Gives the results of the smaller, independent pieces of mineralogic research work carried out by the writer in the chemical laboratory of the United States Geological Survey, from July 1, 1911, to Dec. 31, 1913. Earlier reports of a similar nature have been published as Bulletins 262, 490 and 509 of the Survey, in 1904, 1911 and 1912.

A HANDBOOK OF COLLOID CHEMISTRY—The Recognition of Colloids, the Theory of Colloids, and Their General Physico-Chemical Properties. By Wolfgang Ostwald. Translated by Martin H. Fischer. 6x9½, pp 278, illus.; $3. P. Blakiston's Son & Co., Philadelphia, Penn.

This is a translation of the well-known German edition of 1911. The subject matter is that of "pure," or theoretical, colloid chemistry, including the nature of the colloid state and its definition, the relations of colloids to other states of matter, the energy relations of colloids and their mechanical properties such as viscosity, diffusion and the brownian movement. A second part, covering other specific chemical and physical properties of colloids, was originally planned but has never been issued, even in German. In the main the treatment is general rather than specific, and except for some references to biology, there is practically no discussion of the application of colloid chemistry to other sciences or to technology.

If this translation had appeared immediately following the German edition, it would have been very useful. It can scarcely be thought so now. Not only is five years a long time in a subject which is developing so rapidly as is colloid chemistry, but the lack of texts of colloid science in English has now been supplied by the excellent works of Taylor[1] and of Burton[2] and the briefer but no less excellent sketch of Hatschek.[3] Specialists are already familiar with the Ostwald work in the original. Beginners or incidental inquirers will do better to use the later works. Engineers in search of superficial acquaintance with the properties of colloids will find what they want in Hatschek as well as anywhere, and in briefer compass. The need, generally admitted, for a larger test of practical colloid chemistry useful to engineers and industrial chemists is not met by the Ostwald work or, for that matter, by any other which has yet appeared. The chief merit of the Ostwald book, and at this late date almost its only merit, is a clarity of style and an interesting manner of presentation which were noticeable in the original and which the translator has reproduced quite well. It is inexcusable, however, to use the barbarous term "dispersion means" instead of the well-established "dispersion (or dispersing) medium."

E. E. FREE.

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[1] "The Chemistry of Colloids and Some Technical Applications." By W. W. Taylor, 5x7, pp. 328; Longmans, Green & Co., New York, 1915.

[2] "The Physical Properties of Colloidal Solutions." By E. F. Burton. 5½x9, pp. 200; Longmans, Green & Co., New York, 1916.

[3] "An Introduction to the Physics and Chemistry of Colloids." Second Edition. By Emil Hatschek. 5x7½, pp. 107. P. Blakiston's Son & Co., Philadelphia, 1916.

Editorial Correspondence

SAN FRANCISCO—July 5

The Blue Ledge Copper Country in the northwestern part of Siskiyou County is receiving considerable attention this summer and several companies are continuing developments begun a number of years ago. Plans are being made for the extension of the Medford (Ore.)-Jacksonville Rd., 30 mi. south into the Blue Ledge mining district and eventually perhaps to Eureka in Humboldt County. The pass connecting the Rogue and Klamath Valleys will be used by the proposed Eureka-Medford railway. The National Forest is said to have five billion feet of mature timber that is now deteriorating along this route, and there are promising copper deposits in the Klamath and Applegate Valleys besides the Blue Ledge copper deposits. Much of Siskiyou and Trinity Counties' gold production, as well as mines in Jackson County, Ore., could be best served by this road. Humboldt County would also furnish its quota of traffic from deposits at present inaccessible.

Potash Production at Searles Lake is planned by the Pacific Coast Borax Co. This company owns the only patented land at this greatest American potash deposit, title to the Borax company's land having been granted years ago when the borate was supposed to be the only valuable mineral contained in the mud flats. The land taken up by the borax interests embraced a small portion of the "crystal area" of Searles Lake, and enables the company today to draw the potash-bearing brine from the interstices of the crystal body. Some time ago, the Borax company shipped two tank cars of Searles Lake brine to its Alameda works for testing a method of potash recovery worked out by its chemists and those of the Solvay Process Co. Results were successful and the company is now engaged in drilling wells for fresh water, surveying pipe line and other work preliminary to erection of a plant. A mill site has been filed upon about 1¼ mi. distant from the brine-pumping plant.

BUTTE—July 5

The Report About Anaconda going into Katanga copper deposits is all moonshine.

The Tuolumne Copper Co. is doing extensive preliminary work at the Butte Main Range and Colusa-Leonard Extension properties on the east side of the Butte district. General Manager Paul Gow says he will be shipping ore in 60 days. A fine body of ore was uncovered in the Sinbad shaft, a Main Range property, while the shaft was being enlarged and retimbered at a point about 70 ft. above the 600-ft. level. The same ore has been found in a drift westward from the shaft on the 500-ft. level and at about the end line of the Colusa-Leonard ground. The ore runs from 9 to 20% copper, and it is the intention of the management to mine this ore as soon as the shaft is retimbered, which is being done from the 700 to the surface. The shaft was in bad shape and too small for good work. It is likely that eventually both the Main Range and Colusa-Leonard will be operated through one shaft, although the Colusa-Leonard shaft will be opened shortly and some exploration work done from it. All the new surface buildings at the Sinbad shafts are being erected near the west end line, convenient to the Colusa-Leonard, and both properties will be placed within one fence. In the mining separate ore bins will be built and the ore from the two properties kept separate.

Statements of Butte Mining Companies, filed with the county assessor, in compliance with legal requirements, show income and expenditures for the purpose of assessment. Anaconda Copper Mining Co.'s statement for the year ended May 31, 1916, shows net proceeds of $14,363,881, which is $7,895,442 greater than for the preceding year. This takes in only the company's mines in Silver Bow County. The output during that period was 4,946,061 tons of ore, having a gross value of $11.996 per ton; cost of extraction was $4.14 and cost of reduction $2.04 per ton. The annual report of the North Butte showed: Tons of ore extracted 495,275, gross value $5,103,252; cost of mining, per ton, $4.18; cost of reduction, $2.44 per ton; net proceeds, $1,229,340. The report of Butte & Superior Mining Co., covering operations at its Black Rock mine, is as follows: Tons of ore extracted 591,562, having a total gross value of $20,271,949; cost per ton for extraction, $5.45; smelting, $7.15 per ton; total net earnings, $10,497,079. Elm Orlu shows for the year ended June 1, 200,772 tons of ore extracted; value, $18.52 per ton; cost per ton for extraction was $5.04; total cost of reduction and sale was $8.88 per ton. Net proceeds were $495,757. East Butte showed total production of 240,120 tons of ore with a gross value of $4,505,701; net proceeds were $1,070,060.

DENVER—July 7

Cripple Creek District Production in June amounted to 82,946 tons of ore averaging $14.26 per ton, making a gross output of $1,183,371. The Golden Cycle mill at Colorado City treated approximately 39,000 tons, or about 50% of all ores that were not shipped to smelteries.

Georgetown and Silver Plume, neighboring towns in western Clear Creek County, after more than a decade of quiescence, are becoming active. Substantial productions of silver, lead and zinc ores are being made, chiefly from old mines that were closed because of the low prices for silver and lead and the heavy penalties formerly imposed by smelters upon zinc contents. A recent strike in the Seven Thirty mine disclosed a fine shoot of 1,290-oz. silver ore. The Josephine, Raymond, Virginia City and McClelland are among the active mines.

A New Tungsten Custom Mill is now in operation in Gilpin County, the plant of the Rare Metals Ore Co. having just been completed at Rollinsville, a station on the Denver & Salt Lake R.R. This mill is only four miles from Nederland, though in a different county. The nominal daily capacity is now 75 tons, but it can be easily enlarged to meet any future requirements. Nelson Franklin, well-known sampler of the Cripple Creek district, is manager for the company, the ownership in which is practically identical with that of the Vindicator Consolidated Gold Mining Co.

Renewal of Tungsten Leases by the Primos Mining and Milling Co. has heartened the tungsten producers of Boulder County. The company has announced that it will continue to buy ore from its leasers on the present schedules. Several hundred men are working in the company's mines. The McKenzie mill, a short distance east of Nederland, formerly a gold mill, has been remodeled and is treating tungsten ores from the McKenzie mine as well as custom ores. To boost its county, the "Boulder County Miner," on June 29, issued a magazine supplement of 36 pages entitled "Tungsten Edition." This number is well printed, containing many illustrations of well-known men, mines and scenery in this county, together with numerous excellent articles of historical interest.

SALT LAKE CITY—July 7

The Utah Leasing Co., which is working the tailings dump of the Cactus mill at Newhouse, in Beaver County, will double the present capacity of the flotation plant, bringing it up to 800 tons daily. The mill is designed for 400 tons, but is now treating about 475 tons of tailings per day. The tailings are treated in two Hardinge pebble mills and two Dorr classifiers and then in flotation cells. Ten additional flotation cells are on the ground and will be installed at once. The ratio of concentration is about 35:1, concentrates run about 21% copper. The old tailings are dug by steam shovel.

Much Ore Is Being Stockpiled at Utah mines, the Valley smelters having requested the mining companies to hold ore shipments at contract limits. Production for the first six months of 1916—stimulated by the high price of metals—has proceeded at such a rate, as to have for the time being exceeded smelter capacity. Besides this, the accumulation at properties inaccessible to ore-teams during the winter months, released with the opening of roads during May and June, caused considerable congestion at the railroads, sampling and smelting plants. Data regarding production by Utah mines, collected by the U. S. Geological Survey, indicate a much increased output of copper and lead for 1916. Silver which is dependent upon lead will also show an increase. There will not be any important increase in gold; zinc from sulphide concentrates, and oxidized and sulphide ores will be about the same as in 1915, when the output was 22,000,000 lb. Lead from Bingham will exceed all former totals. Estimating the increased tonnage treated at the concentration mills near Garfield, copper production should amount to fully 225,000,000 lb. for the year.

Metallurgical Research at the University of Utah, carried on under the joint direction of the U. S. Bureau of Mines and of the University, is starting its new year—from July 1, 1916, to July 1, 1917—and the new holders of fellowships have also begun their work. There are seven of these fellowships. Experimental work is being done with a view to developing methods of treatment for the recovery on a commercial basis of the metals in low-grade and complex ores. In Tintic there is a large tonnage of low-grade silver-lead ores, copper-gold-silver ores, and zinc ores, all of which are oxidized. Park City has much lead-silver and lead-zinc ore that is partially oxidized, and in Bingham there are complex sulphides of lead, zinc and iron. Samples of the various types of ores have been collected, and are being worked on. The laboratories are well equipped with leaching, flotation and water-concentrating machinery. There is also a hydro-electric laboratory and a microscopic laboratory. The flotation laboratory has installed Callow, Janney, Case and other well-known flotation machines, and experiments on different ores with all kinds of oil are being made. A flotation process has been developed to treat lead-carbonate ores carrying silver; and the Prince Consolidated Mining Co. of Pioche, Nev., is building a plant to use this process. Leaching with saturated salt solution, to which sulphuric acid is added, has been developed for lead-silver ores which will not yield to flotation. Good work is being done in the problem of the separation of the lead from the zinc-lead sulphide ores. The zinc is leached out by the Anaconda process or the lead is leached out by the acid-brine process. In this way the lead in the zinc ores, hitherto a loss to shippers, is recovered. The research work of the bureau is under the direction of D. A. Lyon.

PHOENIX, ARIZ.—July 5

Higher Freight Rates will be charged on copper bullion, matte and ore going to New York and Eastern refineries. The El Paso & Southwestern Railroad Co. has filed a new tariff with the Arizona corporation commission advancing the rates on shipments from Douglas, Morenci and Clifton 15 to 30%. The commission has communicated with the companies affected, asking if they wish the Interstate Commerce Commission requested to suspend the new rates.

Developments at Tombstone above water level in the old Tombstone Consolidated have disclosed some interesting orebodies. The Bunker Hill Mines Co., a Phelps-Dodge corporation, took over these old properties a year or so ago and began development in the upper levels, under the direction of Emil Grebe, avoiding the task of pumping the enormous flow of water that wrecked the old company. Above the water level, the Bunker Hill company is blocking out gold-silver-lead ore, and in the Tranquility-Tough Nut-Contention section has uncovered numerous bodies of wulfenite. For treatment of low-grade gold-silver ores, 30 stamps with cyanide adjunct have been equipped for percolation of sands and agitation of slimes. In the Escondido, Lucky Cuss, Oregon and Prompter mines, manganese ores have been opened; high-grade ore has been shipped as chemical ore; some of the lower grade as "furnace" ore and some concentrated; the concentrates are graded as chemical ore and the tailings, containing about 10 oz. Ag, are shipped as flux to the Copper Queen smeltery.

Assessment of Producing Arizona Mines, for purposes of taxation, has been placed this year at $172,731,913, an increase of $54,705,910 over last year's figures. While the price of copper and the increase of production have been considered in estimation of the worth of the mines, the Inspiration property at Miami this year is assessed $20,400,896, compared with about $2,000,000 last year. The Copper Queen has been raised about $9,000,000 and the other great mines a few millions each. The assessments on the principal properties follow: Copper Queen, $36,159,300; Calumet & Arizona, $25,248,003, including its Ajo property; United Verde, $20,687,010; Inspiration, $20,400,896; Ray, $15,568,782; Miami, $11,406,803; Arizona Copper, $10,362,468; United Verde Extension, $5,360,280; Shattuck-Arizona, $5,229,400; Old Dominion, $4,487,152; Detroit, $4,394,774; United Globe, $4,353,936; Tom Reed, gold, $2,053,270; Shannon, $1,020,797. Of the smaller operations, the Magma is assessed $743,466, Arizona Commercial $555,838, American Smelting and Refining Co.'s leases, $668,909 and the Consolidated Arizona, $251,535. These figures are exclusive of smelting and reduction plants, or of non-producing mine valuations, which are expected to bring the gross total up to about $212,000,000. These figures are interesting by comparison with those of 10 years ago. The entire tax roll of Arizona was then $62,000,000; of this, the mining industry was taxed $14,574,049 on all classes of property.

JOPLIN—July 8

Joseph Myers, fomer chief of police in Joplin, has been appointed by Governor Major to succeed I. L. Burch, who resigned as deputy state mine inspector for this district several weeks ago.

Another Cut in Wages took place this month and had the effect of sending many of the shovelers to the harvest fields rather than submit to a cut in the wage scale. Many of the plants have been short-handed for shovelers for a long time anyway and the new wage scale will still further reduce the number of men working and the output. Coming at a time when the surplus stocks of ore in the bins is in the neighborhood of 25,000 tons, every movement toward reduction in output will be a safety factor toward the prevention of further recession in ore prices. There have been many natural obstacles to ore production this spring and summer in the way of floods and much ground water. Had the season been more propitious, the surplus stocks of ore in the bins would be much greater.

The Higher Powder Cost will affect many Joplin operators, especially in the hard sheet-ground camps, who have been buying their dynamite upon contracts made before the rise in the price. Powder that was $4.50 per box under these contracts is costing in the market nearly three times that price now. In those mines in which the powder cost is already high, this additional burden is keenly felt. This applies especially to the low-grade mines. The last week saw a number of these compelled to close down or sell their plants to men who have advantageous contracts yet in force. There are a good many subterfuges being attempted to get powder at the old figures. There has been a small reduction in the price of caps due to the lowered price of mercury but this item is small as compared with the amount of dynamite used. This situation means a further reduction in the output of the sheet-ground camps.

VIRGINIA, MINN.—July 8

Shipments of Ore are being maintained, the pit mines working to capacity. Loading is still going on from the stockpiles and there will be no shortage. Although most of the Mesabi mines were closed during the greater part of June, the iron-ore shipments from the Lake Superior district broke all previous records for a single month by over 1,000,000 tons. The June movement amounted to 9,500,000 tons, against 8,400,000 tons in May, the previous record. It looks very much at this time as though the total for the year would reach 55,000,000 tons; it will go over 52,000,000 tons if shipments for the remainder of the year are equal to last year.

The I. W. W. Labor Disturbance on the Mesabi range seems to have passed its zenith. Combined efforts of state and county officials, business men and mine operators have restored order. Practically all strike leaders are now arrested and held on various charges from minor misdeeds to murder. It is estimated that in the Hibbing district alone nearly 1,000 good miners left the district rather than become embroiled in a strike. At 3 a.m., July 8, the residence of Tom Kobiach, Franklin Location, Virginia, was partially destroyed by dynamite. Kobiach has continued to work daily at the Franklin mine despite threats of the strikers. At Biwabik, on July 3, a deputy sheriff and a bystander were killed when an effort was made to serve warrants. Several other deputies were injured. Conditions generally, however, are much improved.

TORONTO—July 10

The Canadian Nickel-Refining Plant of the International company is not likely to be commenced this year. It is understood that nothing will be done before the report of the Ontario Nickel Commission is presented, and this is not expected until late in the fall. The plant, according to announcement, is to be on a scale sufficient to supply the demands of the British Empire, and the report is expected to set forth the nature and extent of these requirements. Were the company to proceed with operations in the meantime, it might find it necessary to extend or modify considerably its original plans. Meanwhile, the delay is being used to reinforce the arguments of the scare-mongers.

The Nickel Question is coming to the front as a political issue. A keen by-election contest for the representation of North Perth in the Ontario legislature is being waged, and the nickel policy of the Provincial Government is strongly attacked by some of the extreme advocates of nickel refining in Canada. A letter from W. F. Maclean, M. P., of Toronto, the leader of the agitation, who delivered metallurgical lectures to the Parliament last winter explaining how to get 50 lb. of nickel alloy from 100 lb. of 2% nickel ore, now asserts that the International Nickel Co. is under German control, and that Canadian nickel is being supplied to the Germans, and the Canadian and Ontario administrations are charged with pursuing an unpatriotic policy under the influence of agents of the International. This attack is practically, though not formally, endorsed by the Liberal party from political motives, and may have an important influence in deciding the election. The arrival of the German merchant submarine in the States and the rumor that nickel will be a part of its return cargo, will doubtless be used by these politicians with telling effect.

The Mining News

ALASKA

JAFET LINDEBERG, of San Francisco, recently sailed from Seattle for Cape York tin district, taking an engine and small mill which will be tried out there during the summer.

ALASKA-GASTINEAU (Juneau)—Milled in June, 164,800 tons, averaging $1.06; in May, 175,215 tons of $1.40 ore; April, 165,930 tons, $0.94; March, 162,796 tons, $1.03; February, 122,856 tons, $1.02; January, 119,914 tons, $1.42. On July 3, milled 8,700 tons; second largest daily mill run thus far.

ARIZONA

Cochise County

COBRIZA (Johnson)—Shipping 3 carloads of copper ore daily to El Paso.

ETZ & WEBB (Johnson)—Have set up 20-ton custom mill near Little Dragoon Mountains; expect to add concentrating section soon.

Coconino County

ARIZONA NAVAJO COPPER (Flagstaff)—Engineers examining route from Flagstaff to the White Mesa mines, 110 mi. northeast. If White Mesa property proves to be big porphyry deposit, railroad will be built.

Greenlee County

ASH PEAK (Duncan)—Considering installation of flotation; electric plant, compressor and other heavy machinery being put in; Shamrock shaft now down 500 ft., will be sunk further; bottom in ore that runs $12 in silver; 1,000 tons of gold-silver ore on dump.

SHANNON COPPER (Clifton)—Profits for first five months of year $320,000; there was $560,000 working capital on June 1 after $190,000 had been set aside to take care of Shannon-Arizona Ry. bonds. Production for May 1,074,000 lb., which yielded a profit of about $100,000.

ARIZONA COPPER (Clifton)—Installation of 85 Callow flotation cells at Morenci mill about completed; will increase capacity to about 4,500 tons daily; main-hoist power being changed from steam to electricity; recently installed Ingersoll-Rand 5,600-cu.ft. compressor in operation; old concentrator at Clifton being remodeled to treat ores from Longfellow North Extension and King mines; will have daily capacity of 500 tons.

Maricopa County

SAMPLING AND ORE-PURCHASING WORKS, at or near Phœnix, proposed by W. B. Twitchell and others.

OVERLAND MINES (Wickenburg)—Shipping carload high-grade manganese ore weekly to Lewellyn Iron Works, Torrance, Calif.; mine 30 mi. southwest of Wickenburg.

Mohave County

PARAMOUNT (Oatman)—Has started sinking shaft.

UNITED WESTERN (Oatman)—Drifting north on 500-ft. level.

OATMAN BELLE (Oatman)—Compressor and hoist installed, and sinking again in progress.

TOM REED (Oatman)—New headframe finished for shaft near Big Jim property; sinking started.

OATMAN (PIONEER (Oatman)—Crosscutting on vein opened at 400 level; winze also to be sunk to 600 ft.

LEXINGTON (Oatman)—Development resumed. Eastern men having financed operation through stock underwriting.

TIPPERARY MINING CO. (Oatman)—New surface equipment being erected. Honolulu men have taken interest. J. R. Hemphill, secretary.

BLACK RANGE (Oatman)—Drifting on 300-ft. level in low-grade ore. E. McNeal & Co., of Chicago, have taken large block of stock, providing funds for continued development.

OATMAN GOLCONDA (Oatman)—New compressor and engine being installed on No. 1 shaft and unwatering started with new pumping plant. Sinking new shaft on vein near Apex Pioneer.

OATMAN GOLD (Oatman)—E. McNeal & Co., brokers, Chicago, have financed company for further exploration of 500-ft. level and necessary equipment. Charles T. Arkins appointed superintendent, vice E. Hilty, resigned.

Pima County

ROSSI AND MURPHY (Twin Buttes)—These properties, adjoining Bush & Baxter mine of American Smelting and Refining Co., have been optioned by F. B. Weeks, of Tucson, for U. S. Smelting, Refining and Mining Co.

Pinal County

MAGMA (Superior)—New 100-ton zinc concentrator making good progress; will be in operation soon.

CHILDS (Winkelman)—Molybdenum prospect, on Copper Creek, recently taken over by Col. Epes Randolph.

FINNEY COPPER (Christmas)—Churn drilling will be started soon. Drift on 100-ft. level in 3% ore carrying gold and silver.

PINAL DEVELOPMENT (Troy)—Has optioned Barbarosa group of 16 claims; hoist and 600-cu.ft. compressor ordered. John C. Devine, manager.

TROY ARIZONA COPPER (Troy)—Force on old Troy mine soon to be increased; Rattler shaft down 160 ft., and crosscut being driven southward to cut main orebody; Buckeye shaft down 500 ft., from which point crosscut will be run to cut Climax fault, 1,000 ft. distant; Alice shaft down 400 ft., passed through 4% copper sulphide. John Galvin and H. C. Rogers of New York, and Charles H. Barney, of Boston, interested; Roy G. Mead, superintendent.

Yavapai County

ARIZONA & CALIFORNIA MINING CO. (Prescott)—Encountered high-grade gold-silver ore in vein cut in Shamrock claim of New State group, 8 mi. south, while crosscutting to tap vein in 130-ft. shaft. Shipments to begin when air connection has been made. W. S. Wilhelm, president.

UNITED VERDE EXTENSION (Jerome)—Letter to stockholders states that orebody on 1,400-ft. level has been developed by about 2,000 ft. of lateral workings in ore, two raises 100 ft. above 1,400-ft. level and several raises in ore; winze being sunk at about center of orebody on 1,400-ft. level to at least 200 ft. Careful sampling on 1,400-ft. level shows 16% copper, and up to present have blocked out upwards of 600,000 tons of ore. It is proposed to sink new two-compartment shaft to be used exclusively for hoisting ore. After completion of winze and new shaft, it is intended to sink Edith shaft to greater depth.

Yuma County

A. L. KREISS, representing Los Angeles men, has been examining conditions at Parker with a view of erecting a 200-ton smelting plant if tonnage is assured.

ZEROLITE-MAMMON (Parker)—Tractor purchased to haul ore to Parker; initial shipment made to Garfield, Utah.

YUMA CONSOLIDATED (Quartzite)—Gravel in shaft from 80- to 95-ft. point, bedrock, averaged $5.24 per cu.yd. Second shaft being started, 200 ft. away.

BILLY MACK (Parker)—Chicago and Kansas City men made final payment on control stock of H. S. Griswold, of Phoenix, and H. Tharpe, of Parker; property 6 mi. north of Parker.

CALIFORNIA

Inyo County

JUMBO (Darwin)—This claim, optioned by Darwin Development Co., developing favorably; several carloads of high-grade silver-lead ore have been mined.

WILSHIRE BISHOP CREEK CO. (Bishop)—At meeting on July 1 all acts of directors were approved; audit by Audit Co. of Los Angeles complete but not ready for presentation; stated to be "favorable to management." "Contribution plan" of Feb. 28 circular brought in $30,473; outstanding, $41,860. Report of engineer, E. W. Walter, dated Oct. 1, 1915, recommended increasing 50-ton mill to 100 tons; ore reserves not specifically stated. Title to mine now appears to be in name of Rocky Point Consolidated Mines Co., Gaylord Wilshire, president.

Kern County

FURTHER GOLD STRIKES reported from Randsburg following the finds of Mapes and Weaver about midway between the old camps of Goler and Garlock.

Nevada County

MURCHIE (Nevada City)—This mine, bonded to H. W. Miller, of 654 W. 51st St., New York, is to be reopened. About 75 men formerly employed.

ALASKA (Nevada City)—Reported long drainage tunnel will be driven to develop mine at depth and avoid the $2,000 monthly pumping expense, which caused property to be closed.

Plumas County

ENGELS COPPER (Keddie)—Driving 4,000-ft. adit to cut orebodies 750 ft. below present workings. Flotation recovery reported to be 83%; mill capacity increased.

Shasta County

MAMMOTH COPPER MINING CO. (Kennett)—This company will erect electrolytic zinc plant to treat its zinc ores, and zinkiferous baghouse dust from its copper-smelting plant. High-grade zinc ore formerly went to Kansas smelteries.

Sierra County

CUBA (Downieville)—This gravel mine at Shady Flat on the Yuba has been bonded by John T. Mason to Thomas Wilson, who is installing pumping and hoisting plant.

GOLD BLUFF (Downieville)—Aërial tramway being extended from the Meservey to the Oxford tunnel. Ore will then be mined from both tunnels and sent to the 20-stamp mill. Controlled by Cliff Leasing Co., of Salt Lake City; Grant Snyder, manager.

Siskiyou County

BLUE WEDGE (Copper)—This copper deposit being developed by New York syndicate.

ST. ALBANS MINING AND MILLING CO. (Medford, Ore.)—Recently incorporated to work 22 copper-gold-silver claims near Copper; vein 20 to 50 ft. wide in places. Erecting camp buildings. Henry Callaghan, manager.

Trinity County

TRINITY DEVELOPMENT CO. (Carrville)—Construction of hull under way and much of machinery for new steel dredge on ground.

COLORADO

Clear Creek County

BELLMAN (Idaho Springs)—Hutchinson lease has opened 6-ft. vein of $9 milling ore. Bert Ziler, superintendent.

McCLELLAND TUNNEL (Idaho Springs)—Development proceeding; recently cut old Freeland vein. W. L. Shaffer, manager.

COMSTOCK (Idaho Springs)—Shaft sunk to 500 ft. Large vein of low-grade ore opened, containing stringers of molybdenite. Richard Staley, lessee.

LAKE (Idaho Springs)—Moore & Bell, who recently acquired Mosher lease, have developed payable ore and will ship 25 tons per day. H. N. Jones, superintendent.

NEW LIFE TUNNEL AND MINING CO. (Idaho Springs)—Recently incorporated to take over the Hoosac tunnel property and other mines. Incorporators are E. D. Quigley, H. C. Perks and F. A. Armour.

Lake County

FRYER HILL PROPERTIES nearly drained. Water in Harvard shaft 15 ft. from bottom and preparations for shaft sinking completed.

REVEILLE (Leadville)—Lessees on this California Gulch property making regular shipments. Work being done through upper tunnel, but lower tunnel will be opened.

WOLFTONE (Leadville)—Water being lowered to 980-ft. level. Heavy flow encountered between fourth and fifth levels where several large stopes must be drained.

La Plata County

COPPER HILL (La Plata)—Flotation process will be installed.

Pueblo County

COLORADO FUEL & IRON CO. (Pueblo)—New by-product coking plant will be installed in Minnequa steel plant. In addition to coke, gas, tar and ammonia liquor will be saved. Gas and tar will be used in steel plant; ammonia manufactured into fertilizer.

Ouray County

SUTTON (Ouray)—Mine being examined for purchase.

CAMP BIRD (Ouray)—Mill going out of commission, pending completion of the 10,700-ft. development tunnel.

San Miguel County

TOMBOY (Telluride)—Mill crushed in June 13,000 tons, yielding bullion $39,900, concentrates $55,000; expenses $66,250; operating profit $28,650.

Summit County

WATERLOO (Montezuma)—Will be reopened.

OLD UNION (Breckenridge)—Crosscutting commenced from 75-ft. level to open vein disclosed by dredging operations.

WELLINGTON (Breckenridge)—Second roaster for concentrates will be installed. Water in Sallie Barber shaft being lowered by bailing.

TONOPAH PLACERS CO. (Breckenridge)—Sure Thing shaft unwatered and driving to cut zinc-lead oreshoot discovered by dredge. Three dredges now in operation, one in French Gulch, one on Swan River and one on Blue River.

Teller County

ELKTON (Elkton)—Leasers working dump at main shaft are shipping about 15 carloads, monthly, running about $6 to $8 per ton.

ISABELLA (Victor)—Shipped about 2,000 tons in June. Buena Vista stope, fifth level yielding high-grade ore; two cars recently brought $3,600.

PRINCE ALBERT (Cripple Creek)—After long idleness, shipments again going forward—from the Vetter lease of this Beacon Hill property.

CONNECTICUT

TUNGSTEN CO. OF AMERICA (Long Hill)—This old tungsten property, about 8 mi. north of Bridgeport, is to be equipped with a 100-ton mill to operate on the blanket deposit reported to average 2 to 3% WO_3; higher grade ore found in pegmatite dikes. New York offices, 115 Broadway; Kirby Thomas, 120 Broadway, consulting engineer.

IDAHO

Lemhi County

LATEST OUT (Gilmore)—Leased Cook and Roy Lauer claims above 600 level from Gilmore Mining Co. and will open from Latest Out workings. Ralph Nichols, manager.

PITTSBURGH-IDAHO CO. (Gilmore)—Mining about 1,200 tons monthly of neutral 30% lead-carbonate ore, containing ½ oz. silver per unit of lead. Has also encountered high-grade gold ore as did other mines of camp—Allie and Gilmore. Sinking winze from 600 level. Plan to sink new vertical shaft from 400-ft. or transportation-tunnel level to 800-ft. level. Over 90 men working. A. S. Ross, manager.

GILMORE MINING CO. (Gilmore)—Raising from 800-ft. or transportation-tunnel level to connect with Latest Out's 600 level, establishing better ventilation and outlet for latter's ores. Raise up 60 ft.; at 30 ft., drift opened 3-ft. lead carbonate ore, carrying silver; two cars shipped ran 20% Pb, 22 oz. Ag and $1.40 Au. Gold vein opened at 400 ft. in Martha shaft; drifted on for 1,000 ft. to the north on 300-ft. level. About 20 men working. Edgar C. Ross, manager.

Shoshone County

CHICAGO-BOSTON MINING CO. (Wallace)—After tests in Western Union mill, company has decided to erect 200-ton flotation mill for its properties in Lake Creek district.

GREAT WESTERN MINING CO. (Wallace)—Being reorganized. W. P. Heimbach and other Duluth, Minn., men, on directorate with George Edimster, of Wallace. New development campaign planned.

FEDERAL (Wallace)—Output at Morning mine being increased; milling facilities already enlarged to handle augmented production. All mines produced in first quarter, this year, 31,844 tons shipping ore and concentrates; gross earnings, $356,125; net, $290,890.

GEORGIA

REPUBLIC MINING CO. (Andersonville)—This bauxite mine shipping 45 tons daily. J. H. Harris, manager.

NEW JERSEY ZINC CO. (Cartersville)—This company, which recently purchased American Ochre Co. property, has bought the Norris barite land, 40 acres, adjoining; also contains ocher. Both properties will be operated under superintendency of L. B. Wommelsdorf.

MICHIGAN

Copper

ISLE ROYALE (Houghton)—Rock production now close to 80,000 tons monthly.

CASS COPPER (Ontonagon)—Second diamond drill hole now being started; first hole down 450 ft.

VICTORIA (Victoria)—Increased production from this property delayed by exigencies of new hoist installation.

ADVENTURE (Greenland)—Two weeks will be required for unwatering and it will probably be a month before hoisting of ore can begin.

AHMEEK (Ahmeek)—Seventh stamphead now in commission; eighth head will not be ready for about six weeks as additional boiler is awaited; a 2,500-kw. turbine for mine use is also to be installed.

MINNESOTA

Cuyuna Range

ROWLEY (Barrows)—Shaft down 60 ft.; 300 gal. of water per minute encountered.

ADBAR (Brainerd)—Raising 1,600 gal. of water per minute. Shaft down 75 ft.; 25 ft. still to go.

FLYNN (Manganese)—E. J. W. Donahue and Duluth associates have started sinking a 6x8-ft. shaft. Two drills at work.

JOAN MINING CO. (Duluth)—Incorporated to hold leases in Sec. 3, 49-27. Properties partially drilled; contain manganiferous iron ore of good grade. Capt. M. L. Fay, Duluth, secretary-treasurer.

CUYUNA-SULTANA (Ironton)—Thus far nearly 30,000 of season's estimated 80,000 tons have been shipped. Underground connection between No. 1 and No. 2 shafts nearly completed. New office, dryhouse and manager's residence recently erected.

Mesabi Range

OLIVER IRON MINING CO. SHIPMENTS from Lake Superior districts for the season to July 8 aggregated 11,000,000 tons, as against 8,000,000 on same date in 1915.

AGNEW (Hibbing)—One miner killed and another seriously injured by cave-in June 8.

MISSOURI

Southeast Missouri

BENEDICT J. BAKER, of Boston, president of the Baker and the Boston-Elvins companies, is drilling large acreage northwest of Bonne Terre.

BAKER LEAD CO. (19 Congress St., Boston, Mass.)—Doing much surface drilling in connection with development of Day tract at Leadwood.

BOSTON-ELVINS LEAD CO. (Elvins)—Shaft down 450 ft. on tract drilled by this Boston company. Making preparations to hoist 1,000 tons per day.

MINE LA MOTTE (Mine La Motte)—This property, comprising 37,600 acres in Madison County, is reported sold to the Valley Material and Transportation Co. of St. Louis, a new corporation in which A. J. Meier, of the old Mine La Motte company, is interested. Crushed limestone is expected to be an important product of the new company.

Joplin District

DR. CARL CO. (Galena, Kan.)—Will erect mill on lease Shoman & Stice land. Five drill holes put down all showed ore; will continue drilling.

ONCE MORE (Joplin)—Underground siphon being used to bring water from field shaft to mill pond. Water raised about 20 ft.

BLATCHLEY (Joplin)—Planning installation of steam shovel at tailing mill on Sweetwater lease; scraper method inadequate.

COMMERCE (Commerce, Okla.)—Will erect new mill on Goodwin & Cooper land, north of Picher, just south of Kansas-Oklahoma state line. Drilling shows ore at 225 ft. New shaft down 40 ft.

UTAH-MISSOURI (Neck City)—Building 1,000-ton mill on recently drilled tract. Ore from 187 to 222 ft.; semi-hard ground; about 4% recovery. H R. Trenholm, manager. Mine to be known as the Goldfield. Company also operating Lucky Tiger and Cocklebur at Neck City. New shaft being sunk on Big Four lease will be connected by 1,000-ft. tram with Lucky Tiger mill.

Northern Arkansas

IN JUNE 59 CARLOADS of blende and zinc-carbonate ore were shipped from this field and at least 30 carloads were produced and are being held in bins for better prices. Of the cars shipped, 36 were from the Rush camp, four from Dodd City, four from Cow Creek, four from Water Creek, four from Kingdom Springs, five from Zinc, twelve from Searcy County, and one from Baxter County. It is expected that nearly 100 cars will be produced during July, as several new mills are starting or will be in operation before end of month. The Edith, the Silver Run and the Moark mills were recently started, the Dixie Girl, the White Eagle, the Sure Pop No. 2, the Washington, the Chickasa and the Omeara will have new plants in operation by August.

MONTANA

Madison County

MOFFIT (Twin Bridges)—Shipments suspended from this property in Bear Gulch. Has shipped two cars weekly since April.

Mineral County

TARBOX (Saltese)—Shaft is down nearly to 700 level. Will be carried to 1,000 level. Fine orebody opened on 400 level. Crosscuts will be driven on 500, 600 and 700 levels to intercept same orebody. Nearly 10,000 tons of ore on dump assaying 30% lead, 9 oz. silver and 9% zinc. Plans for mill being completed.

Silver Bow County

EAST BUTTE (Butte)—June production estimated at 1,500,000 lb.; first half of 1916, about 6,661,000 lb., or at a rate of 13,000,000 lb. per annum.

ANACONDA (Butte)—At Emma mine, everything is in readiness for sinking shaft from 800 to 1,600 level. New engine in place and other equipment ready for this work, as well as for stoping the zinc ore as soon as the reduction plants are ready. Crosscutting on the 1,600 level of Gagnon mine is being rushed; about 300 ft. more is to be done before point under Emma shaft will be reached and raising can begin.

BUTTE & SUPERIOR (Butte)—First Butte company to file report of net proceeds with county assessor for purpose of taxation. Report shows that for fiscal year June, 1915, to June, 1916, net proceeds were $10,497,079, as against $2,648,450 the year before. Report also shows that 591,562 tons of ore were mined of gross value of $20,271,949, an average of $34.269 per ton. Cost of extracting was $5.488 per ton; transportation, $2.15; ore dressing, $0.7149 per ton. Total disbursements were $4,229,117, as follows: Labor, $2,217,755; supplies $1,028,521; construction work, $605,824; improvements at Black Rock mine, $414,034. Program of improvements involves expenditure of $1,000,000, principal feature being sinking of the two new shafts.

NEVADA

Esmeralda County

REORGANIZED BLUE BULL (Goldfield)—Drifts on 700-ft. level continue to follow large quartz bodies yielding occasional encouraging assays.

GOLDFIELD CONSOLIDATED (Goldfield)—June estimated production. 29,000 tons; extraction, $185,000; operating expenses, $145,000; net realization, $40,000. May final results, net realization, $50,693 from 32,400 tons; net cost, $4.66 per ton.

Humboldt County

ROCHESTER MINES CO. (Rochester)—Pres. A. L. Friedman states present milling plant will be enlarged to capacity of about 200 tons per day. Excavation under way.

PACKARD NORTH EXTENSION (Lovelock)—Leasers recently shipped 70 tons $30 ore. Tunnel B, projected to cut extension of Packard vein, has about 40 ft. to go.

ROCHESTER CONSOLIDATED MINES CO. (Rochester)—Incorporated to develop group of six claims near Weaver claims of Rochester Mines Co.; Joseph C. Colligan, Pres.

ROCHESTER LIMERICK (Rochester)—Company organized to develop ground north of Rochester Merger; C. N. Miller, president. Main tunnel, now in 550 ft., to be driven additional 350 ft. to encounter vein on Lucky Joe claim.

Lincoln County

CONSOLIDATED MINING AND SMELTING CO. (Pioche)—New company to operate property in Freiburg district. Some equipment being hauled and pipe line laid.

Lyon County

COMO CONSOLIDATED MINES CO. (Dayton)—Organized by H C. Cutler and associates to take over the Nevada Deep Mines Co., Peer and Lucky Sunday group. Equipped with modern stamp mill and 100-ton cyanide plant. Deeper development will be undertaken.

Nye County

TONOPAH ORE PRODUCTION for week ended July 1 was 9,043 tons valued at $189,934 compared with 9,075 tons for week previous. Producers were: Tonopah Belmont, 2,997 tons; Tonopah Extension, 2,200; Tonopah Mining, 1,800; Jim Butler, 800; West End, 643; Halifax, 210; Rescue-Eula, 178; miscellaneous, 215 tons.

WEST TONOPAH (Tonopah)—Sinking resumed; stated that shaft passed out of capping into trachyte at about 850 ft.

REORGANIZED WHITE CAPS (Manhattan)—Crosscut from bottom or 310-ft. level encountered vein; width and value not yet announced.

TONOPAH EXTENSION (Tonopah)—May profit $56,818, from treatment of 8,055 dry tons having net value of $130,743. Expect to complete repairs to Victor shaft by August.

TONOPAH DIVIDE MINING CO. (Tonopah)—Property at Gold Mountain, six miles south of Tonopah. Grimes & Hanson lease recently shipped to West End mill 60 tons returning $64 per ton.

White Pine County

NE PLUS ULTRA (Hamilton)—Producing about 100 tons monthly of high-grade ore. Considerable ore sacked, awaiting shipment via Eureka to Salt Lake smelteries. Working 11 men.

NEW MEXICO

Grant County

DAVID GOUGH, of El Paso, is developing a disseminated copper-sulphide deposit in the Steeplerock district.

MANHATTAN (Santa Rita)—Phillips & Morgan shipping to Douglas.

LAST CHANCE (Lordsburg)—Robert F Fritz has reopened this mine.

VOLCANO (Steins)—Taken over by Faris V. Bush and associates, who may erect cyanide plant.

CHINO (Hurley)—In five months ended May 31 produced 27,289,792 lb. copper. Flotation being installed.

WALTER INTERRIEDEN AND C. TREADWAY (Lordsburg)—Have purchased Harris & Spence lease on the Nevada claim of "85" mine.

PROGRESS MINING CO. (Steeplerock)—New organization, composed of James V. Parks, Charles Hanson and L. A. Hohstadt, to develop claims lying northwest of the Carlisle, on the same vein.

85 MINING CO. (Lordsburg)—Order duplicating present Deisel power plant sent to Lyons-Atlas Co., Indianapolis; will bring plant up to about 900 hp.; 500-ft. point reached in sinking and crosscuts will soon be underway. Flotation plant under consideration. A. J. Inderrieden manager.

UTAH

Beaver County

MAJESTIC MINES CO. (Milford)—Elephant shaft on Hoosier Boy claim will be sunk from 600 to the 1,000 level. Old Hickory shaft will also be deepened. A. D. Moffat, manager.

Box Elder County

LAKEVIEW (Promontory Point)—Shipped in June 15 cars, four of lead ore and 11 of zinc. Winze from new lower level still in good lead-zinc ore. S. S. Arentz, manager.

Millard County

KING SILVER-COPPER MINING CO. (Delta)—Incorporated to operate silver-copper and silver-lead claims near Whiskey Creek Spring, 20 mi. east of Delta; B. F. Johnson, manager.

BEAVER RANGE MINES CO. (Blackrock)—New company to acquire 10 claims in Mineral Mountain Range, 10 mi. southeast. Both copper and lead veins opened by 1,500 ft. of adits and shafts. John B. Taylor, of Salt Lake City, president; William W. Moody, superintendent.

Salt Lake County

SOUTH HECLA (Alta)—Shipping 50 tons daily from the Wedge workings, 250 and 350 levels.

MICHIGAN-UTAH (Alta)—Copper Prince tunnel now in 1,400 ft., having been driven 240 ft. in June by two shifts. Narrow vein of good grade followed for about 50 ft.

EMMA (Alta)—This old mine, held by Jesse Knight for a number of years, has just been optioned to Charles W. Belser, of New York, by A. O. Jacobson, who has lately been doing some work on the Bay City tunnel level. Mine comprises six claims covering about 60 acres and was famous producer. Not known whom Mr. Belser represents.

Summit County

PARK CITY SHIPMENTS for June were: Silver King Coalition, 54 cars; Ontario, 30; Ontario Federal Leasing, 12; Judge, 44; Silver King Consolidated, 20; Daly-West, 23; Daly, 4; New Quincy, 3; American Flag, 2; Daly-West Quincy Lease, 2; Western Ore Purchasing Co., 3; Charles Moore, 1; E. J. Beggs, 2; Park City Mines, 2; Broadwater Mills, 4; total, 206 cars, or 8,589 tons.

VERMONT

Orange County

VERMONT COPPER CO. (South Strafford)—This company is arranging to resume smelting operations on 300-ton basis, following preliminary tests by George A. Guess. About 30 men working. New York office, 576 Fifth Avenue.

CANADA

Ontario

CROESUS (Munro Township)—A 2-ft. vein encountered in shaft at 400 ft.

DOME LAKE (Porcupine)—Orebody cut on 300-ft. level, proved for 150 ft.

QUAKER CITY (Cobalt)—The 200-ft. shaft unwatered and will be put down farther.

DOME EXTENSION (Porcupine)—Diamond-drill hole 300 ft. east of Dome property has cut 75-ft. vein.

ADANAC (Cobalt)—Native silver opened in vein at 315 ft., west winze. Vein runs up to 14 in. in width.

RED JACKET (Cobalt)—Homer Gibson and associates working this property on lease; William Hatch, in charge.

DOME (Porcupine)—Yield for June was $179,000 from 36,700 tons of ore; average yield $4.88 per ton; cost $2.62.

WRIGHT-HARGRAVES (Kirkland Lake)—Operations resumed; two surface veins containing visible gold and tellurides.

McKINLEY-DARRAGH (Cobalt)—Crosscutting at 400-ft. level to pick up veins encountered on the 200. Upper levels showing better than expected.

TOUGH OAKES (Kirkland Lake)—Shipments between $80,000 to $100,000 per month. Mill treating about 125 tons per day, 21 drills running, but only one of the compressors; not more than 800 hp. available.

GATINEAU ZINC (Burbidge Station)—New deposits of zinc ore discovered on this location; original find was made last fall by J. D. McFarlane and Dennis Callahan. Vein trenched across at intervals of 1,400 ft. showing ore from 6 to 15 ft. wide in places.

COLOMBIA

PATO MINES, LTD. (Zaragoza)—Rich cleanups obtained by dredge in June. For 15 days ended June 22, dredge dug 68,465 cu.yd. yielding $96,494, or about $1.40 per cu.yd.

CHOSEN

ORIENTAL CONSOLIDATED (Unsan)—June cleanup, $128,600. Details of May cleanup: Tabowie mill bullion, $26,348; Taracol, $28,263; Malbong, $22,985; Taracol cyanide bullion, $51,586; Maibong tube-mill bullion, $3,800; total, $132,983; tons milled, 27,164.

The Market Report

Metal Markets

NEW YORK—July 12

All of the principal markets during the last week exhibited a continuance of the reactionary tendency. The statistical position of both copper and lead is good, that of spelter is not so good, but in all cases there is an absence of buyers.

Copper, Tin, Lead 'and Zinc

Copper—Scarcely any business was done, but copper was freely offered in large quantities by several first hands who were seeking to find a level at which buyers would be interested. The principal producers continued out of touch with the market, their output being entirely sold out far ahead, probably to Oct. 1 on the average. Indeed, they are finding it difficult to ship copper rapidly enough to fill their contracts. Other interests that are not so well sold offer liberally for deliveries beginning with September, and others will supply August copper on contracts coupled with September and October, without difference as to price, although for August copper alone a premium would be asked.

The market declined from day to day on free offerings, without developing business. Domestic consuming interests intimated that they might be buyers of large quantities at 23c., r. t., but they refused to make firm bids and no seller cared to go so low. There is also much reason to believe that there is a latent buying power from abroad, which will be exercised as soon as terms become attractive.

Visible Stocks of Copper in Europe on June 30: Great Britain, 4,218; France, 3,385; afloat from Chile, 2,225; afloat from Australia, 4,000; total, 13,828 long tons, or 30,974,720 lb. This is an increase of 1,569 tons over June 15, and of 146 tons over the May 31 report.

Tin—This market was very quiet, buyers holding back. The market declined a little in sympathy with London and in the absence of buying interest here.

Visible Stocks of Tin on June 30, including tin afloat: London, 8,786; Banka and Billiton, 4,040; United States, excluding Pacific ports, 6,537; total, 19,363 long tons. This is a decrease of 254 tons from May 31, but an increase of 3,406 tons over June 30 of last year.

Lead—Following the reduction by the A. S. & R. Co. late Wednesday afternoon, a rather large business was done, but from the outset the new price of the A. S. & R. Co. was cut by independent producers, even as much as $3 per ton. Producers who were sellers of lead at 6.40c., New York, right through the week steadily failed to get business. In the last half of the week the demand flattened out materially, and the sales reported on Tuesday and Wednesday were relatively small. At the close there were sellers at 6.35c., New York.

The St. Louis market declined in about the same way as New York. Sales of lead on the Pacific Coast were made at 6½c., for export.

Spelter—The decline continued from day to day, but early in the week the point was reached at which buyers were interested, and from that time on sales were much larger than in the previous week. To a considerable extent the purchases were short-covering, including buying-in by smelters who had previously sold ahead and had been delayed in making their expected new production, but there was also some buying by domestic consumers. Europe made bids for spelter at a little below the market. There is reason to believe that there is a considerable buying power that will be exercised at a level not much below the present.

At the close spot and July spelter was quoted at 8¼c., August at 8@8¼, September at 7¾@8c. Contracts running far ahead were made at considerably lower figures, business covering the last quarter being reported done on July 8 and 10 at 7½@8c., but at the close spelter for delivery in the last quarter could be bought more cheaply. Brass special was quoted at 9½@10c., intermediate—99¾% Zn—at 13c., and high-grade at 15@17c., all for July shipment.

Zinc Sheets are easier; on July 6, the base price was reduced 1c. per lb. to $17 per 100 lb. On July 11 there was a further reduction of 2c., and the base price is now $15 per 100 lb., f.o.b. Peru, Ill., less 8% discount.

Other Metals

NEW YORK—July 12

Aluminum—The market is rather quiet and demand less active than it has been, while supplies seem better. Quotations are a little easier at 58@60c. per lb. for No. 1 ingots, New York.

Antimony—This market steadied a little and somewhat more business than in the previous week was reported, but the volume continued small. We quote 15½@16½c. for spot. None of the principal interests would quote on futurse.

Imports of Antimony into the United States for the four months ended Apr. 30 were: Antimony contents of ore, 2,894,-

DAILY PRICES OF METALS IN NEW YORK

July	Sterling Exchange	Silver, Cts. per Oz.	Copper	Tin	Lead		Zinc
			Electrolytic, Cts. per Lb.	Spot, Cts. per Lb.	New York, Cts. per Lb.	St. Louis, Cts. per Lb.	St. Louis, Cts. per Lb.
6	4.7569	63⅜	24 @24½	39⅜	6.35 @6.50	6.25 @6.37½	8.25 @8.75
7	4.7575	62¾	23¾ @24¼	39½	6.35 @6.50	6.20 @6.30	8.25 @8.75
8	4.7575	62	23½ @24	39½	6.35 @6.50	6.20 @6.30	8.00 @8.50
10	4.7575	60	23¼ @23½	38¾	6.35 @6.50	6.20 @6.30	8.00 @8.50
11	4.7575	61	23¼ @23¾	38½	6.30 @6.40	6.12½ @6.25	8.00 @8.50
12	4.7569	61⅞	23¼ @23¾	38¾	6.30 6.40	6.12½ 6.25	7.87½ @8.25

The quotations herein are our appraisal of the average markets for copper, lead, spelter and tin based on wholesale contracts for the ordinary deliveries of the trade as made by producers and agencies; and represent, to the best of our judgment, the prevailing values of the metals, reduced to basis of New York, cash, except where St. Louis is given as the basing point. St. Louis and New York are normally quoted 0.17c. apart.

The quotations for electrolytic copper are for cakes, ingots and wirebars. Electrolytic copper is commonly sold at prices including delivery to the consumers and is subject to discounts, etc. The price quoted for copper on "regular terms" (r.t.) is the gross price including freight to the buyer's works and is subject to a discount for cash. The difference between the price delivered and the New York cash equivalent is at present about 0.25c. on domestic business. The price of electrolytic cathodes is 0.05 to 0.10c. below that of electrolytic. Quotations for lead represent wholesale transactions in the open market for good ordinary brands. Quotations for spelter are for ordinary Prime Western brands. Only the St. Louis price is herein quoted, St. Louis being the basing market. We quote the New York price at 17c. per 100 lb. above the St. Louis price.

Silver quotations are as reported by Handy & Harman and are in cents per troy ounce of silver bars 999 fine.

Some current freight rates on metals per 100 lb. are: St. Louis-New York 17c.; St. Louis-Chicago, 6.3c.; St. Louis-Pittsburgh, 13.1c.

LONDON

July	Silver	Copper				Tin		Lead		Zinc	
		Standard		Electrolytic							
		Spot	3 Mos.	£ per Ton	Cts. per Lb.	Spot	3 Mos.	£ per Ton	Cts. per Lb.	£ per Ton	Cts. per Lb.
6	30¼	97	95	130	27.68	173	173½	28¼	6.01	46½	9.90
7	29 15/16	91	89	129	27.47	173	173½	28	5.96	44	9.37
8	29⅝	....	......	......	......		. .	....	....	..	.
10	28⅝	84½	82½	128	27.25	170	170½	28	5.96	44	9.37
11	29⅛	88	86	128	27.25	168½	169	28	5.96	44	9.37
12	29½	93	91	128	27.25	169½	170	28	5.96	45	9.58

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2,240 lb., except silver which is in pence per troy ounce of sterling silver, 0.925 fine. Copper quotations are for standard copper, spot and three months, and for electrolytic, price for the latter being subject to 3 per cent. discount. For convenience in comparison of London prices, in pounds sterling per 2,240 lb., with American prices in cents per pound the following approximate ratios are given, reckoning exchange at 4.80. £15 = 3.21c.; £20 = 4.29c.; £30 = 6.43c.; £40 = 8.57c.; £60 = 12.85c. Variations, £1 = 0.21⅜c.

932 lb.; metal and regulus, 6,523,673 lb.; total, 9,418,605 lb., an increase of 3,177,074 lb. over the corresponding period last year.

Quicksilver—The price in London advanced £1 to £17½, which stiffened the market here, but producers and dealers found it difficult to effect sales. We quote $80@83. San Francisco reports by telegraph $80, market quiet.

Nickel—There is no change, demand for domestic use being about as usual, with some inquiries for export. Quotations are 45@50c. per lb. for ordinary forms, according to size and terms of order. Electrolytic nickel brings 5c. per lb. premium.

Minor Metals—Current quotations for Bismuth are $3.15@3.30 per lb., New York—**Cadmium** is quoted at $1.30@1.50 per lb.—**Cerium,** electrolytic, is sold at $8@9 per lb.—**Cobalt Metal** is quoted at $1.25 per lb.—**Magnesium** is lower, with sales at $3.50@3.75 per lb. for 99% pure.—**Selenium** is from $3 up to $5 per lb., according to size of order.

Gold, Silver and Platinum

NEW YORK—July 12

Gold—The movement of gold from England direct and through Canada has come to a pause for the present, and only one small lot is reported this week.

Platinum—At the beginning of the week the price was $65 per oz. On Friday sales were made at $63 and today at about $60. We quote $62½ as the average for the week.

Silver—The market has experienced sharp fluctuations this week, falling from 30¼d. to 28⅝d., and reacting again to 29½d. The break in price has been due to continued selling by China and liquidation of tired bulls. The stock in London continues large, about £1,200,000, with comparatively small demand, as coinage demand from France and the Continent has ceased for the present. Market closes firmer on cessation of liquidation and selling by China.

Messrs. Samuel Montague & Co., London, write under date of June 22: "Following are the imports and exports in Great Britain of refined silver for the first five months of 1915 and 1916, in ounces:

	1915	1916	Changes
Imports	39,275,640	37,502,989	D. 1,772,651
Exports	32,518,465	20,563,249	D. 11,955,216
Net imports.........	6,757,175	16,939,740	D. 10,182,565

It will be observed that the imports closely approximate for each period, but the exports show a remarkable falling-off of about 37%. This decrease is more than covered by a reduction of nearly 16,000,000 oz. in the shipments to British India. The disposal of the unshipped balance shows how importantly the Home Mint has figured as a buyer during the present year."

Mexican Dollars on July 6 were quoted in New York at 48¾@51¾c.; July 7 at 48⅛@51⅛c., July 8 at 47⅝@50⅝c.; July 10 at 46⅛@49⅛c., July 11 at 46⅞@49⅞c.; July 12 at 46¾@49¾c.; a net drop of 2c. during the week.

Zinc and Lead Ore Markets

JOPLIN, MO.—July 8

Blende, high price $83.17; per ton 60% zinc, premium ore, $80; medium, $75@65; down to $55 low; calamine, per ton 40% zinc, $55@45; average, all grades of zinc, $72.17 per ton. Lead, high price $79.80; base, $77.50@75 per ton 80% metal content; average selling price, all grades of lead, $76.20 per ton.

SHIPMENTS WEEK ENDED JULY 8

	Blende	Calamine	Lead	Values
Totals this week	11,374,870	954,890	1,858,010	$515,700
Totals this year.	371,391,880	29,812,060	63,582,530	22,932,500

Blende value, the week, $421,400; 27 weeks, $19,035 620.
Calamine value, the week, $23,510; 27 weeks, $1,057,230.
Lead value, the week, $70,790; 27 weeks, $2 839,650.

The continued decline in spelter has demoralized the small smelting companies, every one of which withdrew from the market this week indefinitely. One, the Henryetta, has a strike in full force. The others, making only 70% furnace recovery, as a result of the inefficiency produced by prosperity, will smelt the ore on hand and will then "dead fire" unless the situation in metal brightens. The production of zinc ores, which reached the zenith of 10,000 tons the last week of April, has declined to around 8,000 tons per week. Some of the "sheet ground" mines are now arranging to close down and further declines in metal and ore prices will force others to follow soon. It now seems evident the output will be reduced to around 6,500 tons per week by the end of the month.

PLATTEVILLE, WIS.—July 8

The base price paid this week for zinc ore was $67@68 per ton 60% zinc for top grades down to $62 per ton base for medium grades assaying down to 50% zinc. The base price paid for 80% lead ore was $75@77 per ton.

SHIPMENTS, WEEK ENDED JULY 8

	Zinc Ore, Lb.	Lead Ore, Lb.	Sulphur Ore, Lb.
Week	5,100,000	178,830	825,800
Year	124,816,000	4,513,840	30,825,600

Shipped during week to separating plants, 5,976,000 lb. zinc ore. Zinc-ore shipments to smelteries gained 21,436,020 lb., lead-ore shipments gained 838,120 lb. and sulphur-ore shipments gained 16,213,910 lb., as compared with the first six months of 1915.

OTHER ORES

Manganese Ore continues to bring a high price. Quotations are about 75@85c. per unit for 50% Brazilian ore. Notwithstanding the demand for manganese ores the production in the United States in 1915 is reported by the Geological Survey at only 9,569 tons.

Local prospectors report the discovery of a large outcrop of manganese ore at Lower Shebandowan Lake in the Thunder Bay district in Ontario. Further exploration is needed to determine its extent and value.

Tungsten Ore—The ideas of buyers and sellers were very far apart. Business was reported done at figures close to $20 per unit, but we were unable to verify those reports. A broker in trying to buy to fill orders was unable to persuade sellers to let go at less than $30, at which price no business could be done. The market is probably in the neighborhood of $25 per unit.

Antimony Ore—The market for this ore is dead and no quotations are made.

Bismuth Ore—We have had inquiries respecting market value of bismuth ore. There are no quotations for this ore, and no general market for it in this country. Ore might be salable if producer would make a firm offer as to quantity and date of shipment. Price would be a matter of private negotiation.

Iron Trade Review

NEW YORK—July 12

Domestic orders continue quiet, but export business is active and several large orders have been placed for rails, wire and shell steel.

For home use there is a demand for plates for ship and car work, and for bars, though the usual July contracts for bars have not been placed yet.

The pig-iron market continues rather quiet though there has been some demand for bessemer pig for export, and for basic iron from the steel mills. Some large transactions in scrap for steel making are reported, and that class of material has been especially active in the Central West.

Exports of semi-finished steel—ingots, billets and blooms—from the United States in April were 88,764 gross tons; in the four months ended Apr. 30 they were 339,081 tons, against 99,480 tons in the corresponding months of 1915; an increase of 239,601 tons, or 248.5% this year.

The sale of the Pennsylvania Steel Co. and its subsidiaries to the Bethlehem Steel Co. has been completed, the United States Circuit Court of Appeals having thrown out the suit to enjoin the transfer brought by C. H. Venner, of New York.

The United States Steel Corporation reports the total unfilled orders on its books June 30 at 9,640,450 tons of material; a decrease of 297,340 tons from May 31. This is the first decline in unfilled orders since August of last year.

Pig Iron Production in June showed a slight decrease. The reports of the blast furnaces, as collected and published by the "Iron Age" show that on July 1 there were 323 coke and anthracite stacks in blast, having a total daily production of 107,800 tons, being 600 tons less than on June 1. Making allowance for the charcoal furnaces the total make of pig iron in June was 3,247,000 gross tons; for the six months ended June 30 it was 19,611,800 tons. Of this total 13,821,000 tons, or 74.7%, was made by the furnaces owned or operated by the steel companies. The effect of heavy driving for many months, besides that of hot weather, is beginning to show at the furnaces.

A syndicate known as the Sindicato Petrolifero del Oriente Boliviano has been formed by Chilean capitalists to exploit an area of 545,000 hectares (1,345,150 acres) of oil-bearing lands in eastern Bolivia. To carry on the work of exploitation as planned, subscriptions for approximately $10,000,000 are to be raised, chiefly from the nitrate producers in the north of Chile who are desirous of securing an independent and economical source of fuel.

Iron Production in Alabama in June is reported at 204,389 gross tons. For the six months ended June 30 the total make was 854,353 tons in 1915, and 1,367,066 tons in 1916; an increase of 512,713 tons, or 60%, this year. The make of basic pig in the Birmingham district was 67,712 tons in June and 427,819 tons for the half-year. This is the best record made for a half year in this district.

Steel Production, Ingots and Direct Castings, in the United States in 1915 is reported by the Statistical Bureau of the American Iron and Steel Association as follows: Basic openhearth, 22,308,725; acid openhearth, 1,370,377; bessemer, 8,287,213; crucible, 113,782; electric, 69,412; miscellaneous, 1,527; total, 32,151,036 gross tons, being 8,638,006 tons more than in 1914, and 850,162 tons more than in 1913. The total production of rolled iron and steel was 24,392,924 gross tons.

PITTSBURGH—July 11

Record hot weather for the season developed today and steel-mill outputs are materially reduced. In pig iron there was a reduction even in June. Steel consumption, it is believed in steel-making circles, is not being decreased by weather conditions as much as production.

The steel market is extremely quiet, and the decided decline in activity which began about the first of June has now culminated in a practically stagnant market. The Steel Corporation's unfilled obligations decreased 297,340 tons, following continued increases for nine months, but there had been those who predicted a decrease even in May. Of more importance than the June decrease in total obligations is the recent statement of Chairman Gary that the Corporation has about 6,000,000 tons in actual specifications, that being an extremely large tonnage for the corporation subsidiaries to have booked in the form of actual shipping orders. The large independents are as a rule in substantially the same position, and no one considers it among the possibilities for the large interests to make any effort to book orders by offering concessions for many months, unless perhaps forced to do so by the smaller mills making cuts, just as heretofore they have been demanding premiums for the earlier deliveries they could make. It is generally held that the steel market will not be affected by two months more of dullness like that of the present, while it is believed that sufficient new buying will develop by September to maintain the mill position comfortably through the year.

Premiums for early deliveries have practically disappeared, except on plates, and on plates there are smaller premiums than formerly, prompt deliveries being generally obtainable at about 3.50c., against the base price of 2.90c., Pittsburgh.

Pig Iron—The market continues very dull. Some recent reports of sales of basic iron prove to be fabrications, apparently made for the purpose of arousing the interest of buyers. There is continued demand from abroad for bessemer iron, the price of which is easily maintained and despite the $3 spread of bessemer above basic it is thought in some quarters that there may be a further advance as the tonnage of bessemer ore obtainable is somewhat limited. We quote: Bessemer, $21@21.50; basic, $18; foundry and malleable, $18.25@18.50; forge, $18@18.25, f.o.b. Valley furnaces, 95c. higher delivered Pittsburgh.

Steel—Billets and sheet bars continue strong, the market having fully recovered from the flurry of a few weeks ago. There is little domestic demand, but sufficient export demand to absorb all offerings and maintain prices. We quote soft steel billets and sheet bars at $42@43 for bessemer and $44@45 for openhearth, with rods at $55@60, and high-carbon rods $70@80 per ton.

FOREIGN IRON

The iron-ore deposits of the Telbess Basin, near Kuznetsk, in Siberia, were conceded to the Kuznetsk Coal Mines Co. in 1913, and a careful examination was begun. The report recently submitted shows 27,000,000 tons of iron ore so far blocked out and surveyed. The main deposit is on the bank of the Telbess River. It can be easily mined and is near the coal deposits of Kuznetsk. The company prposes to establish extensive iron works.

FERROALLOYS

Spiegeleisen is rather easier as supplies seem more plentiful. Quotations for ordinary 20% spiegel are $45@50 per ton at furnace. Higher grade, 30%, brings $50@55 per ton.

Ferrosilicon, high grade, 50% alloy is $83@85 per ton at mill. We do not hear of any premiums being paid. Lower grade, bessemer ferrosilicon, is from $33 per ton for 10% up to $43 for 16%, at mill.

Ferrotungsten—This alloy for export sale must assay 75% and upward in tungsten and not over 1.25% carbon and 0.05% sulphur. Present value of such metal is 5@6c. per lb. of tungsten content. Alloy with 4% carbon is offered, but there is no market for such, either domestic or foreign.

Ferromanganese—The market has softened farther, prompt being $200@225 as far as it can be quoted with demand so very light, while contract at the regular price of $175 can be had for earlier deliveries than formerly. Deliveries on contracts are reported better than for months.

Reactol—The London correspondent of the "Iron Age" writes as follows of a new high-speed tool steel: "A new steel alloy known as Reactol, and produced at Sheffield, is arousing a good deal of interest in England among makers of high-speed tool steel. It is said that it contains neither tungsten nor cobalt, and that it requires neither forging, hardening nor tempering, but merely has to be ground into shape in order to make it ready for work of the heaviest character. Very high service claims are made for it."

IRON ORE

Ore shipments from the Lake Superior region in June were 9.507,576 long tons, being 1,057,996 tons more than in May. For the season to July 1 the total shipments are reported by the "Iron Trade Review" as below, in long tons:

Port.	1915	1916	Changes
Escanaba	1,248,830	2,602,824	I. 1,353,994
Marquette	547,002	1,154,140	I. 607,138
Ashland	1,161,792	2,204,263	I. 1,042,471
Superior	1,777,600	3,878,915	I. 2,101,315
Duluth	4,295,811	6,325,990	I. 2,030,179
Two Harbors	2,490,248	3,449,435	I. 959,187
Total	11,521,283	19,615,567	I. 8,094,284

The total increase this year was 70.3%. The labor troubles on the Mesabi have not interfered with shipments so far. The June movement was the largest ever reported in one month.

COKE

Coke production in the Connellsville region for the week is reported by the "Courier" at 423,550 net tons; shipments, 437,016 tons. Shipments of Greensburg and Upper Connellsville districts, 37,361 tons.

The United States Geological Survey estimates the production of bituminous coal in the United States in the first half of 1916 at 261,000,000 tons.

Connellsville—Hot weather is interfering with production, as the men are doing less work and ovens are frequently drawn a day or two late. Following a week with a holiday in it, the condition makes supplies limited and spot coke is higher, while any real buying would probably cause a further advance. Contract coke is not in demand. We quote: Spot furnace, $2.65@2.75; contract, $2.30@2.50; spot foundry, $3@3.25; contract foundry, $3.25@3.50, per net ton at ovens.

Chemicals

NEW YORK—July 12

The general market is again quiet and rather inactive. Prices are not strong and heavy chemicals are moving rather slowly.

Arsenic—Supplies are not heavy, but demand is light also; prices are a little easier and sales are reported at $6@6.25 per 100 lb. for early delivery.

Copper Sulphate—Consumers seem rather conservative, and buyers are not active even at the recent decline. Business has been rather small. Quotations are still lower at $9@10 per 100 lb. for large lots for early delivery.

Nitrate of Soda—The market is quiet and there is no pressure either to buy or sell. The reported large stocks on the West Coast do not seem to affect the market, and ocean freights remain very high. Quotations show no material change, $3.10@3.15 per 100 lb. being asked for spot; $3.05@3.10 for August and later delivery. Production in Chile in May reached a total of 243,360 tons, as against 107,000 tons for the corresponding period last year. This makes total production for the first five months of the year 1,231,019 tons, as against 487,957 tons in 1915.

Sulphur—Demand continues good and prices firm. The cost of transportation still helps to keep up quotations, which are $35 per long ton, New York, for spot, and $30 for futures.

Sulphuric Acid—The market is rather easier, and 60-deg. acid is now quoted at $20 per ton; while 66-deg. acid is $35 per ton for early shipment.

PETROLEUM

Exports of mineral oils from the United States in May are reported by the Department of Commerce at 228,478,733 gal., an increase of 2,527,035 gal. over May, 1915. For the five months ended May 31 the total exports were 860,726,752 gal. in 1915, and 953,903,651 gal. in 1916; an increase of 93,176,899 gal., or 10.8%, this year.

Mexican oil imports into the United States in May were 1,806,318 bbl., an increase of 186,766 bbl. over April.

Assessments

Company	Delinq	Sale	Amt.
Advance, Mont	June 15	July 15	$0.005
Algomah, Mich	May 18	....	1.00
American, Utah	June 18	July 20	0.001
Blue Bell, Ida	July 8	Aug. 5	0.002
Bullion, Ida	July 10	July 31	0.01
Cedar Creek, Ida	July 5	Aug. 5	0.01
Central Eureka, Calif	June 16	July 14	0.05
Columbus Ext., Utah	July 13	Aug. 8	0.02
Confidence, Nev	June 23	July 14	0.10
Cons. Imperial, Nev	July 18	Aug. 10	0.01
Crackerjack, Nev	July 3	Aug. 1	0.01
Friend, Ida	June 30	July 20	0.002
Giant, Ida	June 16	July 17	0.003
Goldstrike Bon., Utah	June 15	July 15	0.01
Gold Mt. Champion, Utah	July 20	Aug. 10	0.0025
Gould & Curry, Nev	July 14	Aug. 3	0.03
Great Western, Nev	July 24	Aug. 15	0.005
Hope, Calif	July 17	Aug. 14	0.01
Hugo, Ida	July 29	Aug. 30	0.002
Independence, Ida	July 8	July 29	0.001
Laclede, Ida	July 3	July 25	0.003
Lucky Calumet, Ida	July 20	Aug. 21	0.005
Morgan Argentine, Utah	July 15	Aug. 5	0.01
Nevada-Douglas, Nev	July 15	Aug. 16	0.10
North Lake, Mich	June 14	.	1.00
Old Veteran, Ida	July 8	Aug. 5	0.002
Rio Grande, Nev	June 22	July 22	0.002
Rockford, Ida	June 30	July 21	0.002
Sierra Nevada, Nev	July 11	Aug. 3	0.10
Silver Moon, Ida	July 8	Aug. 3	0.005
Silver Pick, Nev	July 5	Aug. 14	0.01
Southern Swansea, Utah	July 17	Aug. 5	0.001
Spearhead Reor., Nev.	July 3	Aug. 3	0.01
Swansea Ext., Utah	July 10	Aug. 1	0.0025
Tar Baby, Utah	Aug. 3	Sept. 4	0.01
Tarbox, Mont	July 25	Aug. 12	0.005
Tintic Central, Utah	July 12	Aug. 8	0.005
Too. Gypsy Queen, Nev	July 11	Aug. 15	0.01
Uvada, Nev	June 24	July 27	0.02
Victoria, Utah	July 8	Aug. 2	0.005
Wallace, Ida	June 29	July 29	0.0025
Wasatch-Utah, Utah	June 19	July 22	0.0025
West Mercur, Utah	July 8	July 31	0.025

Stock Quotations

SAN FRANCISCO July 11 Name of Comp.	Bid.
Alta	.05
Andes	.11
Best & Belcher	.05
Bullion	04
Caledonia	‡ 44
Challenge Con	04
Confidence	18
Cons. Imperial	01
Con. Virginia	10
Gould & Curry	03
Hale & Norcross	07
Jacket-Cr. Pt.	02
Mexican	15
Occidental	.70
Ophir	28
Overman	06
Savage	‡ 07
Seg Belcher	.02
Sierra Nevada	22
Union Con	71
Utah Con	01
Belmont	4 15
Jim Butler	94
MacNamara	05
Midway	17
Mont.-Tonopah	.23
North Star	13
Rescue Eula	27
West End Con	93
Atlanta	10
Blue Bell	‡ 01
Booth	.15
C.O.D. Con	.03
Comb. Frac	.06
D'field B.R	.02
D'field Daisy	02
Jumbo Extension	77
Pitts.-Silver Peak	08
Round Mountain	41
Sandstorm Kendall	03
Silver Pick	10
Central Eureka	10
Argo	12
Ariz. Central	10
Big Jim	75
Lazy Boy	12
Oatman No. Star	‡ 17
Tom Reed	1 40
United Eastern	3 50
United Western	12

LONDON	June 27
Alaska Tre'dwell	£5 15s 0d
Burma Corp	3 4 4
Cam & Motor	0 14
Camp Bird	0 8 9
El Oro	0 9 0
Esperanza	0 10 7½
Mexico Mines	3 17 6
Nechi, pfd	0 3 3
Oroville	0 16 0
Santa Gert'dis	0 12 3
Tomboy	1 2 6

SALT LAKE July 11 Name of Comp.	Bid
Alta Con	40
Black Jack	05
Colorado Mining	17
Crown Point	04½
Daly-Judge	7 50
Emma Cop	40
Gold Chain	24
Grand Central	65
Iron Blossom	1 67½
Lower Mammoth	.04½
May Day	13
Opohongo	‡ 01¾
Prince Con	1.37½
Seven Troughs	02
Silver King Coal'n	2 90
Silver King Con	3 20
Sioux Con	.11
Uncle Sam	.06½
Yankee	.49

COLO. SPRINGS	July 11
Acacia	.03¼
Doctor Jack Pot	8¼
Elkton Con	15
El Paso	.78
Findlay	.03¼
Gold Sovereign	.02¾
Golden Cycle	2.02½
Granite	67
Isabella	.18
Jack Pot	.05
Jerry Johnson	03½
Mary McKinney	30
Portland	1 68
Vindicator	2 [illegible]

TORONTO	July 11
Adanac	1 81¼
Bailey	06
Chambers Ferland	20
Coniagas	4 50
La Rose	60
Peterson Lake	23
Right of Way	05¼
Seneca Superior	37
T. & Hudson Bay	50 00
Temiskaming	55
Trethewey	‡ 21
Wettlaufer-Lor	12
Dome Exten	[illegible]
Dome Lake	.31
Foley O'Brien	50
Hollinger	29 30
Imperial	‡ 03
Jupiter	21
McIntyre	1 50
Porcu. Crown	75
Preston E. D	‡ 03
Vipond	45
West Dome	36

N. Y. EXCH. July 11 Name of Comp.	Clg.
Alaska Gold M	18¼
Alaska Juneau	8
Am.Sm.&Ref.,com	92
Am. Sm. & Ref., pf	110¼
Am. Sm. Sec., pf. A	91¾
Am. Sm. Sec., pf. B	83½
Am. Zinc	29½
Am. Zinc, pf	60½
Anaconda	79
Batopilas Min	1⅜
Bethlehem Steel	443
Bethlehem Steel, pf	125½
Butte & Superior	62
Chile Cop	20
Chino	46½
Colo. Fuel & Iron	42½
Crucible Steel	73½
Dome Mines	25¼
Federal M. & S.	12½
Federal M. & S., pf	38
Great Nor., ore ctf	35½
Greene Cananea	44
Homestake	130½
Inspiration Con	50¾
International Nickel	45¼
Kennecott	45¼
Lackawanna Steel	68¼
Miami Copper	33¼
Nat'l Lead, com	63¼
National Lead, pf	113
Nev. Consol	16
Ontario Min	6½
Quicksilver	2¼
Quicksilver, pf	4½
Ray Con	21½
Republic I&S, com	44
Republic I&S, pf	108
Sloss-Sheffield	45
Sloss-Sheffield, pf	94
Tennessee Copper	31
Utah Copper	75¼
U. S. Steel, com	84¼
U. S. Steel, pf	117½
Va. Iron C. & C	44

N. Y. CURB	July 11
Beaver Con	37
Buffalo Mines	1
Butte & N. Y.	1¼
Butte C. & Z.	5½
Can. Cop. Corpn	1⅜
Cashboy	.05
Cerro de Pasco	33
Con. Ariz. Sm.	1 15/16
Con. Coppermines	2¼
Con. Nev.-Utah	‡ 28½
Crystal Cop	1
First Nat. Cop	3¼
Florence	41
Goldfield Con	85
Goldfield Merger	.09½
Granite	28
Hecla Min	5¼
Howe Sound	4⅜
Jerome Verde	1⅝
Joplin Ore & Spel	2¼
Kenefick Zinc	‡13½
Kerr Lake	4½
Magma	13¼
Majestic	.68
McKinley-Dar-Sa	.52
Mother Lode	.27
Nevada Hills	.18
N. Y. & Hond	16½
Nipissing Mines	6¾
Oro	‡ 05
Ray Hercules	3½
Rochester Mines	.57
St. Joseph Lead	15½
Standard S. L.	1⅜
Stewart	25
Success	.69
Tonopah	6
Tonopah Ex.	5 3/16
Tribullion	⅛
United Zinc	6¼
White Knob, pf	1¼
Yukon Gold	2

BOSTON EXCH July 11 Name of Comp.	Bid
Adventure	2½
Ahmeek	90
Algomah	1¼
Allouez	59
Ariz. Com., ctfs	8½
Bonanza	25
Butte-Ballaklava	2
Calumet & Ariz	66
Calumet & Hecla	520
Centennial	14
Copper Range	55
Daly West	[illegible]
East Butte	11¼
Franklin	6½
Granby	80
Hancock	12
Helvetia	25
Indiana	2
Island Cr'k, com	45½
Island Cr'k, pfd	88½
Isle Royale	25
Keweenaw	3½
Lake	10¼
La Salle	‡1
Mason Valley	1½
Mass	10¼
Mayflower	2
Michigan	2½
Mohawk	78¼
New Arcadian	4¼
New Idria	11½
North Butte	21
North Lake	1½
Ojibway	1
Old Colony	1⅝
Old Dominion	61
Osceola	80¼
Quincy	81
St. Mary's M. L.	‡74½
Santa Fe	1½
Shannon	8
Shattuck-Ariz	24¼
So. Lake	4½
So. Utah	15
Superior	13¼
Superior & Bost	3⅛
Tamarack	38
Trinity	42
Tuolumne	30
U. S. Smelting	66½
U. S. Smelt'g, pf	50
Utah Apex	4⅛
Utah Con	12⅜
Utah Metal	7
Victoria	2¼
Winona	4½
Wolverine	50
Wyandot	1⅝

BOSTON CURB	July 11
Bingham Mines	10½
Boston Ely	.95
Boston & Mont	.70
Butte & Lon'n Dev	67
Calaveras	4½
Calumet-Corbin	03
Chief Con	1⅝
Cortez	.35
Crown Reserve	.50
Davis-Daly	1½
Eagle & Blue Bell	1⅝
Houghton Copper	1¼
Iron Cap Cop., pf	6
Mexican Metals	.33
Mines of America	2¼
Mojave Tungsten	5
Nat. Zinc & Lead	1½
Nevada-Douglas	1
New Baltic	1⅝
New Cornelia	12¾
Ohio Copper	.10
Oneco	1
Raven Copper	‡.18
Rex Cons	.16
Rilla	.21
United Verde Ext.	37½

‡Last Quotations.

Monthly Average Prices of Metals

SILVER

Month	New York			London		
	1914	1915	1916	1914	1915	1916
January	56.572	48.855	56.775	26.553	22.731	26.960
February	57.506	48.477	56.755	26.573	22.753	26.975
March	58.067	50.241	57.935	26.788	23.708	27.597
April	58.519	50.250	64.415	26.958	23.709	30.662
May	58.175	49.915	74.269	26.704	23.570	35.477
June	56.471	49.034	65.024	25.948	23.267	31.060
July	54.678	47.519	.....	25.219	22.597	......
August	54.341	47.163	....	25.979	22.780	......
September	53.290	48.680		24.260	23.351	..
October	50.654	49.385	..	23.199	23.925	......
November	49.082	51.714	...	22.703	25.094	.....
December	49.375	54.971	.. ..	22.900	26.373	....
Year	54.811	49.684	..	25.314	23.675	..

New York quotations cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine

COPPER

Month	New York		London			
	Electrolytic		Standard		Electrolytic	
	1915	1916	1915	1916	1915	1916
Jan.	13.641	24.008	60.756	88.083	65.719	116.167
Feb.	14.394	26.440	63.494	102.667	*	133.167
Mar.	14.787	26.310	66.152	107.714	*	136.000
April	16.811	27.895	75.096	124.319	*	137.389
May	18.506	28.625	77.600	135.457	*	152.522
June	19.477	26.601	82.574	112.432	95.333	137.455
July	18.796	.....	76.011	...	91.409	....
Aug.	16.941	....	68.673	..	82.333	.....
Sept.	17.502	.....	68.915	.....	85.250	....
Oct.	17.686	..	72.601	..	88.000	....
Nov.	18.627	.....	77.744	..	93.273	...
Dec.	20.133	..	80.773		100.43	......
Year	17.275	......	72.532	...	......	...

TIN

Month	New York		London	
	1915	1916	1915	1916
January	34.260	41.825	156.550	175.548
February	37.415	42.717	176.925	181.107
March	48.426	50.741	180.141	193.609
April	47.884	51.230	166.225	199.736
May	38.790	49.125	162.675	196.511
June	40.288	42.231	167.636	179.466
July	37.423	..	167.080	..
August	34.389	..	151.440	.....
September	33.125	..	152.625	..
October	33.080	....	151.554	..
November	39.224	......	167.670	....
December	38.779	.....	167.000	......
Av. year	38.590		163.960	.....

LEAD

Month	New York		St. Louis		London	
	1915	1916	1915	1916	1915	1916
January	3.729	5.921	3.548	5.826	18.606	31.167
February	3.827	6.246	3.718	6.164	19.122	31.988
March	4.053	7.136	3.997	7.375	21.883	34.440
April	4.221	7.630	4.142	7.655	21.094	34.368
May	4.274	7.463	4.182	7.332	20.347	32.967
June	5.932	6.936	5.836	6.740	25.170	31.0[illegible]1
July	5.659	.....	5.531	....	24.611	.....
August	4.656	....	4.520	....	21.946	......
September	4.610	......	4.490	....	23.151	......
October	4.600	......	4.499	.....	23.994	......
November	5.155	.....	5.078	...	26.278	......
December	5.355	......	5.266	..	28.807	......
Year	4.673	.....	4.5[illegible]7	.....	22.917	......

SPELTER

Month	New York		St. Louis		London	
	1915	1916	1915	1916	1915	1916
Jan.	6.386	16.915	6.211	16.745	30.844	89.810
Feb.	8.436	18.420	8.255	18.260	39.819	97.762
Mar.	8.541	16.846	8.360	16.676	44.141	95.048
April	10.012	16.695	9.837	16.525	49.888	99.056
May	14.781	14.276	14.610	14.[illegible]06	68.100	94.217
June	21.208	11.752	21.038	11.582	100.614	68.591
July	19.026	......	18.856	......	97.250	.....
Aug.	12.781	......	12.611	......	67.786	.....
Sept.	13.440	......	13.270	.....	67.841	......
Oct.	12.800	......	12.596	......	66.536	.....
Nov.	15.962	......	15.792	.....	88.409	.....
Dec.	15.391	......	15.221	..	89.400	......
Year	13.230	......	13.054	..	67.553	......

New York and St. Louis quotations, cents per pound. London, pounds sterling per long ton. * Not reported.

PIG IRON IN PITTSBURGH

Month	Bessemer‡		Basic‡		No. 2 Foundry	
	1915	1916	1915	1916	1915	1916
January	$14.59	$21.60	$13.45	$18.78	$13.90	$19.70
February	14.55	21.16	13.45	18.93	13.90	19.51
March	14.55	21.81	13.45	19.20	13.95	19.45
April	14.55	21.65	13.45	18.95	13.95	19.45
May	14.61	21.78	13.60	19.11	13.83	19.58
June	14.70	21.95	13.67	18.95	13.77	19.34
July	14.94	......	13.91	......	13.68	......
August	16.01	......	15.31	......	14.75	......
September	16.86	......	15.95	......	15.70	......
October	16.95	.....	15.96	.....	15.80	......
November	17.57	.....	16.47	......	17.20	.....
December	19.97	.....	18.44	.....	18.95	......
Year	$15.82	......	$14.76	.....	$14.95	......

‡As reported by W. P. Snyder & Co

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The Boulder County Tungsten District, Colo.

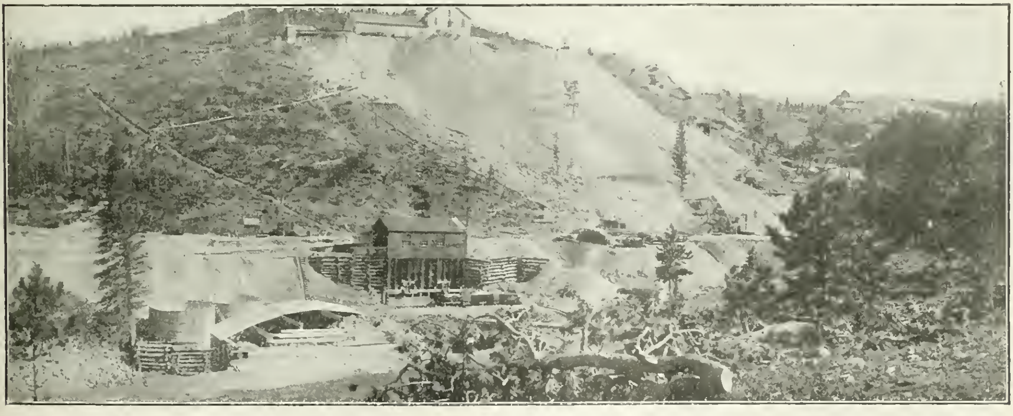
By Harry J. Wolf* and Percy P. Barbour†

SYNOPSIS—This district first became known to mining about 1870, when Sam P. Conger discovered the Cariboo silver mine. The first tungsten ore was produced in 1900. The common tungsten mineral of the district is ferberite. Minerals usually associated with tungsten in other parts of the world are absent. The orebodies are lenticular and pockety.

The Boulder County tungsten district is situated about 25 mi. northwest of Denver, Colo. The promising deposits extend southward into the northern end of Gilpin County. The tungsten-bearing area has a northeast and southwest length of about 12 mi. and a width of about 7 mi.

The more important towns in the district are Nederland, Cardinal, Phœnixville, Rollinsville, Sugarloaf, Magnolia, Lakewood and Stevens Camp. The principal active mining centers in the heart of the district are Nederland, (the chief commercial town), Lakewood and Stevens Camp. The population of Nederland and adjacent territory is about 4,000, Lakewood has about 400 people and Stevens Camp about 500. The entire population of the district is in round figures 5,000. The altitude of Nederland is 8,237 ft. above sea level.

The district is reached by the Colorado & Northern R.R., which runs from Boulder to Sugarloaf and Cardinal. The latter station is about 2 mi. from Nederland. The Denver, Northwestern & Pacific R.R. (Moffatt Road) runs from Denver to Rollinsville, about 4 mi. south of Nederland. The various towns of the district may be reached also by auto stage from Boulder. Nederland is about 12 mi. west and 3 mi. south of Boulder. At the present time there is considerable activity in road building due to the great volume of automobile traffic between Boulder and the district. Several gangs are at work widening the roads and reducing grades and curves. Considerable freighting is done with auto trucks, which have played an important part in the development of the camps. Most of the small hoisting plants now in operation in the district have been installed since Jan. 1, 1916, and Stevens Camp has been entirely built within this period.



CONGER MINE OF THE BOULDER COUNTY TUNGSTEN DISTRICT, COLO., AND BEDDIG MINE IN THE BACKGROUND

The area is on the Front Range about 3 mi. west of the nearest sedimentary rocks. The most important country rock is biotite-horne-blende granite. Other prominent rocks are gneissoid granite, gneiss, fine-grained granite, quartz-mica, schist and pegmatite. The granite, gneiss and schist are of pre-Cambrian age. The gneiss and schist are older than the granite. The pegmatite is frequently coarsely crystalline and is usually in dikes cutting the older rocks. Minerals going to form the veins are described in another paragraph.

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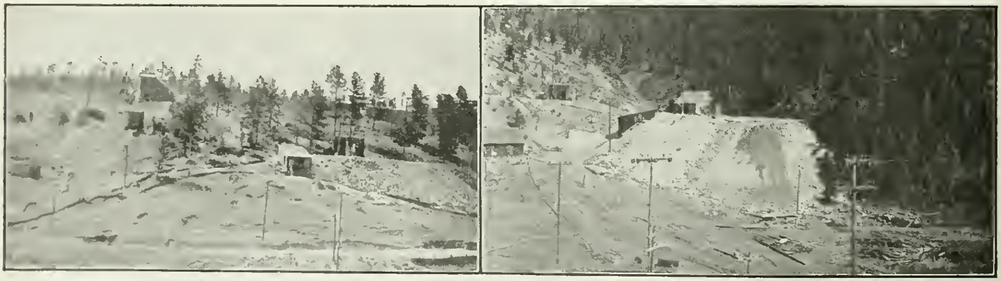
*Mining engineer, Denver, Colo.

†Mining engineer, Idaho Springs, Colo.

The principal ore-forming mineral of the district is ferberite, one of the four commercial tungsten minerals; the other three being wolframite, hübnerite and scheelite. Ferberite is almost entirely iron tungstate, although analyses of typical specimens indicate the presence of small amounts of manganese, calcium and magnesium oxides, silica and alumina. The ferberite in the Boulder County field is usually black but occasionally brown. It is found in finely crystallized compact masses and also in well-developed crystals, wedge-shaped and with rhombic faces. The crystallization appears to be monoclinic in character. The finely crystallized ferberite is found frequently embedded in or closely associated with quartz, and this ore is commonly called "horn rock" by the miners. The vein-forming minerals are frequently brecciated, and fragments of rock varying in size from fine particles to pieces 2 to 3 in. in diameter are embedded in the ferberite. This is referred to as "peanut ore." Sometimes the ferberite occurs in fine particles disseminated throughout the quartz, and fine crushing of the ore is required to liberate it for successful concentration.

TWO OF THE COLORADO TUNGSTEN MILLS; FIRST THE PRIMOS AND THEN THE WOLF TONGUE



VIEWS OF THE RAKE OFF MINE AND THE CLYDE TUNNEL IN THE BOULDER COUNTY TUNGSTEN DISTRICT

The more prominent and most promising veins of the district have a northeast and southwest strike. Veins are frequently in coarsely crystalline pegmatite. As in the case of most veins carrying valuable minerals, crossings and junctions are likely to be accompanied by enrichment. It seems to be a common belief among the miners in the district that the quality of the ore is likely to be improved just west of a junction or dike crossing the vein at an acute angle. Dikes crossing the veins at right angles are supposed to have little influence on the ore. Watercourses are considered favorable indications. Other popular beliefs are that the appearance of schist in the vein is unfavorable and is likely to cut off the ore and that the best ore is more likely to be found in the more acid than in the more basic rocks. The ferberite is frequently found in fine stringers in decomposed granite, with or without small seams of quartz. In the northern part of the district the ferberite is sometimes grayish or brownish in color, while in the southern part it is usually an intense black. The latter characteristic is common of the Beaver Creek locality.

The orebodies are commonly in the form of small lenses a few feet in length. Sometimes these lenses are larger, and exceptional orebodies have reached a length of 150 to 200 ft. Up to the present time the development of the district may be regarded in a general way as somewhat superficial, for most of the mines are less than 300 ft. deep and more than half the properties have reached a depth of less than 200 ft. The Conger mine, with a depth of 1,100 ft., and the Beddig mine, with 600 ft., are the exceptions and represent the deepest development in the district. There are three steam hoists and 58 small electric hoists in operation. This number of small hoists is suggestive of the number of relatively shallow shafts being sunk for development purposes. The accompanying table of some of the more prominent shafts will convey a general idea of the depth of development.

MINE DEVELOPMENT OF THE DISTRICT

Name of Mine	Depth of Shaft, Ft.	Name of Mine	Depth of Shaft, Ft.
Conger	1,100	Cross No. 2	198
Beddig	600	Cross No. 1	190
Cold Spring	350	Lily	160
Clyde	300	Orange Blossom	140
Star	280	Tenderfoot	140
Oregon	260	Crow No. 1	130
Vasco No. 7	260	Bonanza No. 2	117
Forest Home	220	Last Chance	100
Town Lot	210	Jack	100
Pansy	200	Summit	100
Bonanza No. 1	200	Crow No. 11	60

The tungsten properties may be roughly divided into large, moderate and small producers. Large producers are found in three localities: The area including the Conger properties, Sherwood Creek and Lakewood, north and west of Nederland; Stevens Camp, to the east of Nederland; and Beaver Creek, to the south. Among the moderate producers are such properties as the Red Sign and Lucky 2 mines, located in Middle Boulder Cañon, and the Eagle Rock property at Duncan Camp; and the properties in the Rollinsville section south of Nederland. Small producers and properties in process of development are found in some of the districts that include promising properties under development, such as Manchester, Gordon Gulch, Bummer's Gulch, Dry Lake, Loveland Camp, Pullian's Camp and Roger's Tract.

CHIEF OPERATING COMPANIES

The principal companies operating in the district are the Wolf Tongue Mining and Milling Co., the Primos Mining and Milling Co., the Vasco Mining Co. and the Boulder Tungsten Production Co. In addition to these, which control the bulk of the production, there are numerous small companies and private operators.

The Wolf Tongue Mining and Milling Co. controls and operates the following mines: Clyde, Cold Spring, Star, Cross No. 1, Cross No. 2, Pansy, Orange Blossom, Tenderfoot, Last Chance, Town Lot, Oregon, Bonanza No. 1, Bonanza No. 2, Jack and Summit. About forty sets of lessees are at work in these properties. The Clyde mine, about 1½ mi. northeast of Nederland, is operated on company account. The main shaft is 300 ft. deep. A tunnel, part of which is a crosscut, connects with the shaft at a point 230 ft. below the collar. The tunnel cuts the vein at a point 569 ft. from the portal and from this point advances as a drift on the vein a distance of 85 ft. to the shaft. The general strike of the Clyde vein is northeast and southwest, and the dip is about 70° northwest. The principal shoot being worked at present is about 160 ft. long. The ore as mined carries from 3 to 4% tungstic acid and is shipped direct to the mill without sorting. The vein is alongside a pegmatite dike. The method of mining is similar to that employed in shrinkage stoping. The ore is broken down in the stope, and the miners work on top of the ore. The muck line is kept at a convenient distance from the back of the stope by drawing off the excess broken ore through chutes into tramcars in the levels. It is estimated that the gross production of this mine to date is about $80,000. The Wolf Tongue company controls parts of Secs. 5, 7 and 8, in T. 1 S, R. 72 W.

SOME OF THE TYPICAL TUNGSTEN ORE

The Primos Mining and Milling Co. operates the Conger, Beddig, Lily, Crow and other mountain-ranch tracts. About 75 sets of lessees are working in these properties. The Conger mine, about one mile northwest of Nederland, is operated on company account. The main Conger shaft is 1,100 ft. deep. The first level is a tunnel level and connects with the shaft at a point 160 ft. below the collar. The other levels are about 100 ft. apart. On the 200-ft. level the mine is connected with what is known as the old Conger mine to the southwest. The old shaft is operated by lessees. Until recently the company has been sinking the main shaft. The hoisting plant is operated by steam. The shaft is vertical and is equipped with a single-deck cage. The mine cars used are 2 ft. by 2 ft. 3 in. by 3 ft. 3 in. and hold about one ton of ore. The Conger is shipping about 50 tons of ore a day. The ore is hauled over a surface tramway by electric locomotive to the Primos mill. Approximately 120 men are employed in and about the property. This is the largest single producer in the district. The vein has a northeast and southwest strike, and the dip is nearly vertical. The ore is typically brecciated. The Primos company controls section 1 and parts of Sec. 11 and 12, in T. 1 S, R. 73 W and part of Sec. 6, in T. 1 S, R. 72 W.

The Vasco Mining Co. operates nine properties located in the southwest quarter of Sec. 8, T 1 S, R. 72 W. Among the properties owned and operated by the Boulder Tungsten Production Co. are the Forest Home and Clark Tunnel. The Colorado Tungsten Corporation controls part of Sec. 12, in T. 1 S, R. 73 W.

In addition to the four large companies mentioned, there are many small companies and individual operators. The small plants shown in the accompanying illustrations are characteristic of the district. It is a district of small operators, small capital, small plants and small shipments. In some respects it may be called a "poor man's camp." Current wages range from $3.60 to $4.20 a day.

The bulk of all ore produced in the district is mined by lessees who develop and work small blocks of ground on short-time leases. Most of the ore shipments are small, and the lots of ore are usually hauled by wagon from the mine to the purchaser. The four large companies named buy practically all the ore produced in the district. These companies naturally favor their own lessees first and then buy ore from outsiders if they can handle it to advantage.

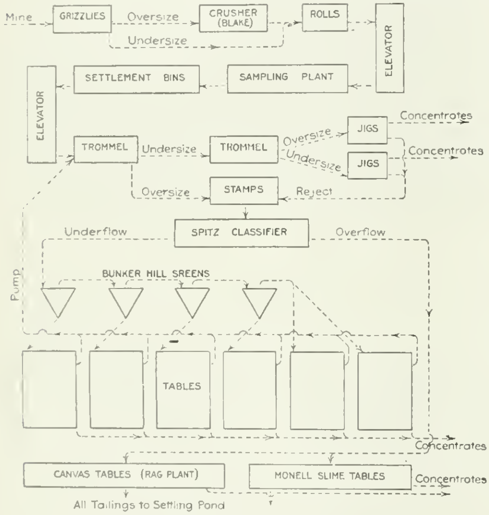
The current leasing practice of the Wolf Tongue Co. is to grant a lease on a block of ground for a period of one year with the usual understanding that it will be renewed for an additional year if the work accomplished by the lessee is satisfactory to the company. After the lessee has performed 30 ft. of sinking, the company may supply him with machine drills and compressed air, sometimes an electric hoist and other equipment, and pay half his expense for labor. Under this arrangement the lessee ships his ore to the company and receives therefor the "prevailing" price at the company's mill. This price has recently ranged from $15 to $20 per unit of tungstic acid on a basis of 60% tungstic acid in the ore. From the net proceeds after deducting treatment charges the company takes 25% royalty.

The common practice of the other three operating companies is to buy the ore from the lessee at current market price and charge a royalty of 25% of the net proceeds after deducting milling and sampling charges. The Primos company usually grants a lease for a period of six months, while the Vasco and Boulder Tungsten companies grant a lease for one year.

Some of the Ore Schedules

The schedules of prices paid for the different grades of ore have varied from time to time with the market for tungsten. The accompanying table shows an example of a recent schedule.

Many of the current leases cover operations involving the working over of old dumps. Some of these operations consists of simple sorting, but several lessees have installed comparatively elaborate washing, sorting and concentrating equipment. The nature of the treatment in use varies with the ingenuity and ability of the operator. Some of the installations include only such screening and jigging apparatus as can be operated by a 2- or 3-hp. gasoline engine. The larger installations include hand sorting, grizzlies, revolving screens, jigs and Wilfley or Card concentrators. Usually three products are made: High-grade crude ore, hand-cobbed milling ore—which requires further treatment at the company's mill—and waste.



FLOW SHEET OF TUNGSTEN MILL

Mills and Milling Practice

Some of the more important mills of the district are the Wolf Tongue, Primos, Ardourell, Eagle Rock, Clark, Clarasdorf, Hildreth, and Vasco, the last under construction. The Colorado Tungsten Corporation has a mill at Boulder. Other plants are in contemplation.

One of the chief difficulties in milling has been the tendency of the ferberite, due to its perfect cleavage and its friability, to slime when crushed in the stamp battery. Much of the slimed ferberite has been recovered by the use of slime tables and canvas tables. Recoveries range from 65 to 85%. Following is an outline of current milling practice. The ore is passed over a 2-in. grizzly, from which the undersize is passed to a stamp battery. The oversize is crushed and delivered to the stamps. The stamps used vary in weight from 750 to 950 lb. each. The number of drops per minute ranges from 70 to 90. The drop is usually low and ranges from 4½ to 6 in., and from 12- to 20-mesh screens are used. The pulp from the batteries is classified and distributed to Wilfley or Card tables upon which the first concentrate is made. The tailings are frequently classified and again delivered to tables, or sometimes Frue vanners. Both 4- and 6-ft. vaners are in use. The tailings from the second concentration on either tables or vanners are sometimes recrushed in a Huntington mill with a 60-mesh screen, and the product is treated on slime or canvas tables. This outline is subject to considerable modification in different mills. In some of the plants, ordinary Harz jigs are employed to advantage and revolving screens are used for sizing. Both Wilfley and Card tables are in use, but

THE WOLF TONGUE MINING COMPANY SCHEDULE FOR TUNGSTEN ORES

Effective June, 20, 1916

Schedule of prices paid for tungsten ore delivered at the Wolf Tongue Mill, Nederland, Colo. Subject to change without notice.

In lots less than $50 a charge of $3 will be made for sampling and assaying; also on lots assaying less than 2%, a charge of $3 per ton will be made for sampling and assaying. Otherwise no charge will be made.

1%	15c.	per lb. for Tungstic Acid	$3.00 per ton
2%	22.5c.	per lb for Tungstic Acid	9.00 per ton
3%	32.3c.	per lb. for Tungstic Acid	19.40 per ton
4%	36.5c	per lb. for Tungstic Acid	29.20 per ton
5%	39.0c.	per lb. for Tungstic Acid	39.00 per ton
6%	40.6c.	per lb. for Tungstic Acid	48.80 per ton
7%	41.8c	per lb. for Tungstic Acid	58.60 per ton
8%	42.7c	per lb. for Tungstic Acid	68.40 per ton
9%	43.7c	per lb for Tungstic Acid	78.80 per ton
10%	44.0c	per lb for Tungstic Acid	88.00 per ton
11%	44.1c	per lb for Tungstic Acid	97.80 per ton
12%	44.7c	per lb for Tungstic Acid	107.40 per ton
13%	45.2c	per lb for Tungstic Acid	117.60 per ton
14%	45.4c.	per lb for Tungstic Acid	127.20 per ton
15%	45.6c.	per lb for Tungstic Acid	137.00 per ton
16%	45.6c.	per lb. for Tungstic Acid	146.00 per ton
17%	46.0c	per lb. for Tungstic Acid	156.60 per ton
18%	46.2c.	per lb for Tungstic Acid	166.40 per ton
19%	46.3c.	per lb for Tungstic Acid	176.20 per ton
20%	46.5c.	per lb. for Tungstic Acid	186.00 per ton
21%	46.6c.	per lb. for Tungstic Acid	195.80 per ton
22%	46.7c.	per lb. for Tungstic Acid	205.60 per ton
23%	46.8c.	per lb for Tungstic Acid	215.40 per ton
24%	46.9c.	per lb. for Tungstic Acid	225.20 per ton
25%	47.0c.	per lb. for Tungstic Acid	235.00 per ton
26%	47.0c.	per lb. for Tungstic Acid	244.80 per ton
27%	47.1c.	per lb for Tungstic Acid	254.60 per ton
28%	47.2c.	per lb. for Tungstic Acid	264.40 per ton
29%	47.2c	per lb. for Tungstic Acid	274.20 per ton
30%	47.3c	per lb. for Tungstic Acid	284.00 per ton
31%	47.4c.	per lb. for Tungstic Acid	$293.80 per ton
32%	47.4c.	per lb. for Tungstic Acid	303.60 per ton
33%	47.4c.	per lb. for Tungstic Acid	313.40 per ton
34%	47.5c.	per lb. for Tungstic Acid	323.20 per ton
35%	47.6c	per lb. for Tungstic Acid	333.00 per ton
36%	47.6c.	per lb. for Tungstic Acid	342.80 per ton
37%	47.6c.	per lb. for Tungstic Acid	352.60 per ton
38%	47.6c.	per lb. for Tungstic Acid	362.40 per ton
39%	47.7c.	per lb for Tungstic Acid	372.20 per ton
40%	47.7c.	per lb. for Tungstic Acid	382.00 per ton
41%	51.2c.	per lb. for Tungstic Acid	420.25 per ton
42%	52.5c.	per lb. for Tungstic Acid	441.00 per ton
43%	53.7c.	per lb. for Tungstic Acid	462.25 per ton
44%	55.0c.	per lb. for Tungstic Acid	484.00 per ton
45%	56.1c.	per lb. for Tungstic Acid	506.25 per ton
46%	57.5c.	per lb for Tungstic Acid	529.00 per ton
47%	58.7c.	per lb. for Tungstic Acid	552.25 per ton
48%	60.0c.	per lb. for Tungstic Acid	576.00 per ton
49%	61.2c.	per lb. for Tungstic Acid	600.25 per ton
50%	62.5c.	per lb. for Tungstic Acid	625.00 per ton
51%	63.7c.	per lb. for Tungstic Acid	650.00 per ton
52%	65.0c	per lb. for Tungstic Acid	676.00 per ton
53%	66.5c.	per lb. for Tungstic Acid	702.25 per ton
54%	67.5c.	per lb. for Tungstic Acid	729.00 per ton
55%	67.5c.	per lb. for Tungstic Acid	756.00 per ton
56%	70.0c.	per lb. for Tungstic Acid	784.00 per ton
57%	71.6c.	per lb. for Tungstic Acid	812.25 per ton
58%	72.4c.	per lb. for Tungstic Acid	841.00 per ton
59%	73.7c.	per lb. for Tungstic Acid	870.00 per ton
60%	75.0c.	per lb. for Tungstic Acid	900.00 per ton

tter seem to be the favorite. The tungsten concen- produced may assay from 40 to 65% tungstic acid, 35% iron oxide, 1 to 3% manganese oxide and 8 to 20% silica. The accompanying flow sheet il- tes typical current practice. The process is usu- ry up to the first trommel or revolving screen and from that point. The concentrates are dried over and sacked. Most of the sampling is done by hand ount of the small size of the average shipment.

e various mills near Nederland have the following ities: The Primos mill treats 30 tons per day, ng from 3 to 5% WO_3; the Ardourell mill has a ity of 25 tons and is treating 1½% material; the Tongue mill handles from 15 to 20 tons of 3½ to re per day; the Clark mill treats 12 to 20 tons per anging from 3 to 5% WO_3. It is estimated that the cts' daily production of WO_3 ranges from 20 to ns.

e general feeling in the district regarding the future opment and prices to be received for the product is istic. It is the belief among operators that the will prove productive to considerable depth below verage now represented by the bulk of the present s. The prophecy regarding the market for tungsten at the price will settle down to a firm figure and ually not fluctuate far from present prices. There uggestion that a protective tariff on tungsten should usidered to favor the producers of this metal in the ed States.

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nerican Demand for Japanese Zinc Dust Growing

iere is a growing demand in the United States for nese zinc dust. It has been developing for several , but has increased considerably since the outbreak e war, probably because other sources of supply have cut off says a recent consular letter in *Commerce rts,* June 24, 1916.

oout 600 tons of zinc dust from the Nagasaki district nt yearly to the United States. The greater part of is purchased by New York and San Francisco im- ers. There is already a large zinc-smelting plant in ection with the Miike mines in the Nagasaki district. estimated that the yearly production of spelter is t 10,000 tons; plant increases are planned to bring yearly output up to 15,000 tons by the end of 1916. ough there is a demand for zinc oxide and zinc hide, there is no production of these at the Miike es at present. Inquiries with regard to these products been received from the United States, and it is ible that their manufacture will be undertaken later.

⁂

ead Plating Replaces Nickel

the effort to cheapen storage-battery parts by reduc- the cost of their plating, the invention of a lead-plat- process resulted. The inventor is J. E. Schmotzer, -president and manager of the U. S. Electro Lead ing Co., 1265 West Second St., Cleveland, Ohio.

he method of electrolytic lead plating used by this pany is similar to that employed in plating with zinc, el or copper, says *Iron Age,* June 22, except that pure is used for plating purposes and different chemicals used in forming the plating solution. This part of process is secret, but a patent has been applied for.

The Willard Storage Battery Co., of Cleveland, has equipped a large plating plant in which the new process is used for plating gray- and malleable-iron castings and steel stampings. From 15,000 to 20,000 parts are lead-plated every day, these being used for battery handles, screws, top connections and terminals.

⁂

Floating Oxidized Ores*

Considerable work on the flotation of oxidized ores has been done by the Salt Lake Station of the Bureau of Mines in coöperation with the metallurgical department of the University of Utah. An article on the subject has been written by O. C. Ralston and Glen L. Allen, and issued by the Bureau of Mines. Attention is called to the fact that most of the experimental work has been done on oxidized ores of lead, because little success has been had with zinc ores, and many others are engaged in working on copper ores.

The successful flotation of oxidized mineral depends, in the opinion of the operators, upon its preliminary sulphidizing, in order to convert at least the surface of the mineral particles to sulphide form. This step is then followed by flotation just as is practiced on the natural sulphide ores. The sulphidizing methods investigated have been that by the use of hydrogen sulphide on either dry or wet ore; by the use of various sulphide solutions and sulpho compounds of sodium; by the use of solutions of the various sulphides and sulpho compounds of calcium; by the use of sulphur vapor; by the use of a sulphureted oil, and with colloidal sulphur. It was found that some of these methods formed a sulphide film on the surface of the particles of such minerals as lead carbonate or copper carbonate, whereas in other cases the mineral particles are sulphidized all the way through.

The methods have been tried on a large number of lead-carbonate ores. Some contain silver and some lead as the principal metal. Many ores have been successfully concentrated, while others refused to yield to flotation concentration. In general, a high alumina content (acid soluble) seems to prevent sulphidizing and flotation. It was found that the best method of applying hydrogen-sulphide gas to dry powdered ore was in a tumbling barrel with a gas inlet in the end. Sulphidizing in a glass bottle showed that the ore blackened quickly after the application of the gas. On attempting to float the lead sulphide as soon as it was blackened, it was found that a low extraction was obtained and also low-grade concentrates unless the pulp was previously acidified with sulphuric acid. By acidifying the pulp, cleaner concentrates were secured, but extractions of lead still remained low. Only by prolonged treatment with hydrogen sulphide gas could the extraction of lead be raised to commercial grade. With a number of ores 8 hr. treatment gave an extraction of over 80% of the lead.

Hydrogen sulphide was considered because it can be cheaply generated. With iron matte available at $5 to $10 per ton and sulphuric acid at about the same price, the cost of the hydrogen sulphide resulting, including all operations, is between $30 and $50 per ton. If this gas in combining with the metal in the ore produces only a superficial film of sulphide, it might be possible to make a ton of gas sulphidize many tons of ore. It was found, however, that the gas attacked the ore with such avidity that by the time the latter was sulphidized sufficiently to permit of good extraction by flotation, it had been sulphidized all through, and practically a chemical equivalent of hydrogen sulphide to the lead in the ore had been absorbed. Application of hydrogen sulphide to the ground ore suspended in water does not seem to be subject to the same difficulty. Filming of the particles seems to take place, and the extractions after a short treatment with the gas are satisfactory.

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*Excerpts from an article by O. C. Ralston and Glen L. Allen, issued by the United States Bureau of Mines.

The best results on lead-carbonate ores were obtained when sodium sulphide was used for the sulphidizing agent. Sodium sulphide has to be introduced in solution and seems to cause true filming. The sulphides of sodium considered commercially applicable are the normal sulphides, Na_2S; sodium polysulphides, Na_2S_4, and Na_2S_5, and the sulphhydrate of sodium, NaSH. The last seems to be quite effective. The normal sulphide is almost as effective, while the polysulphides are the least active. Different ores require from 10 min. to 24 hr. of contact with the sulphide solutions used, depending on the characters of the ore and the substance of the solution. Sodium sulphide varying from 10 to 20 lb. per ton of ore is usually sufficient and should be applied to pulp containing about one ton of water per ton of ore, in order that the solution may be as strong as possible during the sulphidizing stage of the process. After a good black color has developed and the color has ceased to increase in blackness, the pulp is diluted with water to 3:1 or 4:1, and floated. The market for sodium sulphide is limited, and it should be obtainable for less than 2c. per lb., making a process economical enough for commercial purposes.

The polysulphide of calcium, obtained by boiling powdered sulphur with slacked lime, is satisfactory for ores that yield easily to sulphidizing, but is sluggish in action as compared with the sulphides of sodium. Sulphidizing with sulphur vapor has been tried with little success, for the reason that it must be applied at a temperature above the boiling point of sulphur in order to prevent condensation. This means that a temperature of over 445° C. must be reached. The use of a sulphureted flotation oil, in which loosely combined sulphur is available for combination with carbonates of lead or other metals, and the rest of the oil is then available for oiling the artificial sulphide, has given but little encouragement. Colloidal sulphur, mentioned as a possible method of sulphidizing, does not seem to combine with lead carbonate at all. It floats as a white lining of air bubbles in the flotation machine and brings up very little lead with it.

The Course of the Precious Metals

Usually the precious metals contained in a lead-carbonate ore accompany the lead. It has been noticed that the silver extraction will lag behind the lead extraction when the ore is sulphidized with sodium sulphide and that the reverse has usually been true when hydrogen sulphide was used. The importance of sulphidizing flotation is due to the fact that there are many deposits of lead-carbonate ore in the Western States, and many of these ores have been milled with varying success. Frequently lead carbonates can be satisfactorily concentrated by gravity methods, but often it is found that particles of lead carbonates go into the slime and are lost. Tailings containing 5 to 10% of lead are common, and the object of the investigation was to determine whether sulphidizing flotation could be applied to the treatment of these c
and also to prevent the waste that now takes plac
they are treated by gravity concentration. It
also, if successful, render amenable to treatment
ate ores that are too low in grade to be handled by
methods. A flotation plant to apply sulphidizin
tion to an ore containing lead, silver and gold i
constructed by the Prince Consolidated Mining
Pioche, Nev., for the treatment of two tailings
from former pan amalgamation and cyanide operat
that vicinity. It was expected that the plant woul
operation by July 1 of this year.

Tests on Copper and Zinc Ores

A few tests were made on oxidized copper or
hydrogen sulphide seems to be the best medium
phidizing these particles. When applied to the d
the sulphur permeates the particles as it did in t
ores. Applied to the wet pulp, the hydrogen su
seems to cause true filming. Usually black conce
are yielded, but J. M. Callow, of the General Engi
Co., announced that that company has been able to
the amount of sulphur used to a point where the f
green with slightly coated malachite. He has u
little as ½ lb. of sulphur per ton of ore, and that is
good extraction in the plant of the Magma Copper
Magma, Ariz., where his company has put in a suc
installation. Sodium sulphide has been tested by a
ber of large companies where some little oxidized
occurs in the sulphide ores. In this case only 2 o 3
of sodium sulphide per ton of ore is used. Tis
easily added to the machines during flotation or
mixing tanks before flotation. The experience is
some little time of preliminary contact is allowed
flotation is attempted, better sulphidizing of the m
will result. Calcium polysulphide has been used fo
time in a number of large copper mills with indi
success and seems to be detrimental in some ins
On some of the ores tested fair results were obtai
the calcium polysulphide was allowed to act until t
had become well blackened. Sulphur vapor is als
to give good results in some cases. Sulphureted o
being used also, but considerable secrecy is observe
technical details of the work. Colloidal sulphur d
assist, so far as is known, in the flotation of ox
copper. Attempts to float the natural sulphides
with sulphidized minerals have usually failed, sin
sulphidizing agents cause trouble with the flotat
natural sulphides. At one plant this difficulty ha
solved, although the details are not available.

Attempts to float oxidized particles of zinc fron
both before and after sulphidizing by most of the m
that have been mentioned, have met with no success
ever in the laboratory experiments carried out. P
the fact that most of the carbonate ores of zinc c
important amounts of the silicate may be one
reasons for the lack of success with this work.

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Steel Barges to Be Used on a large scale in the rive
trade of the Pittsburgh district. The American Brid
Pittsburgh, has received a contract from the Carnegie
Co. for 70 steel barges to be used by the latter comp
transporting coal from its mines on the Monongahela Ri
its byproduct coke ovens now being build at Clairton.
barge will be 175 ft. long and will carry 900 tons of c
an 8-ft. draft of water.

Operating a Small Copper Blast Furnace

By A. Bregman*

SYNOPSIS—Some details of furnace operation and a discussion of the difficulties that arose in connection with the running of a small copper blast furnace in southwestern Colorado.

Of all the appliances known to metallurgy, perhaps the trickiest, most unstable and hardest to manage is the small blast furnace. The troubles of the operator are much reduced if all conditions are correct, but in most cases conditions are anything but correct. In fact, it is usually only in large plants, such as Anaconda and others, that the necessary preparation can be made to have all the facilities and fluxes desired, and of course even there mishaps occur. In small plants it is an almost constant fight to keep the furnace going, in the face of accidents and adverse conditions that arise in the delivery of the ores and fluxes required.

In a general way the difficulties that a typical small plant must surmount are lack of correct ores and lack of proper machinery and tools. I shall recount some of the troubles that arose in connection with the operation of a small blast furnace in Colorado and tell how some of the difficulties were overcome. To old furnacemen these matters will be trite, but to those who have not had so much experience the details of the operating difficulties encountered may be of interest.

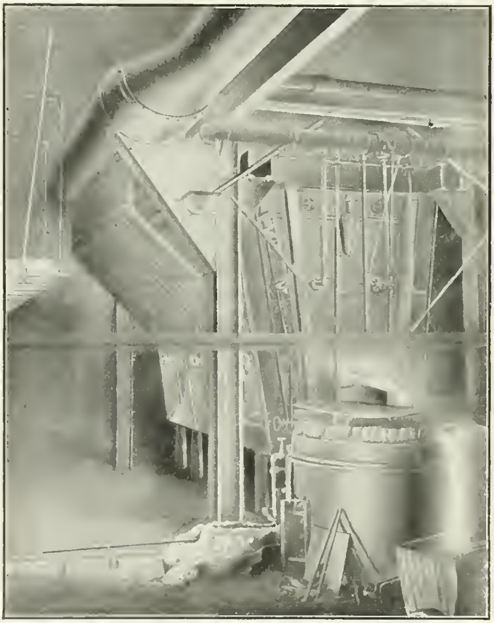
Necessity of Securing Suitable Ores

The business of getting correct ores for the smelting furnace is as important as any branch of the work. For example, "dirty" silica—silica already combined with other substances as amphibole and enstatite—does not increase the concentrating power of the furnace and at the same time is hard to melt and helps to form large crusts on the jacket. Another difficult material is magnetite, one of the hardest known ores to smelt, which often has to be run through the furnace on account of associated metals.

Lack of clean silica (quartz, quartzite, etc.) and of suitable iron ore are both serious drawbacks in the operation of the blast furnace, either large or small. The concentrating power of the furnace plays a large part on the cost sheet. The furnace must be run on the ragged edge of freezing, and usually extra iron ore is necessary if the furnace should begin to freeze. In order to run economically, a balance must be struck that will show the greatest possible earnings with the least possible "grief" to the men. Naturally when any concessions have to be made, it is the men who make them—until the trouble becomes unbearable, when conditions must be eased a little or a new crew will have to be provided. It is usually necessary that the small plant shall work under difficulties that are almost intolerable, in order to show dividends. Some of these difficulties, classified according to the part of the plant in which they occur, will be enumerated.

The combined silicas, as already stated, are difficult to smelt, and in our furnace a great deal of trouble was experienced with the formation of crusts of all sizes. Once or twice they were so large that men got into the furnace to shovel loose dirt off the crusts into the zone of the furnace that was smelting. A fairly common way to remove large crusts (too large for an ordinary bar) was to jerk them loose with a long steel hooked bar, coupled with a block and tackle. Crusts of large size were removed in this way, the flexibility of the ropes preventing any serious jarring or twisting of the plates and seams of the jackets.

The light sheet-steel charging plates of the furnace gave much trouble to the feeders by curling up and interfering with their shoveling. The edge of the heavy cast-iron dumping plate was finally placed over the flattened steel charging plate and no more trouble from buckling ensued.



COPPER BLAST FURNACE WITH CIRCULAR SETTLER

The furnace downtake was built with a sharp 90° elbow and gave great trouble because flue dust collected in the elbow until the draft was impeded and gas and smoke issued from the furnace feed doors. The sharp 90° turn blocked the draft sufficiently to permit the partly molten particles of flue dust to strike the brick lining of the downtake and stick to it. Finally, the passage through the elbow became so small that almost all the gas came out of the feed door, making it impossible for the men to work around the furnace. The plant then had to be shut down and the elbow cleaned out. This happened at regular intervals. The downtake shown in Fig. 2

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*101 West 60th St., New York.

gave no trouble at all in this respect, because a long elbow was used and there was almost no choking of the draft. In regard to the lining of the downtake, it was found that no bricks were necessary above the hood proper when the downtake was correctly designed.

KEEP THE TAPHOLE IN GOOD CONDITION

The tapping end of the furnace should be kept in as good condition as possible—that is, free from crusts, as they can easily spread to the taphole and stop the furnace. Magnetite was especially troublesome in this way. The magnetite also increases greatly the specific gravity of the slag, making the settling of the matte imperfect. There was one stretch of a week when all the matte made at the plant in question had to be resmelted because it was so badly mixed with slag.

At one time there was no ore in the bins except a highly siliceous material running 30% copper. The crew endeavored to keep the furnace going, but it got steadily worse, ceased concentrating and the matte came down in amounts that frightened the tapper. The furnace finally had to be shut down until more suitable ore arrived.

At this plant a simple way to tell whether the furnace was concentrating properly or not was by the smoke that issued from the stack. Thick, heavy smoke right at the mouth of the stack indicated a great deal of sulphur, hence the chances were that with so much issuing unoxidized, the furnace also contained much sulphur and consequently a heavy matte fall. Thin smoke on the other hand indicated a large percentage of SO_2; with the sulphur so largely oxidized, the matte fall was lighter. These indicators were not based on experiment, but were fairly well checked by the running of the furnace as observed below.

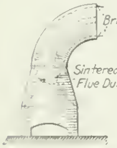

Fig. 1

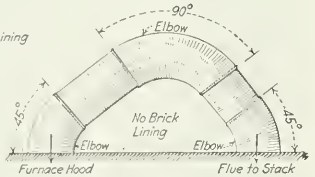

Fig. 2

On the 200-ton furnace (38x180 in.) it was found that 200 gal. per min. of water was more than enough under ordinary conditions. During the blowing in, however, when the fire was right against the jackets, all the water was needed, but at other times the intervening crusts kept the jackets cool.

SOME DEFECTS OF THE FURNACE DESIGN

The overflow launders on the furnace in question were in a bad position. The tuyeres were 12 in. center to center, and when the jacket water got hot and began to steam, it was impossible to see from below just which jacket was getting too hot. Every two or three hours the furnaceman would feel the water from all the discharge pipes from the hanging platform for that purpose, in order to be sure of the condition of the jackets, but this was not a convenient arrangement. The overflow launders should be placed two or three feet outside the tuyeres.

The I-beam buckstays at the sides of the furnace were placed between the jackets. The only disadvantage of this arrangement was that when breakouts occurred at the seam the buckstays interfered with any efforts to stop them. A horizontal girdle would have been better.

The jackets were so designed that the drain valves were directly under the tuyeres. When these tuyeres slagged, the valve handles were burnt off. As the valves were seldom used, the handles were not replaced, but were turned with a small wrench. The drain valves, however, should have been placed about 6 in. to the right or left. The edges of all jackets should have countersunk rivets on the faces that meet each other. This is especially true of the back-end jackets, as the lower one is removed to facilitate cleaning out the furnace during a shutdown. Raised rivet heads cause a great deal of unnecessary labor in connection with the removal and replacement of the jackets.

START FIRE AT BASE OF STACK WHEN BLOWING IN

When blowing in the furnace, it was found best to light a wood fire at the base of the stack just before touching off the wood fire in the furnace itself. This stimulated the draft at the beginning, and once smoke was visible at the top of the stack, there was no difficulty with the draft in the furnace or flues.

In the small plant the furnace taphole is a place that must be watched constantly; the irregularity in the supply of ore and the more delicate weighing required for the small furnace make this point insistent. "Rodding the connection," on the other hand, is only an occasional operation at most plants where large-sized furnaces and a fair amount of coke are used, there being usually a sufficient excess of heat to keep the connection free, unless a zinky or high-lime charge is being smelted. If the matte fall be normal, the taphole of even the small furnace will remain wide open and the old tapper can usually tell whether the taphole is free or not. However, it usually pays to run a rod into the furnace every hour or so to be reassured on this point. When the matte fall is light or when the furnace is running badly, the connection must be watched with the greatest vigilance, but care should be taken not to run the rod into the furnace too frequently or to leave it in the hole more than a second or two, as it may chill the slag so quickly that the hole will be closed entirely.

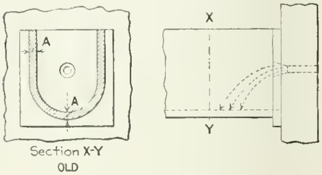

Fig. 3

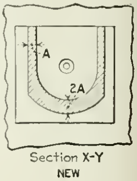

Fig. 4

I might relate one instance illustrative of this point. The furnace was to all appearances running fairly satisfactorily, but the concentration was so high that little matte was being made. Before it was realized, the taphole had closed. The furnace had to be banked and the hole dug out before operations could be resumed. At another time the furnace seemed to be entirely normal, but the taphole kept growing smaller and smaller, for no apparent reason. Among other expedients that were tried was a decrease in the lime rock on the charge. In about two hours the hole was thawed out to its correct proportion. The high-lime slag had chilled so quickly that even the matte could not keep the taphole open; as soon as the lime was reduced the slag remained fluid.

The spout that was supplied with the furnace was merely a cast-iron shell with no water cooling. It was lined entirely with brick, even at the nose. Numerous breakouts occurred, however, and the nose had to be replaced frequently, so that finally a water-jacketed nose was put on and there was no more trouble.

Sometimes, owing to low heat or high silica, the slags would become thick and refuse to run. This happened once just as the furnace was being tapped out through the side, with the air off, in order to bank it for a short time. It became necessary, however, to turn the blast on again and blow the slag out through the side. Of course the blast made more slag, but as soon as the matte began to come more freely, the slag became more fluid and the furnace was drained nicely.

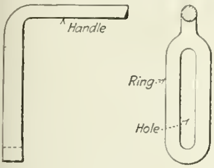

FIG.5

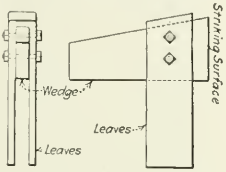

FIG.6

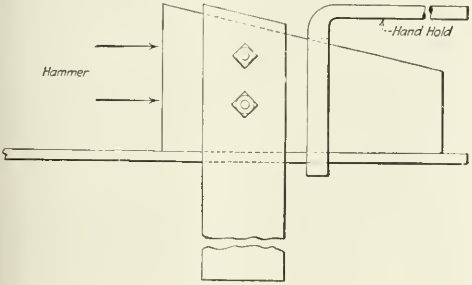

FIG.7

RING AND WEDGE—NOTE LEAVES ON WEDGE

Where pyritic or semipyritic smelting is being done, the settler and the matte-tapping block must be carefully watched. There are numerous appliances for safeguarding the tapping operations, but only a few of them will be mentioned here. The matte launder first used is shown in Fig. 3. There was always trouble with this launder because it would burn out so quickly where the matte first struck it on issuing from the settler. This was remedied by changing the design of the spout (see Fig. 4).

The ring and wedge for pulling out the tapping bar offer some opportunity for comment, as the ring often supplied is practically circular and has no handle. The ring shown in Fig. 5 has a long and narrow opening, which permits the use of a much larger wedge (see Fig. 6) and makes a better mark for the hammerman. The leaves bolted to the wedge (Fig. 6) are for the purpose of keeping it from twisting sideways on the bar. Although this may seem to be making unnecessary additions to a simple contrivance, yet it was found to be a great help, as it made sure that there would be no interruptions in drawing out the bar, thus avoiding much trouble and possible loss of the taphole.

At the plant in question endless trouble was experienced on account of the tapping block, both by reason of its shape and the material of which it was made. The hole was at first small, but naturally became larger as the matte attacked it. Numerous types were tried, and although there was not much difference, the cast-iron block shown in Fig. 8 was most used, as it best fitted the clay plugs used for stopping the flow of matte.

At first solid iron blocks with a coil of pipe cast around the hole were used. They were not satisfactory. The hole burned out to a larger size, and the matte entered the coil, stopping the flow of water. Also, the shape of the hole caused trouble because of difficulty in shutting off the matte. Once a copper block was used, but only once. The matte, which was high in iron, simply ate up the copper and a wild runaway resulted. Finally a cast-iron block with no water coil was adopted.

Procedure When Taphole Became Enlarged

So long as the hole remained small there was no trouble; when the hole grew too large, it was filled with clay and the following procedure resorted to for each tap: (1) Dig a circular trench around the tapping bar about an inch wide and as deep as possible without risking a breakout. (2) Fill in with fresh, soft clay; tamp hard; smooth off face of the hole carefully. (3) Pull out bar with ring and wedge; let matte run until enough has been obtained. (4) Plug with soft clay at the end of the dolly bar. (5) Drive tapping bar in quickly but carefully, to avoid a breakout. Steps 1 and 2 were taken in order to give the matte the inner surface of a ring of cold, damp clay to work against. Without this cold ring the matte would have burned out the dry clay in a short time, and the hole become so large that stopping the flow would have been impossible. Steps 3, 4 and 5 are ordinary procedure. This method was one which required extreme care and skill in handling the tools, but it was the only safe thing that could be done. The matte was low in copper and high in iron, which meant trouble all along from the furnace spout to the matte-casting pans; but the ore would not allow a matte of any other composition.

When the matte was hot there was great danger of its breaking out. Once it was necessary to replace the tapping block at such a time. The bar was withdrawn carefully and the matte quickly shut off before much ran out. The bar was not replaced. Then a mud dam was placed in the launder and a pool of water kept next to the plugged hole (see Fig. 10). This cooled the tapping block to such an extent that the mud could be chipped out of the taphole with safety, and water was allowed to run back into the hole. As fast as was safe the hole was dug out until the water had solidified the settler contents about an inch or two back of the block. The dam and the water were removed and the block carefully taken out. The surface of the settler against which the block fitted was plastered with damp asbestos pulp about ¼ to ½ in. thick. The new jacket was pressed against the asbestos and wedged in place.

When it was desired to open the hole, drilling was begun with a chisel bar and continued until the bright-red color showed, and then the matte was tapped by driving in the tapping bar and pulling it out immediately (the usual practice). After this tap, the hole was plugged and the bar replaced again in the usual manner. This method of changing blocks is quite common in many plants, but in others is rarely resorted to on account of the charge running sufficiently cool to permit the change without the use of the water for cooling. It was often necessary to keep the cold water in the launder even when the tapping block was not going to be removed. Of course if the matte did break through, it was well to hide until the fireworks settled down.

It is essential that the face of the taphole be kept smooth and that the hole be pointed exactly right. Any little obstruction will cause an imperfect fit between the fresh-clay plug and the taphole, and consequently an escape of matte in the form of flying shots, which are both disconcerting and dangerous to the tapper; they are often the cause of runaways. If the bar be badly placed in the hole, it pays to pull it out and replace it correctly; this can be done quite easily, because the matte is not given sufficient time to eat out the taphole to any great size.

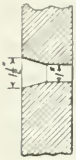

FIG. 8

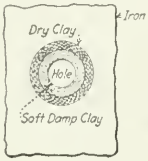

FIG. 9

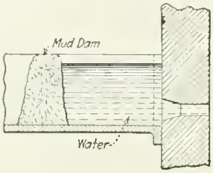

FIG. 10

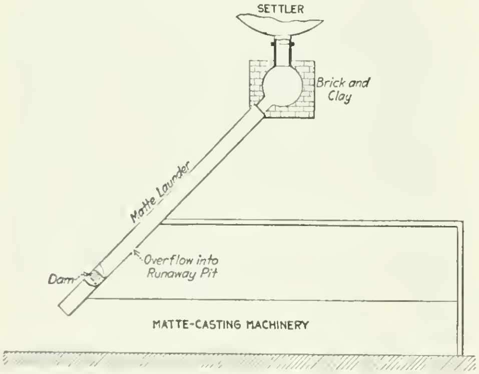

FIG. 11. MATTE-TAPPING ARRANGEMENT

In the settler operation it was noticed that high-iron slag and matte ate up the firebrick quickly. Magnesite brick, however, stood up well, as did also chrome brick. Conversely, high siliceous slag and high copper matte did not attack the brick nearly so much. In the settlers, water-jacketing was not used, but it could probably have been well employed with plain firebrick, under certain circumstances.

Before shutdowns, if the settler was not too hot, it was allowed to fill with matte to within a few inches of the top. The furnace was then blown out. The settler was tapped at intervals as close together as possible, care being taken to keep all holes about the settler covered so that no cold air could get in. The 2-in. layer of slag cooled sufficiently to stick about midway in the settler, and the matte drained off cleanly. When the furnace was ready to start again, all that was necessary was to punch a hole through the thin slag layer where the material overflowed from the furnace spout, and another to allow it to escape to the slag overflow. It is often a nice point of judgment as to just how long a settler can be held without draining. No rule can be set for this, as much depends on the type of slag and the amount of matte in the settler, and other factors.

The matte-casting apparatus used at this plant was a a string of rectangular dumping pans mounted on a 12-in. I-beam on trucks with 12-in wheels, having Hyatt roller bearings. The roller bearings were excellent; the machine ran smoothly and easily until a little hot matte came into contact with the wheels, when they broke as if they had been made of cast iron and struck with a hammer. They were replaced by solid wheels without special bearings, which stood the heat satisfactorily. The machine ran a little harder, of course, but if the track was kept in condition it called for no more men than before.

MATTE RUNAWAYS RENDERED HARMLESS BY DIVERTING MATTE THROUGH SIDE OF LAUNDER INTO PIT

Owing to the arrangement of the tapping floor, it was found necessary to make an angle in the matte launder. This necessitated a bowl, or "fort," to keep the matte from eating a hole where it impinged against the side of the launder. Fig. 14 shows this fort of bricks and clay built around an old slag pot. Occasionally, in spite of everything, a runaway did occur. The first thing done was to divert the flow of matte into a pit for that purpose, by damming the launder with a large piece of solid matte (everything else would have been floated off) and chinking the crevices with clay. The launder had a semicircular piece cut out at the side facing the runaway pit; this was plugged with mud under normal conditions, but at such times the mud was knocked out and the matte flowed freely into the pit. Then, the matte-casting equipment being comparatively safe (the pit was able to take care of a full settler), the men devoted their whole attention to shutting off the matte.

It was found best to keep 5 or 6 in. of matte in the settler at all times. Less than that meant risk of freezing, and more meant too much heat and pressure during a tap. Of course the condition of the settler decided everything. The hotter the settler the less matte was stored and vice versa. The amount varied from 3 to 12 in. in a circular settler 6 ft. in diameter and 3 ft. deep.

It may be well to state in conclusion that these remarks are not intended as a general treatise on copper smelting, but merely to cite a few of the practical devices used to surmount particular difficulties. Many of the practices cited are the commonly used methods in certain plants, but at others these expedients may not be necessary. It is essential in operating a small plant to have especially competent furnacemen, and one is fortunate indeed to secure an old furnaceman who has traveled about the country considerably. The man experienced in one plant only may never have encountered many of these difficulties, and in a small plant the furnaceman is often foreman and superintendent as well.

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A Tin-Concentrating and Smelting Plant for the An-Yuan mines in Hunan Province, southern China, is shortly to be placed in commission by the Wah Chang Mining and Smelting Co., which will offer this product for sale in New York, and through agencies in Europe. These mines are in the Ichanghsien district and contain both oxide and sulphide ores in chimneys in limestone, marmorized by granite and intruded, by a later granite dike along the course of which the ore chimneys are found

Nomenclature of Mining Methods

By George J. Young*

SYNOPSIS—Classification of names of mining methods as employed by many authors and a description of different systems named by terms representing fairly common usage.

One of the important elements that contribute to the value of technical literature and description is precision in the use of terms. This subject has not received the attention it deserves. Method of mining and its equivalent term, "system of mining," have long been used and signify the different features which, taken together, characterize a given method of mining. Systematic mining is the result of evolutionary development. The cruder and simpler methods have been combined and improved, and where the various steps have been repeatedly applied in the case of a single mine, names and terms have been invented as a designation of the method. The nomenclature resulting is not based on any consistent plan, and as a result we are confronted with a large number of names and terms that are loosely used and are confusing to one who has not had actual acquaintance with mining operations. Even to the experienced individual there is often a lack of definiteness in the meaning that should be given to the names in common use.

Factors that Influence the Naming of Methods

The methods of breaking ground are briefly summarized: Drilling and blasting benches; undercutting and breaking by drilling and blasting; shearing or side cutting and breaking by drilling and blasting; top cutting and breaking by drilling and blasting; undercutting and breaking by caving; undercutting and breaking by roof pressure or by wedges; block-holing and breaking by blasting (detached masses); breaking by means of spalling hammers (detached masses).

With the exception of the term "caving" the different methods of breaking have played a subordinate part in the naming of methods. The designation caving is used with considerable looseness and has undoubtedly caused confusion in the minds of many. If the qualifying words "cover" and "ore" and the corresponding expressions "cover caving" and "ore caving" are used, much confusion will be avoided. The methods—top slicing and cover caving, top slicing with partial ore caving, block caving, chute caving—derive their names in part from the word caving to which is prefixed the descriptive word or words.

Sequence of Working, Geometric Position and Direction

The methods of working can be classified as follows:

1. Inclined orebodies are mined: (a) By successive horizontal slices from the top down; (b) by successive horizontal slices from the bottom up; (c) by successive inclined slices from the topmost corner of a block down; (d) by successive inclined slices from the lowermost corner of a block up; (e) by successive slices parallel with the end surface of a block and each slice mined from the top down; (f) by successive slices parallel with the end surface of a block and each slice mined from the bottom up.

2. Orebodies of considerable lateral extent and thickness are mined: (a) By division into blocks and panels and the working of the blocks in sequence or alternately by any of the methods already described; (b) by successive horizontal layers, beginning with the uppermost and taking the layers in sequence; (c) by caving the blocks in sequence from one end of the deposit to the other or from both ends to the center (the deposit is divided into thick layers, and the layers are worked from the top down); (d) by combination of (a) and (c).

3. Mineral deposits of great lateral extent and small thickness are mined: (a) By separate units separated by ribs of mineral left in place with subsequent working of the ribs from the boundaries of the deposit; (b) by division into panels and the working of each panel by (a), (c) or (d) of this division; (c) by successive small units that are mined in sequence from the boundaries back to the main outlet of the mine; (d) by successive small units that may be connected in a more or less continuous face that is advanced from the main working openings of the mine to the boundaries.

The terms underhand stoping, overhand stoping, top slicing, flat-back stoping, inclined-cut stoping, side stoping, rill cut, pyramidal stoping, transverse stoping, cross-stoping, etc., involve sequence, geometric position and to some extent direction. The terms block system and panel system signify the division of the deposit into large units. The terms advancing and retreating signify working out and working back, or the direction relative to the position of the main exit of the mine. The classification indicates the possibilities as well as the difficulties of using sequence, geometric position and direction as a basis for nomenclature.

The Methods of Support

Flat workings are supported: (a) Left as open chambers; (b) by pillars or ribs; (c) by rock packs; (d) by cribs (solid timber crib, open crib, rock-filled crib); (e) by props; (f) by props and head boards; (g) by props and stringers; (h) by drift sets; (i) by square-sets; (j) by waste filling.

Inclined workings are supported: (a) Left as open stopes; (b) by pillars or ribs; (c) by stulls; (d) by stulls and props; (e) by square-sets; (f) by ore filling; (g) by waste filling; (h) by stulls and waste filling; (i) by square-sets and filling.

Filling system, open stope, timbering with pigsties and filling, overhand stoping on waste, overhand stoping on ore, room-and-pillar, square-set system, square-set and fill, prop slice, etc., indicate that the method of support plays a leading part in the nomenclature used for certain methods.

The miscellaneous factors that have played a part in naming methods are: The development working, as in the case of "sublevel stoping," a miner's term—as for example, "the slash system of mining"; the name of an individual, as in the case of the "Mitchell system"; a locality, as exemplified by "the North Staffordshire system."

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*Department of mining, University of Minnesota, Minnesota School of Mines, Minneapolis.

A simple classification of mining methods and their important modifications is given in the following:

CLASSIFICATION

1. Underhand stoping
   - a. Open stope
   - b. Pillar-supported stope
   - c. Stull-supported stope
2. Overhand stoping
   - a. Open stope
   - b. Filled stope
     - 1. Back stope
     - 2. Transverse back stope
3. Combined overhand and underhand stope
   - a. Open stope
   - b. Pillar-supported stope
   - c. Stull-supported stope
4. Rill stoping
   - a. Open stope
   - b. Filled stope
5. Square-set stoping
   - a. Open stope
   - b. Partly filled stope
   - c. Filled stope
   - d. Vertical slice—underhand
   - e. Vertical slice—overhand
   - f. Alternate pillar and stope
6. Shrinkage stoping
   - a. Without ore passes
   - b. With ore passes
   - c. Alternate pillar and stope
7. Top slicing and cover caving
   - a. By drifts
   - b. By rooms
8. Combined top slicing and shrinkage stoping
9. Top slicing with partial ore caving
10. Block caving
11. Combined shrinkage stoping and block caving
12. Chute caving
13. Sublevel stoping
14. Longwall method
    - a. Advancing
      - 1. Without panels
      - 2. With panels
    - b. Retreating
      - 1. Without panels
      - 2. With panels
15. Room-and-pillar method
    - a. Without panels
    - b. With panels
16. Bord-and-pillar method
    - a. Without panels (obsolete)
    - b. With panels

A study of the writings[1] of many accepted authors was made, and all of the many synonymous expressions for the terms as laid down in the "Classification" have been tabulated in groups numbered consistently with the "Classification." This shows the woeful lack of uniformity in usage and the need for it in order to clarify mining texts.

SEGREGATION OF AUTHOR'S TERMS

1. Horizontal cut underhand
   Underhand quarrying of panel cores (Mitchell system)
   Underground milling
   Open-stope method
2. Stoping and filling
   Rock filling
   Filling-up method
   Method of horizontal slices in ascending order with complete filling
   Breast stoping
   Resuing
   Filling system
   Open stope, timbering with pigsties and filling
   Block system of stoping and filling
   Stoping in horizontal layers
   Slicing and filling system
   Opencut system
   Side stoping
   Longwall stoping
   Combined side and longwall stoping
   Back-filling method
   Open-stope method
   Back stoping
   Overhand stoping on waste
   Room-and-pillar with waste filling
   Dry-wall method
   Flat back stoping
   Sawtooth back stoping
   Open stope and filling
   Crosscut method of working
   Transverse with filling
   Cross stoping
   Delprat method
3. Combined stopes
   Combination stoping
   Overhand stoping and milling system
   Back and underhand stoping and milling system
4. Pyramidal stoping (?)
   Inclined cut and filling
   Rill-cut vertical stopes
   Overhand stoping in inclined floors
   Rill-cut stoping
5. Nevada system
   Square-set underhand
   Pillar and stope
   Back-filling method
   Square-set stoping
   Square-set and fill
6. Overhand stoping with shrinkage, no filling
   Overhand stoping with shrinkage and delayed filling
   Shrinkage with waste fill after ore has been removed
   Backstoping
7. Removing pillars and allowing roof to cave
   Crosscut method combined with removal of pillars
   Mining ore from top down
   Method of horizontal slices taken in descending order and allowing surface to sink
   Transverse with caving
   Top slicing and caving
   Caving system, Cumberland method of mining (?)
   Caving method, top-slicing
   Slicing under mats of timber in panels
   Square-set slicing
   Prop slicing
   Panel slicing
8. Kimberley method
9. Caving system
   Subdrifting and caving
   Caving
   Caving, subdrift method
   Subslicing, side slicing, end slicing
   Slicing under ore with back caving in rooms
   Sublevel caving
   Sublevel slicing
10. Caving system, Cumberland method of mining (?)
    Block-caving system
11. Overhand stoping with shrinkage and simultaneous caving
12. Caving by raising
    Block caving into chutes or chute caving
13. Substoping
    Sublevel backstoping
    Drift stoping
    Sublevel method
    Sublevel slicing system
    Combination of subslicing and stoping

Miscellaneous Metal-Mining Terms Not Classified
   Chamber-and-pillar system
   Pillars left as permanent support
   Slices parallel with dip and filling
   Chambers without filling
   Square-set system developing into caving system
   Stoping system
   Filling system
   Room-and-pillar system
   Pillar robbing and hand filling (?)
   Square work and caving
   Pillar robbing
   Square work and pillar robbing in conjunction with sand filling
   Mitchell slicing system

14. Longwall advancing
    Longwall retreating
    Nottingham longwall or Barry system
    Working-home method
    Longwall or Shropshire method
    Longwork
    Combination longwall
15. Pillar and stall
    Post and stall
    Room and stoop (Scotland)
    Heading and stall
    Stalls and breasts
    Square work (South Staffordshire thick-seam method)
    Single-stall working
    Double-stall working
    South Staffordshire or thick-seam method
    Double-room system
    Single-entry room-and-pillar mining
    Double-entry room-and-pillar mining
    Triple-entry room-and-pillar mining
    County of Durham system, combination of the panel and room-and-pillar method
16. Following up the whole with the broken
    Bord and pillar
    System of large pillars known locally as coal gateways
    Lancashire bord-and-pillar system
    Wide or square work, modification of bord and pillar
    Narrow working
    Modified room-and-pillar working
    Room system for gaseous mines, Brown panel system for gaseous mines
    Checkerboard system (?)

Miscellaneous
   Rock-chute mining
   Room system with caving
   Rearer method of working inclined seams
   Working coal in lifts
   North Staffordshire method of working rearer seams
   Warwickshire method of working contiguous seams

The classification given is believed to be comprehensive and the terms fairly to represent usage. The significant features characteristic of the different methods are described in the following:

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[1] J. Callon, "Lectures on Mining"; Per Larsson, "Trans. A. I. M. E.," Vol. XVI, p. 119; R. P. Rothwell, "Trans. A. I. M. E.," Vol. XVI, p. 862; John Fulton, "Trans. A. I. M. E.," Vol. XVI, p. 891; C. LeNeve Foster, "Textbook of Ore and Stone Mining"; M. C. Ihlseng, "A Manual of Mining"; Hatch and Chalmers, "Gold Mines of the Rand"; A. G. Charlton, "Gold Mining and Milling in Western Australia"; N. W. Parlee, "Mine Timbering"; Donald Clark, "Australian Mining and Metallurgy"; M. C. Ihlseng and E. B. Wilson, "A Manual of Mining"; W. H. Storms, "Timbering and Mining"; H. C. Hoover, "Principles of Mining"; L. W. Mayer, "Mining Methods in Europe"; W. R. Crane, "Ore Mining Methods"; F. W. Sperr, "L. S. M. I.," Vol. XV, p. 179, also P. S. Williams; R. B. Brinsmade, "Mining Without Timber"; D. C. Livingston, "Trans. A. I. M. E.," Vol. XLIII, p. 662; F. C. Roberts, "L. S. M. I.," Vol. XVI, p. —; F. W. Sperr, "Eng. and Min. Journ.," Vol. XCIII, p. 1181; P. B. McDonald, "M. & S. P.," Vol. CVII, p. 9; W. Bayliss, E. D. M'Neil and J. S. Lutes, "L. S. M. I.," Vol. XVIII, p. 133; C. A. Allen, "Trans. A. I. M. E.," Vol. XLIX, p. 366; P. B. Scotland, Bull. XCVIII, p. 483, A. I. M. E.; Kirby Thomas, "L. S. M. I.," Vol. X, p. —; H. W. Hughes, "A Textbook of Coal Mining"; Cockin; C. M. Balles, "Modern Mining Practice," Vol. IV; R. S. S. Redmayne, "Modern Practice in Mining," Vol. III; "Practical Coal Mining," Vol. II, Editor W. S. Boulton; H. T. Hulst, G. R. Jackson and W. A. Siebenthal, "L. S. M. I.," 1914; O. E. Olson, O. M. Shaus and F. Blackwell, "L. S. M. I.," September, 1915.

1. Underhand Stoping—This term has established itself and is consistently used. The stope may start below the floor of a level and be extended by successive horizontal slices, either worked sequentially or simultaneously in a series of steps. The modifications consist in the working of the block by a series of slices parallel with the dip, each slice being worked from the top down and the slices being taken in sequence. The stope may be left as an open stope or supported by stulls or pillars. Filling can be used after the stope has been finished or may follow the stope as a back fill.

2. Overhand Stoping—The broad compass of this term and the various modifications have combined to make it more of a general designation than one to which a specific meaning can be attached. It signifies the working of a block of ore from a lower level to a level above. Methods 3, 4, 5, 6, 11, 12 and 13 are important modifications of overhand stoping that have received specific names. In a restricted way overhand stoping can be applied to open or waste filled stopes that are excavated in a series of horizontal slices either sequentially or simultaneously from the bottom of a block to its top. Stull timbering or the use of pillars characterize the method. Filling is used in many instances.

3. Combined Overhand and Underhand Stoping—This term is used with a fair degree of consistency and signifies the workings of a block simultaneously from the bottom to its top and from the top to the bottom. The modifications are distinguished by the support used—open stopes, stull-supported stopes or pillar-supported stopes.

4. Rill Stoping—The term is consistently used and signifies the working of a block by a series of slices taken at an angle with the drift. The slices are taken sequentially, and a slice may be started from the top and worked down or from the bottom and worked up. It is evident that in the former case the method can be considered as a form of underhand stoping. In stepped overhand stoping there is a close approximation to rill stoping. Two modifications have been suggested in the outline-open stopes and filled stopes. In most cases where this method of mining is practiced, the filled stope is used. Support may be by stulls, stulls and filling, pillars or pillars and filling. Saw tooth stoping can be looked upon as a modification of rill stoping. In this case the stope face is formed by the simultaneous working of two sets of diagonal slices at right angles to each other.

5. Square-Set Stoping—The elasticity of this method has resulted in a number of modifications which have not received a consistent nomenclature. The group term applies the use of square-set timbering as an essential feature of the method. The method is overhand stoping. The stope may be worked in horizontal slices, as a stepped face or in vertical slices. The modifications given in the outline—open stope, partly filled stope, filled stope, vertical slice (underhand), vertical slice (overhand), alternate pillar and stope—cover the more important variations.

6. Shrinkage Stoping—The method is a modification of overhand stoping and its characteristic is the use of a part of the ore for the purpose of support and as a working platform. As applied to small orebodies two modifications are met with—stoping without ore passes (chutes) and stoping with ore passes (surplus ore is removed by means of the ore passes). As applied to large orebodies the stopes are separated by pillars or ribs and the name used is shrinkage stoping with alternate pillar and stope.

7. Top Slicing and Cover Caving—The important feature is the working of the orebody from the top down in successive horizontal slices that may follow one another sequentially or simultaneously. The whole thickness of the slice is worked. The ore may be broken by overhand or underhand stoping in each unit. The overburden or cover is caved after mining a unit. The method is a retreating method. The longwall method, the pillar robbing in both room and pillar, and bord-and-pillar methods of mining coal are essentially the same in principle as top slicing. The principal difference is that a single slice only is worked in these methods. Two modifications have been named—top slicing by drifts and top slicing by rooms. From the support used, other terms could be adopted—prop slicing, square-set slicing, drift slicing, tee-set slicing, prop-and-sill slicing. A timber mat is used in almost all cases.

8. Combined Top Slicing and Shrinkage Stoping—In this method the orebody is worked from the top down in successive slices. In the working of each slice the unit is worked as a shrinkage stope. The broken ore serves to give lateral support to the sides of the unit and also serves as a working platform from which the back is reached. After working a unit the cover is caved. No timber mat is used.

9. Top Slicing Combined with Ore Caving—In this method the orebody is worked from the top down in successive slices. Instead of taking the full height of the slice, only the lower part is taken and the upper part is caved. After removing this portion of the ore, the cover is caved. A timber mat is used in most cases to separate the broken cover from the ore and to give safety.

10. Block Caving—In this method the ore is worked from the top down in successive layers of much greater thickness than characteristic of top slicing. Each block is undercut over the greater part of its bottom area and the supporting pillars blasted out. As the block caves and settles, the cover follows. The method might be considered as involving many of the features of the preceding one, but applied on a larger scale.

11. Combined Shrinkage Stoping and Block Caving—In this method the orebody is worked from the top down in successive layers of much greater thickness than in top slicing. The mass of ore is weakened by a series of shrinkage stopes, which are extended up between the ribs, pillars or blocks, which are subsequently caved. The intervening blocks are undercut and caved as in block caving. The cover follows the caved ore.

12. Chute Caving—The method involves both overhand stoping and ore caving. The chamber is started as an overhand stope from the head of a chute and is extended up until the back weakens sufficiently to cave. The orebody is worked from the top down in thick slices, each slice being, however, attacked from the bottom and the working extending from the floor of the slice up to an intermediate point. The cover follows down upon the caved ore.

13. Sublevel Stoping—This method involves features of overhand, underhand and shrinkage stoping. Its characteristic feature is the use of sublevels. The sublevels are worked simultaneously, the lowest on a given block being farthest advanced and the "subs" above following one another at short intervals. The uppermost

sublevel underneath the cover is partly caved. The caved cover follows down upon the caved ore. The broken ore is in part drawn from the level, and a part remains in the stope in order to give lateral support to the walls and to prevent admixture of cover and ore. The breaking faces are developed by crosscuts, which are extended from wall to wall from the end of the sublevel. The method can also be looked upon as a retreating method, the orebody being worked from the top down and the individual blocks upon a given level being worked from their ends to the center.

14. Longwall Method—All of the coal-mining methods overlap to a greater or less extent, and separation of the systems named in the key list is sometimes difficult. In longwall mining the distinguishing features are the winning of all of the coal on the first working. in most instances the use of top or roof pressure in mining and the caving or subsidence of the roof after the working. Unlike top slicing, the subsidence of the roof follows more or less continuously after the working of the coal. The face of coal may be continuous (straight or curved) or stepped. It may be carried at right angles to or parallel with the dip. Two important modifications are generally recognized—longwall advancing and longwall retreating.

15. Room-and-Pillar Method—The distinguishing feature is the winning of 50% or more of the coal in the first working. The coal is mined in rooms separated by narrow ribs. The coal in the ribs is won by subsequent working which may be likened to top slicing. In the rib working the roof is caved in successive blocks. The first working is an advancing and the winning of the rib coal a retreating method. The rooms are driven parallel with one another, and the room faces may be extended parallel, at right angles or at an angle to the dip.

16. Bord-and-Pillar Method—The distinguishing feature is the winning of less than 50% of coal on the first working, which in the best examples of this system is more an extension of the development work than mining. The second working is similar in principle to top slicing. The coal is won by a retreating system, the cover being caved after each unit has been worked. The two modifications given—working by the panel system and without the panel system—are more characteristic of the evolutionary development of the method than names that would characterize the present application of the system. The term "bord-and-pillar" is not used to any great extent in our own mining literature, but has a place in English literature and might well be adopted, since we have no equivalent term.

Nomenclature of Openpit Mining

The various terms that are in use to designate the winning of orebodies by surface workings are: Opencut mining, open or day workings, open work, quarrying. The term quarrying is used more or less loosely but should be confined to the winning of nonmetalliferous minerals and the excavation of dimension stone rather than to ore or coal. The following terms indicate particular methods of openpit mining: (1) Stripping system; (2) milling system, glory-hole system, chute system; (3) tunnel system.

(1) The term given here refers particularly to the removal of the overburden and is not sufficiently descriptive. I would suggest the name "terrace or bench openpit working." The method as applied consists in the removal of the ore in one or more benches, the ore face being broken by blasting and the broken ore loaded by hand, shoveling machine or steam shovel.

(2) The three names given refer to the same method. It consists of an underground system of haulageways beneath the block of ore, which has had its top surface exposed by the removal of the overburden. Connecting with the haulageways are chutes that extend up to the surface, and are spaced at intervals of 50 ft. or at any other convenient distance. The excavation of the ore begins at the top of the chute, and the broken ore is removed by loading it out from the chutes into cars on the haulage level. The ore block is worked from the top down, and the method is similar in principle to underhand stoping.

(3) In this method tunnels or drifts are extended at regular intervals from the floor of the pit into the orebody. The extension of the tunnel beyond the working face is made great enough to facilitate the handling of several cars at a time. The cars are loaded by lifting short boards which span an opening on the center line of the tunnel obtained by omitting several pieces of lagging. The top of the tunnel is protected by lagging. The method avoids the construction of raises and chutes, and facilitates the filling of the cars.

Technical mining journals and the transactions of the mining societies contribute greatly to the crystallization of the meaning to be attached to and the precise use of terms that are applicable to mining methods. While a consistent nomenclature is desirable, it is obvious that there are practical difficulties in securing short terms that will be sufficiently illuminating and comprehensive. It is suggested that writers define the terms used, and in their descriptions of methods they should describe in detail. This will lead ultimately to a standardization of mining terms simply by evolution. Such a standardization would greatly benefit the industry.

Locating Alaska Placer Claims

By A. L. H. Street*

A law enacted by the Alaska legislature in 1913 and relating to placer-mining claims provides that within 90 days from the date of discovery a locator shall record a certificate describing the location with reference to some natural object, permanent monument or well-known mining claim. It is also required that the certificate be recorded. Applying this law in the late case of Cloninger vs. Finlaison, 230 Federal Reporter, 98, the United States Circuit Court for the Ninth Circuit holds that an unverified certificate is not entitled to be recorded, that recording it confers no rights, and that a certificate describing a claim as "No. 1 Bear Creek placer mining claim" and as being situated in the While River mining district, and stating that Bear Creek is tributary to Big Eldorado, is insufficient for failing to describe the location with reasonable definiteness.

The court also applies the Federal statute which provides that no person shall locate a placer mining claim in Alaska as attorney for another unless duly authorized by written power of attorney acknowledged and recorded, by holding that such power of attorney need not be recorded before the location is made, it being sufficient that it be recorded before any adverse claim is filed.

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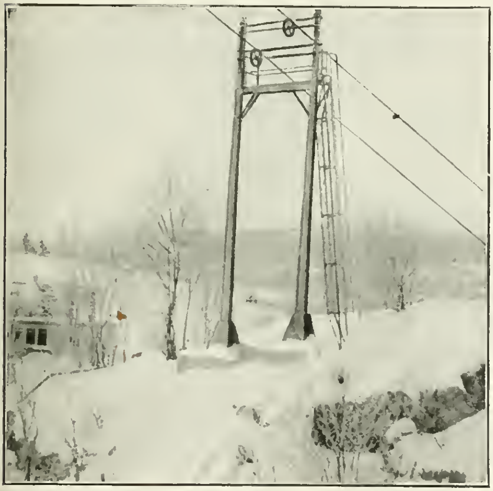
*Attorney at law, 829 Security Building, Minneapolis, Minn.

Details of Practical Mining

Concrete Idler Stands

By H. H. Hunner[*]

At the Isabella mine, Palmer, Mich., the Cascade Mining Co. has in use three concrete idler stands. The largest is placed on a solid-rock bluff 80 ft. from the steel idler on the shafthouse. The span between the two poles of the stand was made great enough so that by adding a third it will serve the ropes on the cage hoist. A play of 3 in. was allowed between the side of the post and the idler hub at its outer position in locating the post. On a line between centers eight anchor-bolt holes were located 1½ and 3 ft. respectively on each side of the post. On lines at 45° and 90° to the first line, 16 more holes were similarly located. A jackhamer was used to drill the holes 8 in. deep. Anchor bolts made of ½-in. round with 1¼-in. eye and an 8-in. shank were next cemented into the holes facing centers.



ONE OF THE CONCRETE IDLER STANDS

Forms were built to the full height of the stand. Reinforcing rods were welded full length and the bottoms given approximately the correct bend before being placed in position. The corner rods were ⅞ in. square and were carried to the top of the posts. The side rods were of 1-in. square ribbed steel, ending just below the horizontal crossbrace. Horizontal ties 1x⅛ in., made to fit inside the rods, were spaced 5 ft. apart. Starting with intervals of 20 in. from the top of the beveled pier, the rods were wired horizontally, ending with intervals of 10 in. at the top. Four ¼-in. square iron rods and three horizontal ties of ⅛x1 in., 4 in. square, were used as reinforcement in the 8x8-in. horizontal brace. Eight inches back from the ends the four horizontal rods were bent down and bound to the vertical rods in the posts.

The base forms were made of 2-in. hemlock, the pier and pole forms of 1-in. hemlock. The latter were made in three sections. The bottom section was 12 ft., the middle section 10 ft. and the top section 8½ ft. long. Three sides of the forms were nailed together on the ground and then placed around the rods and the fourth side nailed on. The form was lined in with a transit and spragged securely. The reinforcing rods were first bound to the horizontal crosstie at the collar of the beveled pier only. The base forms being finished, the rock footing was washed clean and the rods spragged into position, using a transit to line up the bottom ring. The base was then poured, short lengths of rail, pieces of old cable, etc., serving as reinforcement. The forms for the beveled piers were immediately centered and filled. The mixing was all done by machine, the mixture in the base and beveled forms being 3-2-1. The same mixture was used in the poles, except that the pebbles were limited to a maximum of ¾ in.

The wiring of the rods were completed while the base was setting for two days. The lower section of the pole forms was then centered, spragged and filled. The rods cleared the inside of the forms by 1¼ in., so it was necessary to watch them closely in tamping to keep them centered. The middle section was added after allowing a few days for the setting of the bottom section. The top forms were spragged to the lower sections of the opposite form already placed and filled. The top section was handled in the same way. The holes for the bolts were left by inserting a 1-in. iron pipe in the forms just the length of the inside dimensions of the form. The brace form was set into the sides of the top forms and filled at the same time. The forms were left on for several days, and then the whole stand was allowed to set for two weeks, after which the steelwork was added. The cost was as follows:

Total labor cost (ladder included)		$356.15
2,936 lb. reinforcing steel (1 in., ⅞ in., ¾ in. and ½ in.	$46.98	
$\frac{5}{16}$-in. galvanized steel wire, 3-strand	4.00	
95 sacks cement	31.58	
Sand (cost of hauling)	27.00	
Total iron and steel (ladder included, reinforcing not included)	23.16	
Total costs		132.72
Total supplies		$488.87

The wood used in the forms was worth about $28 per 1,000 ft. b.m. new.

⁂

The Cement Gun in Mining Work

The American Zinc Co. of Tennessee purchased a cement gun to cement the bottom of a creek wherein crevices occurred which let water into the mine workings. That work has not been begun yet owing to the water in the creek being too high, but probably it will be started at an early date.

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[*] Mining engineer, Hibbing, Mich.

In the meantime the gun has been used to cover many crevices in the mine where water entered during rainy periods. The procedure has been to cover a crevice with triangular mesh wire, fastened along the edge of the crevice with pieces of steel, small rocks being used inside to give backing to the gunite. Then with the gun mixture of cement and sand spread over the wire, it has resulted in making the crevice water-tight. The gun will not work against flowing water, so the crevices must be taken when they are dry.

The gun has been very useful in finishing concrete bulkheads, making them water-tight all over and especially joining them to the sides of the drifts. Also some encouraging work has been done by cementing cracks in the roof of the mine which threatened to enlarge and cause slabs to fall.

* * *

Ingenious Special Devices for Tunnel Surveys[*]

Interesting special devices are employed in the survey work on two new tunnels now under construction in Milwaukee, Wis. One of them is a tunnel instrument table that is easily placed, easily taken down and that, when in use, does not block the operation of the muck-cars. In connection with it are points of novelty in the tunnel marks and the way of using them. These are features of the Shore tunnel of the new Linwood Ave. intake under Lake Michigan, north of the North Point pumping station. A similar system of marks is used in the Lake St. sewer tunnel in the northern part of the city. A new thing in this tunnel is a sighting fork for giving tunnel center-line grades from the roof marks.

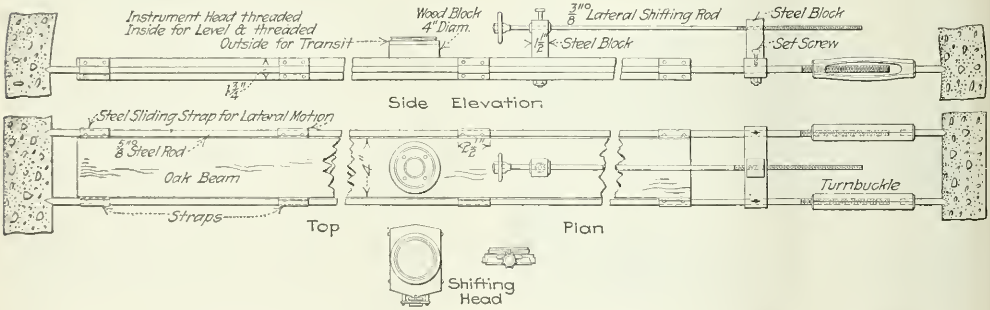

FIG. 1. QUICK-SHIFT TUNNEL INSTRUMENT TABLE USED IN LINWOOD AVE. TUNNEL, MILWAUKEE

Handy Instrument Table

The instrument table in the Shore tunnel serves as a support for either transit or level. The timber track floor laid inside the concrete lining of the tunnel is not steady enough to permit setting the instrument tripod on it, and an extension tripod set against the tunnel ring beyond the floor would block the haulage track. The portable table was designed by Lee G. Warren, resident engineer, to meet these conditions. It is wholly above car clearance and gives rigid support on the concrete lining.

The table, Fig. 1, consists of a 5x$1\frac{3}{4}$-in. board transverse to the tunnel and somewhat shorter than its diameter, which is carried by and slides between two parallel $\frac{5}{8}$-in. round steel bars $4\frac{1}{2}$ in. apart and about 9 ft. long. Near one end each bar has a turnbuckle. By means of this the bars can be expanded or contracted to set them against the wall or release them. The ends of the bars are pointed, so that they can seat firmly in shallow pits or conical depressions chipped in the concrete wall of the tunnel. The bars extend along the sides of the table board and are held to it by metal straps and loops screwed to the board. The board is about 18 in. shorter than the bars, and near one end it has a long fine-thread brass adjusting screw engaging an abutment block in the board and a nut fastened to a crossbar fixed on the side bars. By this means the table board can be shifted transverse to the tunnel axis and the instrument centered accurately on the longitudinal axis of the tunnel.

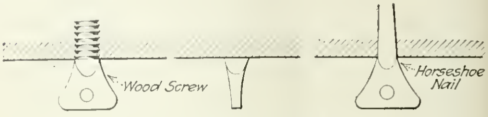

FIG. 2. NAIL OR SCREW ROOF-MARKS USED IN MILWAUKEE TUNNELS

Near the middle of the board is fastened a tripod head, which is used directly to carry the level. To mount the transit, a Berger cross-slide head is screwed on the fixed head. The screw-control slide adjustment of this special head enables the instrument to be moved parallel to the tunnel axis and thus makes it possible to center the telescope directly under the point of the plumb-bob suspended from the roof marks.

Before setting the table in place, two keel marks are made on the side of the tunnel at the proper point, and shallow depressions are then chipped in the concrete at the marks to furnish a secure seating for the ends of the bars. Then the table is lifted up, and the bars are expanded into the depressions. The instrument is at convenient height for observing, and the clearance under the table is sufficient for the $\frac{3}{4}$-yd. tunnel cars.

As the concrete lining in this tunnel is kept close up to the excavation face, survey marks are needed in the concrete only. About every 60 ft. a short block of 2x4 is concreted in the crown of the arch flush with the under surface, and later an alignment mark is screwed into the block. The mark is a woodscrew whose head has been forged flat and pierced with a $\frac{1}{16}$-in. hole, to serve as sighting point or to hold a plumb-bob cord. It is said to be not difficult to set these screws on center line (by transit sight) accurately enough for lining in the heading work and the forms. The two points nearest the face have plumb-bobs swung in them all the time until the next two points ahead have been set, and alignment of the headings and forms forward is obtained at any time by sighting past the cords.

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[*] "Engineering News," June 15, 1916.

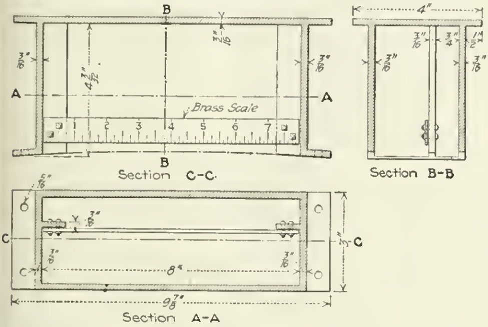


FIG. 3. SCALE ROOF-MARK USED IN LINWOOD AVE. TUNNEL

For lining in to grade, similar screw points are set at springing line on both sides of the tunnel barrel. Strings stretched across the tunnel between the opposite points give the means of sighting forward and lining in the front of the concreting form to correct elevation.

Permanent roof marks for the accurate prolongation of the tunnel survey are set about every 125 ft. The mark is a cast-iron box concreted in the arch flush with its under surface, with a brass scale transverse to the tunnel axis fixed permanently in this box, as shown by Fig. 3. The scale is graduated to tenths of an inch, and it is read to one-hundredths by a portable vernier plumb-bob hook, not shown in the sketch. This vernier hook is carried by the engineer and is slipped over the scale for alignment sights, the vernier reading being recorded when the plumb-bob cord is on center line.

There is special need for accurate work in the alignment in this tunnel, because one of the shafts is driven about 30 ft. off the tunnel and reaches the tunnel by a crossdrift. Further, the tunnel makes an angle just at the point of entry of this drift; to insure correct running of the two headings from this shaft, therefore, rather accurate instrument work is required.

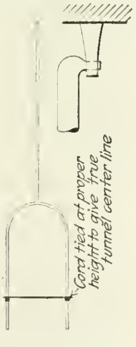


FIG. 4. GRADE-SIGHTING FORK

The permanent roof mark is also used for the definite reading of grades. Elevations are taken against the under side of the scale in the roof mark by means of an inverted level rod.

All headings of this tunnel are driven with compressed air. A roof mark is set in each air lock.

The Lake St. sewer tunnel, whose headings are worked under atmospheric pressure, has no permanent roof-mark system, but uses for both temporary and permanent service a roof mark like those employed by the inspectors in the Shore tunnel. There is a difference, however, in that the Shore tunnel roof marks are made of woodscrews with flat head, while R. H. Cahill, resident engineer of the Lake St. sewer tunnel, uses horseshoe nails with head similarly shaped and perforated.

These marks are set in pairs, 16 ft. apart along the tunnel, with an interval of 60 to 100 ft. between successive pairs. The pair nearest the heading excavation is used for sighting forward for the heading alignment and for aligning the forms. The theory of the arrangement is that it is fairly easy to sight along two strings that are only 16 ft. apart. On the other hand, it is not necessary to establish a new sighting pair every 16 ft., the interval of about 80 ft. being found very satisfactory.

For giving grade, side marks are not thought necessary, but the same roof marks are used by the help of a novel device, Fig. 4. It consists of a fork 3½ ft. long, made of light steel rod, with a hook-shaped lateral projection at the end of the straight or handle portion, this projection being about $\frac{1}{16}$ in. in diameter so as to fit into the perforation of the roof mark. When the fork hangs on the roof mark, a string stretched across the tines of the fork furnishes an excellent sighting point for grade. The string is adjusted for a given roof mark until it is just on tunnel center line, according to transit sight. The fork is then kept in just this adjustment (a record of the distance from hook to string is also noted) so long as grade sights need to be taken at this point. Hanging the proper forks at the two roof marks 16 ft. apart, a sight is taken forward over the two cords onto the front end of the concreting form until this is brought up to true tunnel grade. The headings are kept in grade and line by the foreman sighting by the marks.

Acknowledgments for information are due to the resident engineers, R. H. Cahill and Lee G. Warren, and to George F. Staal, City Engineer of Milwaukee, under whose direction both pieces of work are being done.

* * *

Ore-Breaking an Aid to Crushing

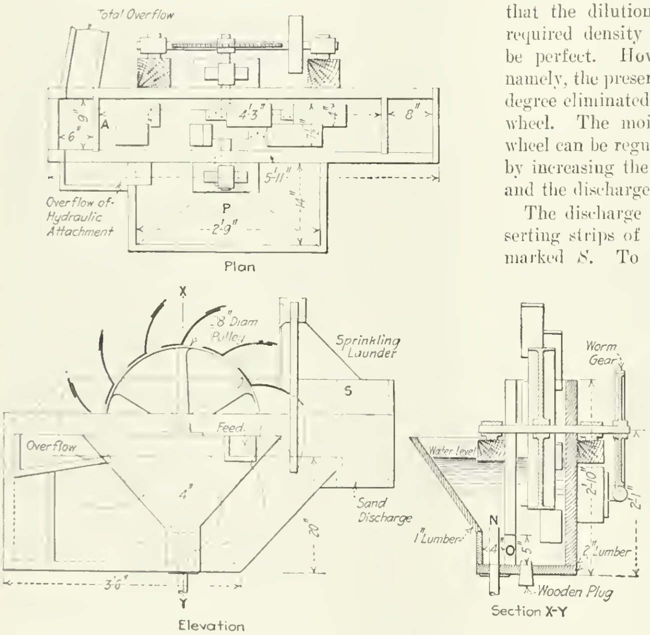
The breaking of ore in such a manner that coarse crushing is reduced to a minimum is practiced at Broken Hill, Australia. In stoping, as many holes as practicable are drilled at each set up, and these are fired by ordinary fuses cut to lengths to give the desired rotation of shots, blasting gelatin (92% nitroglycerin) being used so as to effect the maximum of shattering of the ore to save spalling.

For the same reason, says E. J. Horwood in a paper presented at the February, 1916, meeting of the A. I. M. E. in New York, simultaneous firing with electric fuses was, after making tests, found uneconomical, as the ore came down in much larger pieces, entailing added expense in "popping" and spalling. The firing of one hole at a time results in numerous cross-breaks in the ore and reduces the cost of breaking up to the size required by the mills—that is about 10 in. diameter. Another disadvantage of electric firing in stopes was that the excessive vibration set up in firing all the explosives at one time was a source of danger, as it would tend to weaken the backs of stopes and lead to accidents through falls of ground.

Details of Milling and Smelting

Combination Pulp Classifier*

The requirements of the milling practice at a Bolivian tin-concentration plant were such that neither the existing hydraulic nor mechanical classifiers completely satisfied, so a new machine was designed to do the work. As shown in the accompanying drawing, the device consists of a narrow wooden trough in which a paddlewheel revolves. Details of the construction of the classifier can be easily gathered from the drawing. The tips of the blades are protected by ¼-in. iron strips fixed with two countersunk rivets. The strips last about 4 months and are replaced at small cost. The blades are cut from ¼-in. plate and bent in the fire. They are fixed to the rim of the pulley by three 1x⅜-in. machine bolts. The holes in the rim and those in the blades are bored from a templet, and spare blades are kept ready so that but little time is lost in making renewals. The wheel is driven at the rate of 3 r.p.m. by a simple worm gear—in this case taken from an old vanner—directly belted to a lineshaft. The feed is introduced into the trough near the bottom at *O*, after having been submitted to hydraulic classification in the pyramidal attachment *P*, in which an ascending current of water flows out of the pipe *N*. Consequently the material undesirable in the jig feed is floated off with the use of less hydraulic water than needed in an ordinary hindered-settling classifier because the slimes that come with the sands into the trough are separated by the paddlewheel and flow over at *A*. It is evident that classification in the hydraulic pocket does not entirely take place under hindered-settling conditions, because in that case the sand treated by the wheel could not contain any slimes. The amount of hydraulic water used is such that the dilution of the overflow does not exceed the required density and therefore the classification cannot be perfect. However, the most objectionable factor—namely, the presence of slimes in the jig feed—is to a large degree eliminated by the subsequent action of the paddlewheel. The moisture in the sands discharged by the wheel can be regulated by raising the level of discharge or by increasing the distance between the tips of the blades and the discharge.



COMBINATION PULP CLASSIFIER

The discharge level of the sands can be varied by inserting strips of wood of different heights into the slots marked *S*. To obtain practical results the sands are discharged at a point 1½ in. above the overflow with 50 to 55% moisture, but with the level of sands discharge raised to 2½ in. above the overflow and the discharge edge spaced from the wheel, as shown in the drawing, the product contains but 30 to 35% moisture, although under these conditions the capacity decreases out of all proportion. If the machine is overfed, the sands pile up so high at the discharge that part of them remain lying on the paddles and fall back into the trough at the other side, finally choking the classifier.

The second method gives a drier and cleaner product, because the sands are piled up in front of the wheel until they reach a sufficient height to slide over the discharge edge, and nearly all the water drains back into the trough. There is no objection to placing the overflow rim in the trough close to the paddles, which makes the machine more compact.

A spray is provided to remove the adhering grains of sand from the blades of the wheel, and after having cleaned the blades, the water falls on the pile of sands lying in front of the wheel and gives them a final wash. The slower the wheel revolves the cleaner will be the sands product, because then every blade brings up slightly more sands than it can deliver, and part of the material falls back into the trough to be shoved up again by the next blade. Therefore the sand is repeatedly turned over before being discharged, which materially assists in removing the slimes.

The classifier can easily handle per 24 hr. 60 tons of dry pulp with a specific gravity of 3.5 to 3.8. It satisfactorily performed the work required of it.

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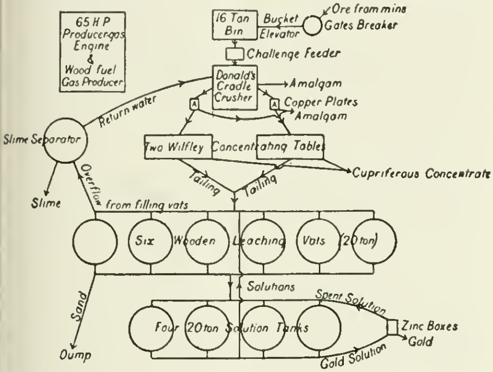
*Excerpt from a paper by M. G. F. Sohnlein, Machacamarca, Bolivia, to be read at the Arizona meeting, September, 1916, of the American Institute of Mining Engineers.

Donald's Cradle Crusher

At the new mill of the Queen Bee Co. of South Australia a novel fine crusher is being tried out, which is known as Donald's Cradle Crusher. It consists essentially of a semicylinder 6 ft. in diameter and about the same length, resting upon what are described as knife-edge bearings. The cylinder is oscillated at about 20 double rocks per minute. Three metal rollers, each weighing about 1½ tons, rest on renewable tracks within the periphery of the semicylinder and do the fine crushing as the cylinder oscillates. Apparently this machine embodies a modification of the tube-mill idea wherein the heavy rollers do the work of tube-mill balls or pebbles.



FLOW SHEET OF THE QUEEN BEE MILL

The flow-sheet of the mill is given on the accompanying diagram.

Inside amalgamation is practiced, and the crushed product is discharged through screens at both ends of the cylinder. It is claimed that the machine is an efficient amalgamator and that the crushed product is very free from slimes.

The divided discharge passes over small amalgamating plates and thence over Wilfley concentrators to recover the copper. Provision is made for the tailings to be run into 20-ton cyanide vats, the overflow water going to a slime separator from which it is returned to the crusher.—"Review of Mining Operations," South Australia, No. 23.

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Formula for Belt Slip*

By W. F. Schaphorst

In the transmission of power by belts a certain amount of slip is inevitable. Over 2% slip indicates that there is something materially wrong and that the losses are likely to be considerable. The following formula is useful for the calculation of the percentage slip:

$$100 = \frac{100n(d+t)}{N(D+t)}$$

in which

n = R.p.m. of the driven pulley;
N = R.p.m. of the driving pulley;
d = Diameter of driven pulley in inches;
D = Diameter of driving pulley in inches;
t = Thickness of belt in inches.

The application of this formula will give a factor greater than zero. If under 2%, the belt is considered to be operating satisfactorily. If over 2% the loss should be investigated. The annual cost of this excessive slip can be calculated from the following formula:

Cost per year in dollars =

$$\left[0.98 - \frac{n(d+t)}{N(D+t)}\right] PCHW$$

where

P = Hp. delivered by the engine to the driving pulley;
C = Cost in dollars of one hp.-hr.;
H = Running hours per day;
W = Working days per year.

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*Copyright, 1916, by W. F. Schaphorst, Woolworth Building, New York City.

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Extraction of Gold and Silver from Matte by Lead*

In practice there are two different processes for the extraction of the noble metals from materials containing gold and silver.

1. Smelting with lead ores or lead-carrying materials in the blast furnace. The resulting base bullion is desilverized and the gold and silver parted.

2. Treatment of mattes and speises with molten lead (Crooke and Davies). The treatment of copper matte with molten lead for the removal of gold and silver i. still used in Japan (Bull. A. I. M. E., Nov., 1914. p. 2693).

The results from practice show in general that the gold collects chiefly in the base bullion, the silver dividing itself between base bullion and matte. The percentage extraction of silver is lower, the greater the amount of matte for the same amount of base bullion. This fact is brought out clearly in an article by M. Ortin (Metall und Erz, 1913, p. 840).

Experimental results are given in an article by S. Blisinski (Chemik Polski, XII, 1912, No. 8). He made a series of synthetic mattes by melting together FeS (Fe = 70.25, S = 25.54 per cent.) with Cu_2S (Cu = 78.8, S = 20.98 per cent.) in such proportions, that the resulting mattes contained about 25 per cent. copper. These mattes were repeatedly remelted with powdered silver and gold. Thirty grams of this material was then melted with lead in a muffle furnace in a graphite crucible. In these tests the quantity of the lead, the temperature, and the duration of the melting were varied. In the resulting product lead, gold and silver were determined. The first series of experiments were made with mattes A and B of the following analyses:

	Ag	Cu	Fe	S
A	7.32	17.10	46.80	25.24
B	8.80	17.50	44.95	25.18

Thirty grams each of A and B were melted with 15 to 120 gr. Pb at 1,000, 1,100 and 1,250° C. for from 45 to 90 minutes.

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*Translated in abstract from the Journal of the Russian Metallurgical Society, 1914, No. 4, pp. 511 to 522, and published in "Met. & Chem. Engr.," June 15, 1916.

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The Use of Screw Jacks for driving lath timbers is a practice in vogue in the Proprietary and other mines at Broken Hill, Australia, says E. J. Horwood in a paper presented at the February, 1916, meeting of the A. I. M. E. in New York. Hammering not only destroys the lath before it gets home, if driving is difficult, but the vibration tends to start a run of ground.

Company Reports

The Osceola Consolidated Mining Co. of Michigan reports copper sales of 19,731,472 lb. at 18.19c., a total of $3,589,605, and miscellaneous receipts of $1,104. Mining expenses were $1,611,676; new construction, $82,074; smelting, freight, commissions, Eastern office, etc., $283,277; interest debit, $2,822; leaving a working profit of $1,610,860. Dividends of $11 per share were paid, or $1,057,650, leaving an increase in assets of $553,210 for the year, and a balance of assets of $2,166,647 at Dec. 31, 1915. Comparative results for 1914 and 1915 are as follows:

	1914	1915
Tons of rock treated	1,108,447	1,361,089
Cost of mining, milling and taxes per ton of rock	$1.29	$1.18
Pounds of mineral obtained	20,997,900	26,777,790
Pounds of refined copper produced	14,970,737	19,731,472
Per cent. of copper in mineral	71.296	73.686
Pounds copper pe. ton of rock	13.5	14.5
Cost per Pound:		
Mine expense	9.52c.	8.17c.
Construction	0.14c.	0.41c.
Smelting, etc	1.12c.	1.44c.
Interest	0.01c.	0.01c.
Total cost	10.79c.	10.03c.
Osceola Branch:		
Sinking in feet	153	0
Openings in feet	2,746	4,144
North Kearsarge Branch:		
Sinking in feet	102	173.5
Openings in feet	1,808	4,550
South Kearsarge Branch:		
Sinking in feet	0	0
Openings in feet	27	74

No. 6 shaft, Osceola branch, is now 4,734 ft. from surface; No. 1 on the North Kearsarge is 3,873.5 ft. from the surface and No. 1, South Kearsarge branch is now 2,820.5 ft. from the surface. The ore in the Osceola branch ran 14.26 lb. per ton; North Kearsarge, 12.87 lb. and South Kearsarge, 16.72 lb. per ton of rock. Costs in these three branches were 12.34c., 10.99c. and 7.77c., respectively.

* * *

In the Dome Mines report for 1915 the most interesting feature concerns the ore reserves. At the end of 1914 the reserves stood at 2,782,811 tons averaging $4.15. This figure was based on the idea of wholesale mining. During 1915 the development of much higher grade orebodies necessitated a revision of the estimates and as a consequence it was found possible to exclude a large tonnage of unpayable ore. Notwithstanding this elimination and also the production of $1,887,958, the ore reserves at the end of the year were 2,600,000 tons averaging $6.20, or a total of $16,120,000. No ore is estimated below the 7th level, nor is any account taken of intersections on the 7th level that have not yet been developed. The ore below the 7th level has been proved by diamond-drill holes. The net value of the ore reserves is approximately $22.50 a share or a total of $9,000,000.

During the year there was recovered a total of $1,887,958 from which the net proft was $912,379 as compared with $315,179 for the previous year. Total operating costs were $2.559 a ton and it is estimated that with the increased milling capacity the costs will be reduced to $2.25 a ton. The mill capacity is being brought up to 45,000 tons a month and the management is already considering plans for still further additions.

* * *

The Nova Scotia Steel and Coal Co., Ltd., reports as follows for 1915: Coke made, 90,896 tons; limestone and dolomite quarried, 79,211 tons; pig iron made, 73,110 tons; steel ingots made at Sydney mines, 97,072 tons; steel billets rolled in New Glasgow, 76,082 tons; total shipments of finished forgings, etc., from the New Glasgow plant, 60,283 tons. There were nearly 3,000,000 shrapnel and high-explosive shell bodies manufactured in 1915, chiefly 3-in. shrapnel and 4½-in. and 60-lb. high-explosive. The company is now prepared to furnish shell bodies up to 12-in. diameter. Coal mined amounted to 611,923 tons, a decrease of 140,230 tons from 1914. The company used 285,971 tons, a decrease of 110,323 tons. Iron ore mined amounted to 125,609 tons, the smallest output for many years. Nearly all was used in the company's own operations. Net profits for the year were $2,094,170, of which $36,310 was used in bond retirement, and $604,718 in paying interest on bonds and debenture stocks and all accumulated dividends to Dec. 31, 1915, leaving, with the $57,466 carried forward in profit and loss on Jan. 1, 1915, a total profit and loss balance of $1,510,609. During the year $1,000,000 in debenture stock and 15,000 shares of the ordinary stock were issued. The Eastern Car Co., Ltd., all of whose common stock is owned by the Nova Scotia Steel and Coal Co., in the year ended Nov. 30, 1915, showed a profit after writing off depreciation, betterments, etc., of $359,746, out of which it paid bond interest and all dividends on the preferred stock, and carried forward a balance of $222,546. The total capitalization of the Nova Scotia Steel and Coal Co. is now $7,500,000 of common stock, $1,000,000 preferred, $5,833,309 bonds and $4,000,000 debenture stock.

* * *

The Calumet & Hecla Mining Co., of Michigan, reports a copper production of 72,613,320 lb. of copper for 1915, of which 71,030,518 lb. was produced from the mine and 1,582,802 lb. from the sand bank at Torch Lake. Statistics of copper recovery from ore are as follows:

	1913	1914	1915
Tons of rock crushed	2,035,625	2,592,462	3,188,583
Mine cost per ton of rock, excluding construction	$2.38	$1.85	$1.71
Pounds of refined copper	45,016,890	53,691,562	71,030,518
Pounds copper per ton of rock	22.11	20.70	22.28
Cost of construction per lb., Cu.	1.54c.	1.00c.	0.47c.
Total cost per pound Cu	14.25c.	11.35c.	9.33c.
Price received	15.77c.	14.01c.	18.11c.

From the Conglomerate lode there was 1,739,984 tons of rock treated carrying 29.74 lb. of copper per ton. Shaft sinking on this lode amounted to 201 ft. and drifting to 5,522 ft. The South Hecla Nos. 9 and 10 is now down 8,132.7 ft. On the Osceola lode 1,448,599 tons of rock was treated, carrying only 13.32 lb. of copper per ton of rock and produced at a cost of 9.71c. per lb. There was 10,206 ft. of drifting done here. No. 16 shaft is deepest, 3,274 ft. No work was done on the Kearsarge lode, on the Manitou-Frontenac Branch, or the St. Louis Branch during 1915. For recrushing coarse tailings the new pebble mill plant is far superior to the chilean mills of the old plant as shown by the following comparison:

	Old Chileans	New Pebble
Tons coarse tailings crushed	337,243	168,461
Pounds Cu per ton in tailings	13.14	13.14
Pounds Cu saved	4.01	4.73
Cost per pound, excluding smelting and selling	6.52c.	4.36c.

The Torch Lake tailings reclamation plant went into commission in a small way in June, but was interrupted by power troubles in July and August. Since September it has been running continuously. There are now 48 Hardinge mills regrinding sand-bank tailings, this will soon be increased by 16 more. The leaching plant is approaching completion and it is hoped to have it in operation early in the summer. Current assets exceed current liabilities by $8,256,446, excluding from current assets all subsidiary shares held and from current liabilities the $4,134,000 in notes due in 1919.

* * *

The Greene Cananea Copper Co., which holds 961,398 shares out of 1,000,000 of the Greene Consolidated Copper Co., reports no dividends paid in 1915, but 1% declared payable on Jan. 17, 1916. Its gross income was $550,571; its expenses, $44,532; leaving net of $506,039. The dividend referred to amounted to $488,337. The mines and works controlled by the company produced during 1915 from its own ores and those purchased a total of 16,335,081 lb. of fine copper, 635,997 oz. of silver, and 3,774 oz. of gold. The price received for its copper was 19.556c. per lb. The total cost was 11.086c., after deducting the precious-metal values and miscellaneous revenue, but including shutdown charges and general expense. **The Cananea Consolidated Copper Co.** produced 15,843,318 lb. of copper at a cost of 10.94c. per lb., and sold it for 19.541c. per lb. Operating profits were $1,362,606, from which $500,000 was paid to stockholders of the Greene Consolidated Copper Co. There was 270,584 tons of ore mined during 1915, of which 274 tons were sold to other smelters, and 79,642 tons were concentrated 3.142 to 1. Altogether the reduction works operated from

June 15 to Oct. 24, when Villa took possession of Northern Sonora, and from Dec. 10 to the end of the year (still running on May 10). A total of 312,196 tons of ore were treated, 293,663 domestic, 15,364 of foreign, and 3,169 custom. The returnable copper in foreign and custom ores was 3,087,506 lb., silver was 99,340 oz., and gold, 388 oz. About $200,000 loss was suffered through requisition of supplies, etc. **The San Pedro Copper Co.**, also owned by Greene Cananea, mined 15,574 tons of ore, of which 182 tons was sold to other smelters and 15,364 tons treated by it. Production was: Copper, 791,763 lb., silver, 18,920 oz.; and gold, 106 oz. Net income was $47,938.

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The Ahmeek Mining Co. of Michigan reports as follows for the year ended Dec. 31, 1915:

	1914	1915
Tons of rock treated	590,519	948,874
Cost of mining, milling and taxes per ton of rock	$1.55	$1.26
Pounds of mineral obtained	20,333,000	32,292,325
Pounds of refined copper produced	13,634,605	21,800,492
Per cent. copper to mineral	67.06	67.50
Pounds copper per ton of rock	23.1	23.0
Mining expenses per pound copper	6.73c.	5.48c.
Construction	1.68c.	0.81c.
Smelting, freight, commissions	1.30c.	1.67c.
Total cost per pound copper	9.71c.	7.96c.

There was 175 ft. of shaft sinking and 8,419 ft. of crosscutting done in 1915. No. 2 shaft is now 2,775 ft. from the surface. A concrete foundation has been placed there for a new steel rockhouse, erection of which was begun in March, 1916. Two new stamps were installed and the regrinding plant for them finished in January. Two new stamps will be installed this year. Dividends of $18 were paid and the balance of net assets increased by $614,882, making a total at the end of the year of $1,583,654.

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The Isle Royale Copper Co., operating in Michigan, reports a copper production for 1915 of 9,342,106 lb., sold at 18.36c. per lb., and silver sales of $38,974. Net profit for the year was $498,277, while net current assets increased by $214,709. Comparative figures for 1914 and 1915 are:

	1914	1915
Tons of rock treated	474,349	680,270
Mining, milling, and taxes per ton of rock	$1.49	$1.45
Pounds of mineral obtained	9,451,115	13,727,832
Pounds refined copper produced	6,601,235	9,342,106
Per cent. refined copper in mineral	69.85	68.05
Pounds copper per ton of rock	13.9	13.7
Cost per pound, mining expense	10.67c.	10.56c.
Construction	0.53c.	1.50c.
Unwatering Huron shaft	0.13c.	0.23c.
Smelting, freight, etc	1.46c.	2.06c.
Interest	0.21c.	0.22c.
Extraordinary expense	......	1.96c.
Total cost per pound of copper	13.05c.	14.94c.

Sinking amounted to 538.5 ft. No. 2 shaft is 3,211 ft. deep. There were 14,446 ft. of openings driven, and 799,800 tons of rock hoisted, of which 15% was discarded, or 119,620 tons. The old mill was destroyed by fire on Dec. 7, 1914, on June 7, 1915, the first unit in the new mill was placed in commission, and the third on Aug. 27. New machinery for the slime copper was being put in at the time of the fire, and while the coarse jigging machinery has not been changed, Wilfley tables have been installed throughout for the finished product and for the slimes. A Hardinge mill is being erected to regrind the richer of the coarse products.

⁂

The Centennial Copper Co. of Michigan reports sale of 2,347,500 lb. of copper in 1915 at 18.145c. per lb., and an increase of quick assets for the year of $248,484, making a balance of quick assets on Dec. 31, 1915, of $273,119. Comparative results for 1914 and 1915 are as follows:

	1914	1915
Tons of rock treated	138,136	150,191
Cost of mining, milling and taxes per ton of rock	$1.838	$1.753
Pounds of mineral obtained	3,311,780	3,029,880
Refined copper produced	2,287,130	2,347,500
Per cent. copper in mineral	69.06	77.48
Pounds copper per ton of rock	16.56	15.63
Mining costs per pound of copper	11.10c.	11.21c.
Smelting, freight, commission, etc	1.11c.	1.16c.
Interest	0.35c.	0.08c.
Total cost per pound of copper	12.56c.	12.45c.

No sinking was done during the year and 2,366 ft. of openings made. No. 2 shaft is now 4,293 ft. deep.

⁂

The Alaska Mexican Gold Mining Co., operating at Douglas Island, Alaska, for the year 1915 reports 216,428 tons crushed, giving a yield of $190,980 in free gold and 4,769 tons of concentrates from which $188,817 was recovered. The total yield was thus $379,797, or $1.75 per ton. Profits were $99,477, and $90,000 dividends were paid. Development work amounted to 2,153 ft. on the Mexican property, 354 ft. on the United property and a share of 3,696 ft. of joint work by itself, the Treadwell and United companies. Of the 216,428 tons milled, only 79,135 tons was broken during the year, 137,293 tons being drawn from stock. Ore reserves amounted to 1,188,866 tons of $1.87 tenor on Dec. 31, 1915, against 688,738 of $2.68 tenor on Dec. 31, 1914. This includes pillars. The Mexican mill crushed 214,179 tons of ore with a stamp duty of 5.24 tons. One pound of chrome-steel shoe crushed 2.48 tons of ore and 1 lb. of Treadwell die crushed 5.34 tons. Milling costs were $0.306 per ton. Sulphurets were treated at the plant owned jointly by Mexican, Treadwell and United. Crushing cost $0.040; tramming, $0.016; stamping, $0.192; concentrating, $0.058. Development costs were $14.739 per ft., stoping, $1.111 per ton; tramming, $0.151; hoisting, $0.104 per ton.

⁂

The McKinley-Darragh-Savage Mines of Cobalt, Ltd., report for the year 1915 that 1,008,383 oz. of silver was removed from the McKinley mine and dumps of which 170,236 was lost in milling and that 308,122 oz. was removed from the Savage mine and dumps of which 38,454 was lost in milling, making a total of 1,061,136 oz. recovered. Their average price received was 50.785c. per oz. and the total costs were 28.710c. per oz. Estimated ore reserves on Jan. 1, 1916, were 1,871,280 oz. of silver compared with 2,132,820 oz. of silver on Jan. 1, 1915, an estimated shrinkage of 261,540 oz. There were 63,661 tons of ore treated by the mill. The purchase of new properties was considered during the year, but none was found sufficiently attractive to warrant its purchase.

⁂

The Tonopah Extension Mining Co., of Tonopah, Nev., during the year ended Mar. 31, 1916, produced 91,981.54 dry tons of ore averaging $18.038 per ton, on which a recovery of 92.39% was made. The silver sold amounted to 2,106,518 oz. at 52.578c. per oz., and the gold amounted to 20,575 oz. Mining costs were $4.614 per ton of ore; milling, $4.478, and marketing and refining, $0.501. Profits were $584,421, of which $412,496 was declared in dividends, $63,043 was spent in new construction, $26,625 used to pay net liabilities incurred in the acquisition of the Tonopah Merger and Tonopah Victor properties, and $82,255 was carried to surplus. The capital stock of the Tonopah Extension Co. was increased during the year from 1,000,000 shares to 2,000,000 shares (par value, $1) and $329,368 of the new stock given for the Merger and Victor properties. At the same time the company acquired plant, equipment, supplies, etc., valued at $66,170, and assumed liabilities of $43,388. The present area of the Extension properties is 551.1 acres. A total of 13,967 ft. of development work was done during the year, but no attempt has been made to block out ore reserves.

⁂

The Shannon Copper Co., operating at Clifton, Ariz., reports that it operated only about seven months of the year ended Dec. 31, 1915. In that period it produced 6,017,642 lb. of copper, 35,499.63 oz. of silver and 690.417 oz. of gold. The copper sold at 17.799c. per lb. and the silver for 48.978c. per oz., making returns from metal sales $1,102,275. Operating expenses were $853,625, leaving operating profits of $248,650. To this must be added interest receipts of $16,228, while expenses during the period the company was not operating were $43,044 and the Shannon-Arizona Railway Co. had a deficit of $12,155, leaving final net profits of $209,678. The company's leaching experiments have demonstrated that the mill tailings, and possibly the low grade, semi-oxidized ores can be treated at a substantial profit, and the company has a 150-ton leaching plant under construction, which should be completed by the end of June. Current assets exceed current liabilities by $555,688, not including as an asset $381,000 of the Shannon-Arizona Railway Co.'s bonds. Only $194,000 of these bonds are now on the hands of the public.

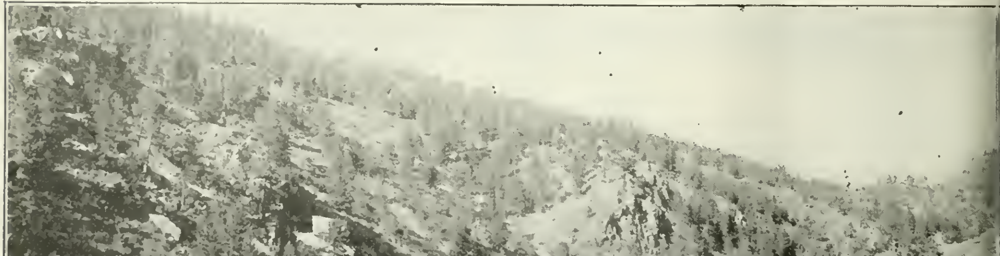
⁂

The Alaska Treadwell Gold Mining Co., operating at Douglas Island, Alaska, reports profits of $718,521 and dividends of $650,000 for the year 1915. There was 900,211 tons crushed, yielding $936,092 in free gold and 19,177 tons of sulphurets yielding $892,631, or a total of $2.03 per ton of ore against 910,285 tons of ore in 1914 yielding $2.60 per ton. There was 7,284 ft. of development work performed by the Alaska Treadwell in its own ground, 11 ft. in Alaska United ground, and 3,696 ft. of joint work by Treadwell, United and Mexican. There was only 613,063 tons of ore broken during the year, the remainder of the material sent to the mills being drawn from stock on hand. Ore reserves at the end of the year were 6,611,571 tons of ore in place and 401,184 tons broken, but the estimate of ore in places includes that which must remain in pillars. The central steam-power plant was increased to 4,750 kw., while about $10,000 was expended in improvements on the hydro-electric plant. Development costs were $18.42 per ft.; stoping cost, $0.525 per ton; tramming, $0.114 per ton; hoisting, $0.10 per ton.

Views of the Boulder Count

PANORAMIC VIEW LOOKING NORTH TOWARD NEDERLAND,

This famous tungsten district is situated about 25 mi. northwest of Denver, Colo., and covers an area about 1
northern end of Gilpin County, where a custom mill has recently been built. Nederland is at an altitude of 8,2
Nederland, or the entire journey may be made by auto stage



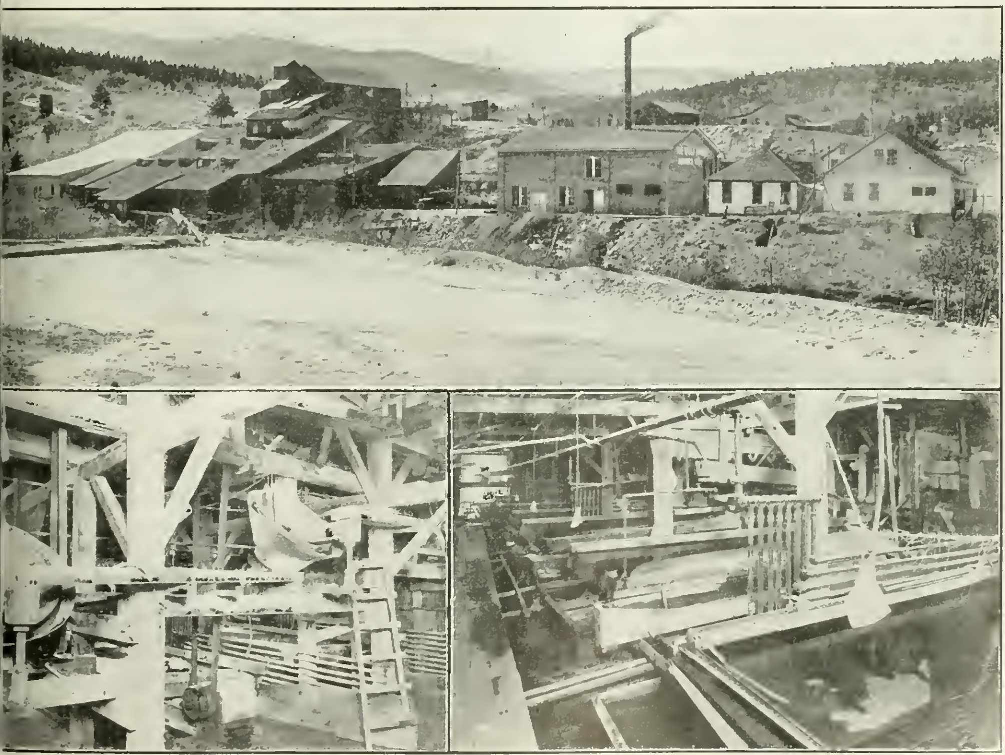
STEVENS CAMP, ONE OF THE NEW TOWNS IN THE BOULDER TUNGSTEN DISTRICT

This is one of the new sections of the district. These buildings have practically all been erected since Jan. 1, 1916. New bank building at left and Vasco No. 5 mill being erected in right center

ungsten Field in Colorado

IERCIAL CENTER OF THE BOULDER COUNTY TUNGSTEN FIELD .

und 7 mi. wide. With the extraordinary development of the last year, this tungsten field has been extended into the reached by the Colorado & Northern R.R. from Boulder to Cardinal and then by wagon or automobile, 2 mi. to



MILL OF WOLF TONGUE MINING CO., ONE OF THE LEADING TUNGSTEN PRODUCERS

Note the newly completed "rag plant" at the left of the upper view. The two interiors, below, show the Bunker Hill screens and the Card and Wilfley concentrating tables

Correspondence and Discussion

Was Graves Our First Engineer?

A short time ago I had the good fortune to run across a copy of "The Great Industries of the United States," published in 1873 by J. B. Burr and Hyde, Hartford, Conn., no doubt by subscription, as the volume has the familiar make-up of contemporary works of that character. This book, while in great part anonymous, contains much interesting matter of a type rarely found in purely popular works. It seems to have been written by a trained and intelligent writer, who had made considerable historical research, and to whom the few palpable "write-ups" therein must have been thorns in the side. The work, moreover, at the present day is more than interesting in the basis of comparison it affords between the condition of several of our industries, which at the time of publication were considered extraordinarily prosperous, and their present expanded state. The articles descriptive of any particular industry are generally prefaced by notes of the history of that branch of the arts, and the following excerpts from the chapter entitled "Iron and Its Preparation" may be interesting to readers of the *Journal*.

After speaking of the early attempts of the London Company in 1610-23 to utilize the iron ores of Virginia, attempts frustrated in great part by a general massacre by the Indians in the latter year, which stopped the production of iron until 1712, the writer goes on to Massachusetts and says as follows:

> With the enterprise for colonizing Massachusetts Bay, the Court of Assistants in London, who took an active part in the measure, contemplated the production of iron. The journal kept of the proceedings of the court states that at a meeting held on Mar. 2, 1628, "also for Mr. Malbon it was propounded, he having skill in iron works, and willing to put in £25 in stock, it should be accounted as £50, and his charges to be borne out and home from New England; and upon his return and report on what may be done about iron works, consideration to be had of proceedings therein accordingly, and further recompense if there be cause to entertain him." Three days after, an arrangement was made with Thomas Graves, of Gravesend, Kent, to visit New England at the expense of the company as "a man experienced in iron works, in salt works, in measuring and surveying of lands, and in fortifications, in lead, copper and alum mines." On his part Graves agreed to serve the company six or eight months for a free passage out and home and £5 a month with board. If he remained three years, the company was to transport his family and to support them to the next harvest, pay him £50 a year, give him a house and 100 acres of land, with a share in the land allotment; while any additional compensation was at the company's discretion. Whether Graves, who settled at Charleston, discovered any mines does not appear. No steps were taken toward the manufacture of iron until 15 years after this date.

If Mr. Malbon was not the first metallurgical expert and Thomas Graves the first qualified mining engineer to visit this country, then who were? It will be noticed that Graves did not disdain agriculture, and his experiences in fortification would have fitted him for a place in the public eye at the present time. Mr. Malbon, it is seen, was ready to back his opinion by personal investment, also more or less on the lines of modern mining-engineering finance. If some of the readers of the *Journal*, inclined to research, would endeavor to find more of the history of these early worthies, it would not seem wasted labor to place something of their achievements on permanent record.

LOUIS JANIN, JR.

Patton, Calif., June 6, 1916.

* * *

Error in Formula for Sag[*]

I was interested, a short time ago, in an article on engineering formulas. The author dwelt mainly on the probability of mistakes in such formulas and the carrying of those mistakes from year to year through many editions of well-known engineering books. The fact that several books carried the same formulas without the errors being discovered was considered by the author sufficient proof that engineers in general are careless or have too much confidence in one another.

I recently discovered a mistake made in some way or other by an author or printer some twenty or so years ago in the following formula for sag. Instead of "inches" the definition of D should read "feet."

$$S = \frac{PL^2}{8D} + PD$$

where

S = Tension on a sagging rope close to the pulley:
P = Weight of rope per foot;
L = Distance between pulleys in feet;
D = Sag of rope in *feet* (not inches).

Wherever I have found the original article copied, the mistake has been copied also. Kent's Mechanical Engineering Handbook and Same's handbook both repeat the error. The original article appeared in Vol. XII of the A. S. M. E. "Proceedings," under "Rope Driving," by C. W. Hunt, and "inches" is used there. Catalog 054 of the C. W. Hunt Co. also copied it as "inches."

The error may or may not be serious. Since the same formula is applicable to computations for strength of belts, overhead cables, trolley lines, suspension bridges, wires, etc., it is quite possible that someone has inadvertently used the formula in such computations with the result that, with additions of ice or wind loads, they have broken and trains have been tied up. I do not claim that this formula has been the cause of wire breakdowns, but I repeat that it is quite possible that such is the case, for I stumbled across the error myself in connection with making computations for sag in belting. I would also have used it in connection with any suspension problem.

To prove that this error could easily lead to a breakdown, take a sag of ½ in. in a wire 30 ft. between supports, weighing 0.43 lb. per ft. Substituting in the formula as "feet," I get about 1,160 lb. tension. Substituting as "inches," it is only 97 lb. tension. The actual tension, then, would be 12 times the computed.

Since this selfsame formula is applicable to anything uniformly loaded, sagging as per Nature's catenary, I am of the belief that the error is really serious.

New York City. S. F. WILSON.

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[*] "Power," June 20, 1916.

The Consolidated Amador Mines

By Lewis H. Eddy*

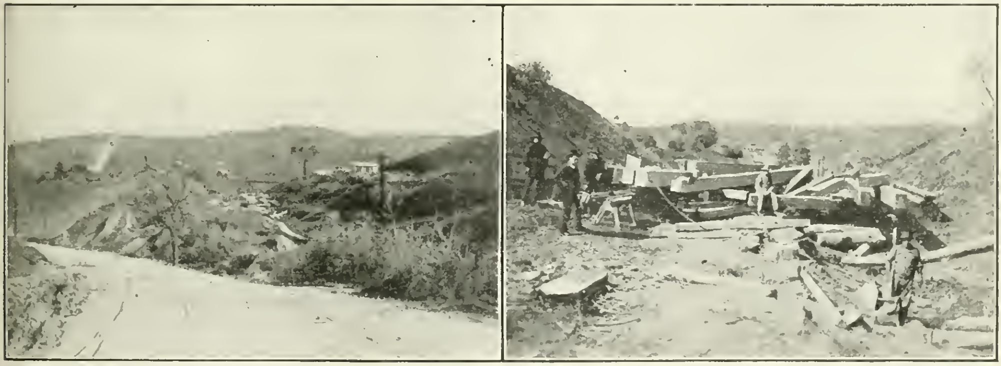
SYNOPSIS—The Consolidated Amador Mines, previously known by several names, is an old Mother Lode property, opened before 1852. After a varied career the property fell into the hands of Mrs. Hetty Green. It lay idle a number of years, but has recently been acquired by T. Walter Beam and associates, who will unwater and develop it.

The Consolidated Amador Mining Co., of which T. Walter Beam is president and manager, began unwatering the Eureka-Badger-Summit mines at Sutter Creek, Amador County, Calif., in May, 1916. The company, formed of several stockholders of the United States Steel Corporation, purchased the property outright in February, 1916, from Mrs. Hetty Green, of New York, for cash, at a price approximating $500,000. Preparatory work for unwatering and developing, placing foundations for hoist and other equipment and the construction of necessary buildings was begun in March. Unwatering the old Eureka shaft started in the first week of June. The one-story brick building erected for and used as a company store during the early life of the mines, when Alvinza Hayward was sole owner of the property, and still in good repair, has been remodeled inside and partitioned into convenient office rooms.

The new equipment consists of Wellman-Seaver-Morgan hoist, and Cameron No. 9 pumps for unwatering. The hoist will be used initially for placing the pumps and carrying the men into the shaft as the water is lowered and permanently for deepening the shaft and for the usual hoisting in the operation of the mine. The hoist has a total capacity of 4,000 ft. depth, lifting 16,000 lb. The rope speed is 1,000 ft. per min., 1⅛-in. plow-steel rope being used. Compressed air is the initial power for unwatering, but the permanent power for mine operation will be electricity, and centrifugal pumps will be used when the mine is in operation. The Pacific Gas and Electric Co., which supplies the mines of the Mother Lode, has a power line across the property.

The property is situated at an elevation of 1,500 ft. above sea level, just east of the town of Sutter Creek and south of the stream of that name. The Wildman-Mahoney abuts the old Eureka on the north and the Central Eureka adjoins it on the south; the South Eureka, Oneida, Kennedy and Argonaut cover the southerly portion of the Mother Lode between Sutter Creek and Jackson. The purchase by the Consolidated Amador includes over 3,300 ft. on the Mother Lode, of which only 1,200 ft. has been even partly prospected, the remainder being virgin ground. But little crosscutting was done by the former operators, a feature of mining since deemed essential in this region.

The greatest vertical depth sunk by the former owners was 2,060 ft. Three shafts were sunk at an incline of 70° east, following the general dip of the veins. These shafts and drifts on the veins and a small amount of crosscuts aggregated approximately 11,000 lin.ft. The underground excavation is estimated at over 7,000,000 cu.ft. The mines were in operation for about 30 years. The mine makes about 200 gal. of water per minute, and it will require about six months to take the water out. Exploration and development will proceed as the unwatering progresses.



SITE OF OLD EUREKA SHAFT AND PREPARATIONS FOR RETIMBERING IT

The history of these mines dates back prior to 1852, when originally developed by Alvinza Hayward, whose subsequent mining operations extended into most of the quartz-mining districts of the northern half of California. The property has been variously known as the Hayward, the Old Eureka, the Amador Consolidated and the Hetty Green in about that order. Alvinza Hayward started it in the early 50's and Hetty Green finished it in the middle 80's, so far as the past history is concerned; the future remains with the Consolidated Amador Mining Co. Various estimates have been made by mining men acquainted with the operation of the Old Eureka, as the property is commonly known, as to the amount of gold produced in the 30 years or more of active operation. These estimates vary from $10,000,000 to $22,000,000. I have it from men who were closely associated with Mr. Hayward in both social and business relations, and moreover were then and are still engaged in the operation of Mother Lode mines, that the property produced approximately $17,000,000. This figure, however, may include only the period of Hayward's exclusive control.

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*Associate editor, 3430 Peralta St., Oakland, Calif.

In 1852 Hayward installed a 10-stamp mill on the Eureka mine and in 1856 built a new mill of 20 stamps and added 20 more stamps to this mill in 1857. In 1858 he purchased the Eureka mine and in 1859 became the sole owner of the Badger, consolidating these two claims as the Hayward mine. During the following 10 years three shafts had been sunk to depths of 760 ft., 960 ft. and 1,230 ft. The mine made about 4,500 gal. of water per day, which in June, 1868, was being hoisted in buckets from the north and the south shafts. This water increased in a few months to double that amount. At that time the two mills were dropping a total of 46 stamps, having a combined capacity of 80 tons of ore per day. Some of the ore was sent to custom mills. The gold was nearly all free, and amalgamation was chiefly inside and on copper apron plates. The first 200 ft. of the Badger did not pay; then the vein got wider and the ore richer. Within 500 ft. of the surface the yield did not exceed $11 per ton, but at the 1,000-ft. point a wide vein was disclosed and the grade of ore had increased to $27 per ton. The mine employed 60 miners, 12 blacksmiths and engineers and 25 others as feeders, amalgamators, teamsters, etc., or a total of 97 men. The mine was worked in two shifts of 10 hr. each. J. Ross Brown in "Mineral Resources," U. S. Treas. Rep. 1868, pp. 75-6, stated that 125,000 tons of ore in sight, was reported—enough to keep the two mills going for five years.

Authoritative Information Scarce

Mr. Brown accounted for the absence of authentic first-hand information by explaining: "The proprietor of the mine has a great fear of being suspected of seeking publicity, and he refuses to give information about the details of his receipts or expenses, or even to communicate his experience or his opinions about quartz mining." This fine satire may have been lost on the man who made millions by minding his own business, but it was and is well appreciated by California miners and newspaper men who never had cause to suspect that Alvinza Hayward would ever divulge any information about his own business for the benefit of the public. The report continues: "It is therefore necessary to rely upon statements of persons not connected with the mine for the yield, and they say the total has been $6,000,000; gross last year $27 per ton, net $22 per ton; amount of rock worked in 1866, 30,000 tons; profit that year, $660,000. Quartz in sight estimated will yield $3,375,000 gross, $2,750,000 net."

In April, 1870, the main shaft was burned and in consequence the mine was idle for four months; but notwithstanding this delay the report of the company secretary showed receipts for the year from proceeds of ore, $301,553, and receipts from all sources, $311,701; construction of shaft, etc., $98,298; mine account, $63,105; general expenses, $20,887; showing a profit on 8 months' operation, in addition to repair costs, of $139,111, from which dividends amounting to $111,000 were paid. It was nearly 18 months before the property was again in complete working order and new hoisting works installed, which Rossiter W. Raymond stated in his United States Mint report of 1872 to be the best and most complete shaft and hoisting works on the coast. In the place of the old bucket plan of hoisting rock, a substantial track was installed on which iron cars capable of holding 18,000 lb. were run and speedily hoisted to the surface. At that time there were two sets of hoisting works, each driven by an 80-hp. steam engine.

The old shaft was down 1,250 ft., inclined 70° east, on the ledge 10 ft. thick at the bottom. The new three-compartment shaft at the same incline was down 1,300 ft. The mine was then one of the deepest in California and was equipped with one 40-stamp mill steam driven by a 75-hp. engine and crushing 80 tons per 24 hr.; and two 16-stamp mills driven by water power. The company employed regularly 100 men. From 1866 to 1872 the ore averaged $20 per ton, supplying 40 stamps. The Tenth Annual Report (1890) of State Mineralogist William Irelan, Jr., contained the following interesting paragraph regarding geological features of the Eureka and Summit mines, then known as the Amador Consolidated, which had been idle for several years:

> North of that portion of the ground known as the Eureka claim, in which the great bonanza occurred, the slate intervening between the greenstone hanging wall and the west country greenstone is very wide. A very short distance north of the north end of the Eureka claim this slate is about 1,000 ft. wide, while immediately south of this north boundary and directly west of and facing the huge bodies of high-grade ore constituting the Eureka bonanza, this slate suddenly narrows to a width not exceeding 150 to 200 ft. Throughout the whole length of the Eureka oreshoot this width is maintained, and after passing it, going south, the distance between the greenstone increases rapidly until it reaches 500 to 650 ft. near the north end of the Summit, which abuts against the Eureka ground. A short distance south of this, in the Summit ground, was found another body of high-grade ore. The diminution in width of the slate belt and the near approach of the east and west country greenstones may present conditions peculiarly favorable to the formation of these highly metalliferous veins of quartz.

Change of Ownership

About 1873 Captain Green, who was a deep-sea shipmaster, fell in with Alvinza Hayward on one or more of his visits to San Francisco and was induced to interest some English friends in the purchase of the property. Hayward recommended that with the completion of the Sutter canal the expense of milling would be reduced materially, as the canal would yield an abundant and unfailing supply of water for milling and power. The new owners took hold and proceeded to deepen the shaft from the lowest level, 1,665 ft. to the 2,000-ft. point. The mine at that time had a large reserve of low-grade ore which could be profitably worked by water power, reducing the milling costs to $1 per ton. This ore kept the 40-stamp mill going, and in 1880 a new 1,500-ft. shaft was sunk with 12 men in three shifts of 8 hr. each. Drifts were run from this shaft in three directions, and the waste rock loosened on the night shift was stored or used for filling, so that hoisting was confined to the day shift.

Captain Green, with his English friends, acquired an interest or shares in the Amador Consolidated, which consisted of a large majority of the stock. Then, the story goes, when Hayward found that prospecting and development were essential parts of economic mining and he was not getting it all for himself, he began to unload his stock to Mrs. Hetty Green. He was not given to dividing his profits, and when it became necessary to expend a large amount of money to make a fair profit in mining, he usually dropped it. Hayward was also unlucky in respect to fires in mines. Another fire in this property, at the lowest level, occurred shortly after the Greens became interested, and after it was extinguished only the levels above the 800 were mined. The repairs did not extend below that level; and after the ore above the 800 level was extracted, the mine closed and was allowed to fill with water. By this time Hayward was out of it and Mrs. Green was in. The English shareholders became delinquent in assessments for taxes. Mrs. Green finally came to own all the shares. Her idea was that it was a good investment for her son, Colonel Green, if he should be inclined to mining, but he was not so inclined.

Mrs. Green believed that the fires and other mishaps were the work of persons desirous of taking the mine away from her. Every attempt to secure an option of purchase or a lease was met with a blunt refusal to consider anything but a direct and outright sale for cash or an equivalent, and only to mining men who were strong enough to reopen and operate it, as she had unbounded faith in the value of the property. Mr. Beam tried for three years before he could get Mrs. Green to listen to him. When she came to understand who made up the company subscribing to the purchase, she said she was "not afraid of that crowd financially." and they could have the mine "for cash—take it or leave it, and no more talk." They took it. The entry into the Mother Lode region of these men who are operating extensively in other parts of the country adds another great mining enterprise to Amador County. Mr. Beam deserves success for having formed so strong a company and for his persistence, which secured what is believed by other competent mining engineers to be one of the great mines of the Mother Lode.

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Oil-Well Fires Caused by Static Electricity

The origin of oil-well fires has been investigated by J. T. Hayward, who comes to the conclusion that many of them are caused by an electric discharge brought about by momentarily turning the entire well into a huge Leyden jar. The casing forms the outer coating and the bailer the inner, while the intervening air or gas is the dielectric (*Petroleum Review*, May 13, 1916). The jar is charged through the bailing line, from electricity generated by friction on the various drums or sheaves. To prevent such fires, he says all metal surfaces should be earthed and the band-wheels, shafts, etc., should run in metal bearings, one of which should be earthed. He also advises the use of a silent-discharge comb on every belt.

This silent-discharge comb is most cheaply made as follows: A strip of sheet iron 100 mm. wide and slightly longer than the width of the belt is nailed upon a piece of board, the nails passing clear through the board. One of these should be placed across the belt not more than an inch from the inside and earthed. It is preferable to use one after each pulley.

⁂

Oil Production for 1916

The quantity of petroleum marketed in the United States during the first half of 1916 is estimated by John D. Northrop of the United States Geological Survey at 140,000,000 bbls. This estimate is moderate and the apportionment of the output among the major fields is as follows: Appalachian field, 11,100,000 bbl.; Lima-Indiana field, 1,800,000; Illinois field, 7,900,000; Kansas and Oklahoma field, 50,500,000; Northern and Central Texas field, 1,200,000; Northwest Louisiana field, 6,800,000; Gulf Coast field, 11,100,000; Wyoming and Montana field, 2,400,000; California field, 43,500,000; miscellaneous (Colorado, Michigan and Missouri), 100,000 bbl.; total, 140,000,000 bbl.

This quantity, which includes a little oil actually produced in 1915 but marketed during 1916, is less than the output during the first half of 1915, though it is greater than one-half the entire quantity marketed last year. The fact that this quantity reflects the results of general activity throughout all oil-producing areas rather than flush production in restricted areas is significant and leads to no other conclusion than that the final statistics of oil marketed in 1916 are destined to establish a new record.

⁂

Prosperity in American Mining; Record Production Predicted

"The accomplishments of the mining industry in the six-month period just completed warrants the forecast that 1916 is to be a record-breaking year." With this statement the director of the United States Geological Survey sums up his official midyear review of the mineral industry as reported to him by the Government geologists and statisticians covering the different subjects.

Shipments of iron ore from Lake Superior points for five months of 1916 exceeded by more than 80% those for the same months in 1915, and the indications for the year are favorable for a new high record on iron-ore production and of pig iron as well. Higher prices with a steady demand are stimulating the mining of manganese, with the result that this year's output of ore is expected to surpass the large production of last year.

Most precious-metal mines are operating at full capacity. The gold production will probably fall below the high yield of last year, but silver is expected to break all previous records.

Copper is continuing the steady increase in production which began early last year, and the forecast for 1916 indicates not only the largest output ever known, but also the largest profits.

The lead and zinc mines are producing ore at a rate exceeding that of last year, and the prevailing prices have made possible the working of large quantities of low-grade ore.

In quicksilver mining the outlook is for an output similar to that of 1915, which was the largest for several years. Thus far in 1916 the average price has greatly exceeded the 1915 price.

The reports from the Survey's Western offices are all optimistic. In Arizona mines and smelters are working at high pressure and the production of metals already shows an increase that promises to make the value of the output nearly double that of last year. Arizona will maintain first place as a copper producer. New Mexico is continuing its rapid progress as a metal-mining stat with increases in its output of lead, copper, zinc, gold and silver. The mines of Colorado in the six month just past have shown some changes in output as compared with last year; an increase of 30% in copper is indicated, together with small gains in lead and zinc, a 15%

decrease in gold and little change in silver. This output, however, represents a large gain in value of mine production. Mining has also been stimulated in Montana, and the forecast indicates an increase of 60% in the value of the mine product over that of last year. Idaho mines are increasing their shipments in all the metals, with higher wages and dividends as the result of better prices.

Utah is experiencing an ore production in excess of smelter capacity. The value of the 1916 output of copper is expected to be double that of last year. Throughout Nevada old mines are being reopened and regular producers are working at full capacity. The chief gains in production will be in copper, lead and zinc. The increased activity in the mining industry of California is found largely in the reopening of mines long idle and in the opening of new mines for chrome, tungsten, manganese antimony and magnesite, rail shipments of these ores to the East being made possible by prevailing high prices. In Alaska copper mining is showing advances and both copper and gold promise to exceed last year.

⁂

Foreign Trade in Lead and Zinc

The imports of lead into the United States for May and the four months ended May 31, are reported by the Department of Commerce as below, in pounds:

	May	Five Months
Lead in ore	2,068,788	11,202,259
Lead in base bullion	......	13,793,189
Lead, metallic	15,198	2,558,857
Total lead	2,083,986	27,554,305

The actual tonnage of lead ore was 7,875 tons, of which 4,932 tons came from Mexico, 2,148 tons from Canada and the remainder from Guatemala, Chile and Peru.

Imports of zinc in all forms in May and the four months ended May 31, are reported by the Department of Commerce as below, in pounds:

	May	Five Months
Zinc in ores	40,741,730	168,631,067
Metallic zinc	121,565	683,427
Zinc dust	201,186	1,069,756

The zinc dust imported in May came from Japan (113,014 lb.) and France (88,172 lb.). The total ore imported in May was 38,425 tons; 10,267 tons being from Mexico, 54 tons from Guatemala, 3,502 tons from Canada, 12,544 tons from Spain, 1,476 tons from French East Indies, 1,280 tons from China and 9,501 tons from Australia.

Exports of zinc from the United States in May and the four months ended May 31, were, in pounds:

Exports	May	Five Months
Zinc, pigs, bars, etc., from domestic ore	10,187,550	57,266,448
Zinc, pigs, bars, etc., from foreign ore	9,622,366	28,095,912
Zinc plates and sheets	7,063,133	32,625,482
Zinc blocks, etc., reëxported	. . .	336,000
Total metallic zinc	26,873,049	118,323,842
Zinc dross	...	3,211,446
Zinc dust, reëxported	14,998	112,417

Exports of lead during May in the form of pigs, bars, etc., produced from domestic ore, amounted to 15,030,880 lb., and from foreign ore, to 1,281,153 lb.

⁂

Leasing of Forfeited Mineral Claims is now possible in British Columbia since the passing of the "Taxation Act Amendment Act, 1916," recently. Upon the payment of $25 per year the leaser has all the rights of a free miner under the Mineral Act. He may obtain a crown grant of the property if he shows that he has done $200 worth of work per year during the continuance of his lease and the payment of any back taxes or dues.

A Siberian Mining Company

The Maritime Province, Siberia, contains deposits of silver, lead and zinc, the working of which began in 1909. One company built a concentrating plant at a cost of $500,000 in 1914. It proved a success, and in 1914 the output consisted of 90.66 tons of lead concentrates, averaging about 71% lead, 4.5% zinc, and 1,100 gr. of silver, as well as 194.14 tons of concentrates, containing 33.5% zinc and 7% lead. According to official figures, the output in 1915, from 5 out of 11 mines belonging to the company, amounted to over 30,000 tons of lead ore. The undertaking is increasing its output each year; it began in 1909 with only 97 long tons of silver-lead ore and increased the output in 1913 to 29,956 tons. In 1914 and 1915, on account of the war, the production was smaller.

According to a commerce report issued recently by the Department of Commerce, Washington, D. C., the company owns 11 deposits covering an area of over 2,635 acres, and in addition, a gold deposit covering 191 acres; it also rents from the government 1,350 acres of land for various purposes. The mines are equipped with 180 buildings, costing $252,500; a concentrator, costing $500,000; a narrow-gage railroad, 23 mi. long, costing $159,000; an aërial cableway, costing $29,500; and conveyors, wharves, wagon roads, etc., costing $18,000. As the greater part of the capital invested in this enterprise is German, the management of the undertaking is intrusted to a special board of temporary managers.

NEW PATENTS

United States patent specifications listed below may be obtained from "The Engineering and Mining Journal" at 25c. each. British patents are supplied at 40c. each.

ALUMINATES—Production of Aluminates from Alunite. Paul R. Hershman and Raymond D. Cooke, Chicago, Ill., assignors to Mineral Products Corporation, New York, N. Y. (U. S. No. 1,189,254; July 4, 1916.)

CONCENTRATOR—Ore Concentrator. Rudolph Leonhart, San Anselmo, Calif. (U. S. No. 1,190,306; July 11, 1916.)

CRUSHER—Rock Crusher. Frank B. McCabe, Lewiston, Penn. (U. S. No. 1,189,594; July 4, 1916.)

CRUSHING—Ball Mill. Ernest S. Gregory, Anaconda, Mont. (U. S. No. 1,190,401; July 11, 1916.)

DIGGING AND CONVEYING APPARATUS. Robert P. Greenleaf, Hudson, Ohio, assignor to Frank Billings, Cleveland, Ohio. (U. S. No. 1,189,443; July 4, 1916.)

DRILL—Rock Drill. Andrew L. Engels and Joseph Walker, Bisbee, Ariz. (U. S. No. 1,190,387; July 11, 1916.)

ELECTRIC FURNACE. Peter Eyermann, Witkowitz, Austria-Hungary. (U. S. No. 1,189,356; July 4, 1916.)

ELECTROLYTIC CELL and the Process of Electrolyzing Metal. Christian Dantsizen, Scotia, N. Y., assignor to General Electric Co. (U. S. No. 1,190,122; July 4, 1916.)

FERROMANGANESE—Process of Producing Ferromanganese Alloys. Harry Schagrin, South Bethlehem, Penn. (U. S. No. 1,190,679; July 11, 1916.)

FLOTATION—Oil and Acid Feeder. Albert Campbell, Anaconda, Mont. (U. S. 1,190,721; July 11, 1916.)

FLUE DUST—Process for Reducing Flue Dust and Other Metal Fines. Samuel L. Boggs, Pittsburgh, Penn. (U. S. No. 1,190,772; July 11, 1916.)

INGOTS—Apparatus for and Process of Casting Ingots of Metals and Alloys. Pierre Henri Gaston Durville, Paris, France. (U. S. No. 1,189,548; July 4, 1916.)

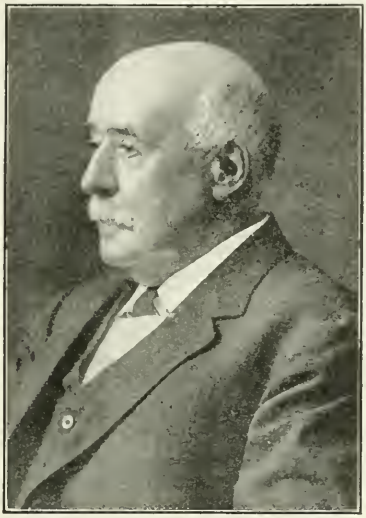
LEACHING—Process of Recovering Values from Ores. Henry Hirsching, Oakland, Calif. (U. S. No. 1,190,549; July 11, 1916.)

LOCOMOTIVE with Haulage-Cable Mechanism. Dudley T. Fisher, Columbus, Ohio, assignor, by mense assignments, to the Jeffrey Manufacturing Co. (U. S. No. 1,190,394; July 11, 1916.)

METAL COATING—Flux for Coating Metal Baths. James H. Maddy, New York, N. Y., and Bruno H. Schubert, Weehawken, N. J., assignors to the Lohmann Co., New York, N. Y. (U. S. No. 1,189,373; July 4, 1916.)

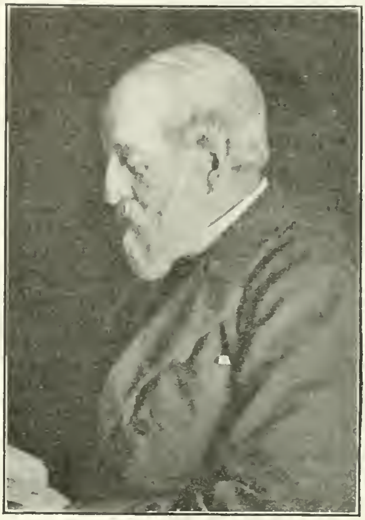
ROASTING—Process of Treating Metalliferous Materials for Roasting, Reducing, Sintering, and Like Processes. Friedrich Carl Wilhelm Timm, Hamburg, Germany. (U. S. No. 1,189,313; July 4, 1916.)

Men of the Calumet & Hecla



ALEXANDER AGASSIZ

The builder of Calumet & Hecla and for many years its executive head. Under him the company attained its great prestige, made its wonderful record of dividends.



QUINCY A. SHAW

The able coadjutor and friend of Alexander Agassiz. One of the promoters of the Calumet & Hecla Mining Co. and its first president. Mr. Shaw died in 1908

RODOLPHE L. AGASSIZ

Son of Alexander Agassiz, and present president of the Calumet & Hecla company

TIMOTHY O'SHEA

The oldest employee of the Calumet & Hecla company, having worked for it continuously for 50 years and six months

Editorials

The Proposed Tax on Copper

The more carefully is examined the proposed tax on copper the more unfair does it appear to be and the more bungling in its operation if it be enacted in its present form. This tax is to fall primarily upon refiners and manufacturers. Smelters are not to pay anything directly unless they sell their copper for immediate consumption. The producers of copper who are miners only are not called upon to pay anything. The incidence of this tax will therefore be as follows:

1. Upon refiners who are sellers. If the refiner treats raw material on toll, as the A. S. & R. Co. does for the Utah Copper Co., he will hand back the refined copper to the customer and the latter will pay the tax. If, however, he treats raw material that he has purchased, he will have to pay the tax. The tax may then be charged up to the smelter and by the smelter to the miner from whom he gets the ore, but if either the retiner or smelter or both are treating material on long-time contract, the tax cannot be thrown back. If the refiner is treating crude copper for a selling agency, the latter will have to pay the tax. Here is a fine complication that is not only based upon injustice in principle, but will without any doubt make the assessment of the tax dependent upon a series of arbitrary Treasury decisions, no matter how Congress tries to phrase it.

2. Smelters and refiners like the Lake companies will have to pay the tax.

3. Smelters that sell pig copper to consumers will have to pay the tax.

4. Brass makers will have to pay the tax, and in their case the copper on which refiners have already paid will have to pay again—a double taxation that will apply to about 30% of the copper consumed domestically.

Furthermore, it is to be remarked that these companies that will have to pay on their product are obliged to pay the regular income tax on their net profit. Also that these companies are already required to pay a large part of the local taxes in the States wherein their properties are situated. In Arizona, for example, the major part of the expense of running the state is borne by the copper companies.

Congress proposes to exempt the copper companies when their profit falls below 10%, and graciously, but correctly, permits capital charges to be included in the cost. However, the actual cost of producing copper is a question respecting which experts have been disputing for the last 10 years without coming to an agreement, and that is going to be a fine mess into which to inject the taxgatherers of the Treasury Department.

These arguments should not divert attention from the unfairness of the whole project. Congress has been for a year back considering new taxes. Among other things it was proposed to tax gasoline. There was such a protest against a tax on it, which would affect millions of voters, that the politicians did not venture to risk it. Apparently in casting their eyes around they noted the large profits that the copper companies have been making and concluded that there was an industry wherein a tax would be paid directly by so few people that their objections could be disregarded. Otherwise, why copper?

Copper has not figured among the war brides any more than iron and steel, lead, gasoline and a hundred other commodities. The maximum price for it in 1916 has been but a few cents a pound higher than in 1907, when there was no war. In the copper industry there was no such extravagance as in others wherein the price rose to four, five and ten times normal.

That there has been a great demand for copper for military purposes, let it be granted. But if money is to be raised by taxation on that ground, why should it not be raised from *all* commodities that have been enhanced in value on that account?

⁂

The London Standard Copper Market

Upon several occasions during the last year the *Journal* has referred to the absence of real meaning that has come to pass in transactions in copper on the London Metal Exchange and the insignificance of the quotations that are cabled broadcast from there. Renewed attention has lately been drawn to this subject.

In normal times the London Standard market offered free facilities to anybody to buy and sell through a member of the London Metal Exchange, so that the quotations there, supposedly, reflected the opinion of pretty nearly the entire world interested in the metal dealt in. To affect the quotation either up or down there would have to be transactions of considerable volume.

Last March the British Government put restrictions on dealings on the London Metal Exchange so that purchases could only be made for actual consumption in Great Britain, and since then no one has been allowed to sell unless he has the metal or can show documentary evidence of its being afloat. Furthermore, there is a British export embargo on all metals. Necessarily the dealings on the exchange are thus limited to consumers in Great Britain, and practically they can buy only spot metal. As there is now hardly any spot metal in Great Britain except about 1,000 tons of undesirable arsenical Standard copper, there is no inducement for the British consumer to go to the exchange for his supplies.

LONDON QUOTATIONS AND SALES OF STANDARD

Date	Spot	Futures	Sales, Tons	Date	Spot	Futures	Sales, Tons
June 9	£123–10	£119–10	..	June 27	£102	£98	75
12	121–10	119	..	28	103	100	75
13	121	118–10	..	29	104	100	25
14	118	116	..	30	103	100	25
15	113	110	..	July 3	102	98	100
16	113	110	..	4	98–10	94–10	50
19	110	106	25	5	96–10	94–10	50
20	106	103	100	6	97	95	..
21	98	96	25	7	91	89	50
22	97	95	50	10	84–10	82–10	..
23	98	96	50				
26	102	99	75	Tons			775

The result developed by this state of affairs is that the few dealers who have affiliations with consumers can work the market in either direction by the purchase or sale of a single 25-ton lot. The quotation is sent broadcast to the world, as heretofore, but the majority of persons who note the quotations are ignorant of the changed conditions. How altered are the conditions is evinced by the accompanying statement of the sales on the London exchange during the period from June 9 to July 10, both dates inclusive. In that period of one month there was sold 775 long tons—1,736,000 lb. About 200,000,000 lb. per month has to be sold monthly on the average by American refiners to dispose of their output.

On the strength of those trifling transactions there was a decline of about £10 per ton, equal to 8½c. per lb. Even more rediculous is the showing of a downward plunge, an upward swing and another downward plunge on transactions whereof the maximum in any one day was only 100 tons.

The object no doubt aimed at by Great Britain was to discourage wildcat speculation, and we cannot find fault with any means the government may have chosen to accomplish that object, but it would appear that the only result attained is to make the London Metal Exchange look ridiculous. It would be far better to close the exchange altogether for all the service it renders the public. To the producers these quotations are meaningless and worthless, but the general public does not know it. As we have previously remarked, American producers long since ceased to pay any attention to them.

*

Matte or Regulus

The Board of General Appraisers of the Treasury Department has given a decision in the long-standing dispute between smelters and the customs officers as to what is regulus of copper. This goes back to 1896, since which time it has been the subject of numerous actions and decisions, generally in favor of the importers. However, the Government has never been satisfied and has steadily been desirous of trying the case again.

The matter hinges upon the lead content. Lead-bearing ores are dutiable. Regulus of copper is free. How, then, about copper matte containing lead? Copper matte is certainly not a lead-bearing ore, but is it a regulus of copper? The United States Board of General Appraisers has decided in the affirmative. This is not only a decision of common sense, but also it conforms to metallurgical understanding.

*

Cost of Producing Spelter

When spelter fell to the level of about 8c. per lb., it was overlooked that that price was probably not far above what 5c. would be in normal times. For the cost of production has increased greatly in many of the important districts. There has been a large advance in the wages for labor, in the cost of explosives, and in material generally. On the other hand, there has been reduction in the efficiency of labor, which has told terrifically—in zinc smelting especially.

Some people think that the cost of producing zinc is now 40% higher than it was in 1913. On that hypothesis a 5c. cost then would be a 7c. cost now. It is certain that up to the middle of 1914 zinc producers looked upon a 7c. market as something fat, something to be expected only once in seven years or so. Fluctuations of ½ to 1c. from normal were regarded as major swings. Now producers draw long faces over an 8c. market and look for swings of several cents per pound.

Of course there is going to be a readjustment to the old order. Wages will come down; extractions will go up. Competition will reign. During the process of readjustment there will be some interesting things which probably no one is wise enough to prophesy any more than anybody could what happened in 1915.

*

Calumet & Hecla

On July 15 the Calumet & Hecla Mining Co. celebrated its 50th anniversary. The day was made a festival. The officers and directors of the company went out to the mine from Boston by special train, and the 5,500 employees in Calumet and vicinity were given a holiday without loss of pay. Medals—gold, silver and bronze—were presented by the company to its employees who had been in service for long series of years, and of these there are a great number. It is doubtful if there be any other great industrial company of the United States—certainly no other mining company—that can show such a record of loyalty, faithfulness and long service on the part of a large number of its men as Calumet & Hecla can. Noteworthy among them is Timothy O'Shea, who has worked with the company for 50½ years, having been one of those who dug the original pit at the discovery place. Mr. O'Shea is now the senior of all, his old officers having departed one by one. But in the administration of the company there is a continuity of service and tradition, the present president—Rodolphe L. Agassiz—being a son of Alexander Agassiz, the great president, while James McNaughton, the general manager, was born in Calumet and has occupied his present position for many years.

The Calumet & Hecla is the most successful mining company of the United States. Not only did it make wonderful returns to those who invested in it 50 years ago, but also the glamor of those returns impressed the public generally—especially the New England public—and made it interested in mining investments elsewhere and willing to risk money in them. Thus Calumet & Hecla contributed more or less directly to the development of the mining industry everywhere in the United States.

Its policy, both with respect to its attitude toward its employees and to its customers—and for that matter we may add toward the public generally—has been generous, broadminded and praiseworthy, a good model for others to pattern by. The American mining industry has been better in all ways through the presence of the Calumet & Hecla Mining Co. in it.

*

The idea that the United States never exercises a strong hand in foreign affairs or intervenes in them is erroneous. At the present time this country is dictating the course of events in four other countries—Haiti, Santo Domingo, Panama and Nicaragua. In Haiti and Santo Domingo the United States is actually establishing thoroughgoing protectorates. In none of these four countries has the United States Government been willing to wait for free and fair elections or intimated its intention to abide by them. Why should there be the difference in attitude toward them and toward Mexico? Is it for the reason that Mexico is conceived to be like its own prickly pears, hard to handle?

BY THE WAY

In an address delivered by W. H. Dawe, president of the Transvaal Chamber of Mines, at the annual meeting held in Johannesburg, Mar. 27, 1916, it was stated that the accident death rate for 1915 was the lowest on record, being 3.17 per 1,000 per annum for white employees and natives combined, compared with 3.22 in 1914. In 1905 and 1906 the rates were 5.15 and 5.19.

⁂

Bringing international procedure down to the "plain people" might relieve the courts of a lot of work. Perhaps infringers under the apex law might avoid responsibility by adopting the system outlined in the following story from the Kansas City *Star:*

"Yassah! Brudder Tump sho' flogged me plenty. He knocked me down and drug me around and beat me and mauled me twell muh tongue hung out."

"What yo' all gwine to do about it, sah?"

"Do? What kin I do? De gen'leman done disavow de whole incident!"

⁂

Under the caption "First Aid to Pershing," the *Saturday Evening Post* says:

> A street carnival now touring the South is seemingly the repository of a most perplexing military secret. On a recent visit by this particular carnival to a Tennessee city a part of the attending throng heard a barker extol the clairvoyant powers of Madam ——.
>
> This Goddess of Wisdom, while thoroughly blindfolded, gave instant answers to any questions. The seeker after truth merely wrote on a slip of paper the question nearest his heart, which, being read out by the barker in the hearing of all the crowd, was as publicly answered.
>
> Whether Minnie still loved Tom and where the old hermit buried the gold were questions legitimate enough; but that somebody had taken advantage of a lady's trustful disposition her answer revealed when Madam —— was confronted with the query:
>
> "Where is Villa?"
>
> Her reply was:
>
> "Her real name is not Villa. It is Margaret; and she is now in Atlanta, Georgia."

⁂

"B. C. 7—Experts on the Yellow River (China) report three plans for flood control: First, the best plan is to lead the water to the sea; second, a good plan is to divide the water and carry it over all the land by canals; third, the worst plan is to raise the banks higher. There is a proverb in China, said to date 2,000 years B. C., still inscribed on a stone monument at the head of the Min River in Szechwan to the effect 'dig deep the ditch, keep low the dikes.'"—China, an Interpretation, by Bishop J. W. Bashford.

Bishop Bashford cannot be accused of political enmity to Representative Humphreys, of Mississippi, who wants the United States to spend $15,000,000 on levees along the Mississippi River. But even the Chinese engineers of 7 B. C. reported unfavorably on the Humphreys flood control bill because they knew the plan does not work.

But what we started to say is that pork is the hardest of all things to digest, never being assimilated by the human stomach in less than 8 hr. and by the body politic in a like number of years.

⁂

The *Journal* has previously called attention to Congressman Tavenner's pernicious proposal. Respecting it the *Evening Post* remarks that at the moment when we are so afraid of Germany's efficiency as to be arming against her at an unheard-of rate, there is an ominous effort in Congress to prevent real efficiency in various directions. Thus Congressman Tavenner has introduced a bill prohibiting "time-studies" and other moves toward the efficiency of those engaged in Government work. There is also a Van Dyke bill, the object of which is similarly to make against the efficiency of the Post Office Department—than which no department is in more need of efficiency, Heaven knows. It is also reported that similar labor-union attacks upon scientific management are to take form of riders to the Post Office, Navy, Army, and Fortifications Appropriation bills. Congress has already injured the scientific-management system at our arsenals, thereby increasing the cost of the cannon that are to defend us. If these riders go through, efficiency in the Government service will be prohibited by law—and yet we think ourselves superior to Chinese administrative methods! Here is a great chance for the Security Leagues and other advocates of preparedness to do the country a useful service by preventing such legislation.

⁂

Proposed Reclassification of Spelter

Nonferrous metals and alloys were discussed at length at the annual meeting of the American Society for Testing Materials, held at Atlantic City, June 27-30. Extensive revisions in the standard specifications for virgin spelter were recommended, which consisted essentially of a change in the grading of virgin spelter by addition of the grade "Selected," the recognized grades now being as follows: *A*, High grade; *B*, Intermediate; *C*, Brass Special; *D*, Prime Western. The new grade "Selected" will come between Brass Special and Prime Western.

In the former specifications it was provided that Brass Special spelter should not contain over 0.75% lead, 0.04% iron and 0.75% cadmium. It also was to be free from aluminum and the sum of the lead, iron and cadmium was not to exceed 1.20%. This was changed as follows: Brass Special spelter shall not contain over 0.60% lead, 0.03% iron and 0.50% cadmium, and the sum of the lead, iron and cadmium shall not exceed 1%. Selected spelter shall not contain over 0.80% lead, 0.04% iron and 0.75% cadmium. It also was to be free from aluminum, and the sum of the lead, iron and cadmium may not exceed 1.25%. The previous specifications for Prime Western spelter provide that is should not contain over 1.50% lead and 0.08% iron, whereas the revision decreases the percentage of iron to 0.06, the percentage of lead remaining unchanged.

The section referring to sampling was stricken out and the following substituted: "Select 10 slabs at random from a carload and saw each slab completely across from the middle of one long side to the middle of the other, and use the sawdust as the sample; or drill three 9-mm. holes along one diagonal of each slab, boring completely through, and taking care to make fine drillings; the holes should be drilled as nearly as possible at the middle and halfway between either end and the middle of such diagonals. Go over the drillings or sawings with a powerful magnet to take out any iron which may have come from the drill or saw and mix the sample thoroughly. The drill or saw must be thoroughly cleaned before use, and no lubricant shall be used in either drilling or sawing."

PERSONALS

John T. Young has gone from Rolla, Mo., to Metcalf, Ariz.

A. W. Koch has gone from Mascot, Tenn., to Granby, Mo.

Charles E. Schwarz has gone from St. Louis to Miami, Okla.

Curtis Alexander, recently in Mexico, is now at San Diego, Calif.

W. Frank Lewis, lately at Hillsboro, N. M., is now at Ewen, Mich.

Harlan H. Bradt has gone to Duluth, Minn., from Pittsburgh.

E. H. Cook, recently at Culiacan, Mexico, is now at Los Angeles.

W. H. Moore has gone from Pasadena, Calif., to Black Diamond, Wash.

Siegfried Fischer is now at Golden, Colo. He was recently in New York.

George B. Holden, recently at Wickenburg, Ariz., is now in New York.

Andrew Walz is now at Springfield, Mo. He was recently in New York.

W. L. Lawshe is now at Seattle, Wash., having gone there from Montana.

Ben. B. Lawrence, of New York, has gone from Oregon to San Francisco.

E. D. Brewer, recently at Edwards, N. Y., is now at Buckingham, Quebec.

Orel E. Young has gone from Cleveland, Ohio, to Salt Lake City, Utah.

Gust. Setz is now at Berkeley, Calif. He was recently at San Antonio, Tex.

F. P. Williams, of New York, is now at Fomento, Santa Clara Province, Cuba.

Harold W. Yost has gone from the Great Falls mine, Potomac, Md., to St. Louis.

James Wilding, lately at the Inspiration Mill, Miami, Ariz., has gone to San Francisco.

Felix E. Wormser, of New York, is now with the Snake River Mining Co., Huntington, Ore.

G. L. Sheldon, of Ely, Nev., is in Washington County, Idaho, making examinations of mining property.

Fred S. Porter, late at Treadwell, Alaska, is now with the Canadian Klondike Mining Co., at Dawson, Yukon.

M. L. Fuller, of the Associated Geological Engineers, has started for Cuba to conduct expert investigations.

Frank C. Rork, recently at Lansing, Mich., is now with the Consolidated Arizona Copper Co. at Humboldt, Ariz.

F. Julius Fohs, consulting oil geologist, has moved into his new quarters in the new Gallais Building, Suite 307, Tulsa, Okla.

Robert W. Woolley has resigned his position as director of the United States Mint, in order to take an active part in the political campaign.

Herbert W. Gepp, **H. R. Hanley** and **John G. Kirchen** were elected to membership in the Mining and Metallurgical Society of America in June.

Dr. William O'Neil Sherman, of Pittsburgh, will represent the United States Steel Corporation in the hospital research work outlined by the Rockefeller Institute.

Gen. John Carson, of Montreal, who before the war was prominent in mining circles, is now one of the commanders directing the forward movement of the Allies.

On July 13 **Frederick G. Clapp**, of the Associated Geological Engineers, left for Wyoming, planning to visit also certain Kansas and Oklahoma fields before his return to New York.

M. H. Kuryla is manager of the Broadwater Mills Co., at Park City, Utah. In the "Journal" of June 24, 1916, the name of M. H. Atwater was erroneously given in this connection.

J. W. Brown has succeeded **Daniel W. Thatcher** as secretary-treasurer of Isabella Mines Co. and the main office of the company will be removed to its Lee mine on Bull Hill, Victor, Colo.

Edwin W. Mills has published in the transactions of the Korea branch of the Royal Asiatic Society, Vol. 7, Part 1, a very creditable and exhaustive memoir on gold mining in Korea.

James E. Davis, formerly superintendent of the Central Eureka mine, at Sutter Creek, Calif., has been appointed superintendent for the Calaveras Consolidated Mining Co., at Melones.

Newton Higbee, of Buffalo, representing a New York syndicate, has bought two claims and taken options on seven others in the Shining Tree district, about 90 mi. north of Sudbury, Ont.

Prof. Waldemar Lindgren went to the West in the latter part of June, where he is engaged on some professional work He does not expect to return to Boston until the latter part of August.

The vacancy in geology in the University of Kansas, caused by the resignation of Prof. W. H. Twenhofel, has been filled by the election of **Dr. Raymond C. Moore**, of the University of Chicago.

Charles Camsell, of the Canadian Geological Survey, has gone to Peace River, Alberta, to investigate the potash resources of the district and to supervise the work of three parties in the oil field.

Roy G. Mead has resigned his position as mineral examiner for the General Land Office, Department of the Interior, to become manager of the Gila Development Co. and the Troy-Arizona Copper Co. at Troy, Ariz.

Burr E. Cartwright, who has been prominently connected with the mining industries of Cobalt and Porcupine, Ont., has retired from active business on account of ill-health and has resigned the presidency of the Adanac Silver Mines .

Prof. R. C. Wallace, of the University of Manitoba, and J. S. De Lury, lecturer on Geology at the University having completed a survey of the Rice Lake gold field, have gone to make an examination of the mining area north of The Pas.

Samuel L. Nicholson, prominent mine operator of Leadville, has announced his candidacy for the office of governor of Colorado, on the republican ticket. He was defeated two years ago in the state convention for the same nomination. Mr. Nicholson is manager of the Western Mining Co., successfully operating the Wolftone mine. It is probable that he will compete for the nomination with Allison Stocker, state auditor, who also has various mining interests.

Harrison A. Dunn is still in prison in the City of Mexico. The Department of State received from its representative there a dispatch on July 17, stating that he had again made bitter representation to the Mexican Government regarding its failure to release Mr. Dunn, that the Minister of Foreign Affairs—Cabrera—claimed that the member of the cabinet corresponding to the Secretary of the Interior in our Government opposed Dunn's release on the ground that Dunn had taught the Zapatistas the use of dynamite. However, Senor Cabrera expected to be able to overcome this opposition and obtain Mr. Dunn's release at an early date. In view of the influence of Senor Cabrera in the present Mexican government, this report should be considered encouraging.

OBITUARY

Lucius L. Wittich, mining news editor of the Joplin "News Herald," died at Joplin, Mo., on June 25. For many years his name had been prominently identified with the lead and zinc industry of Missouri and particularly of the Joplin district, through his contributions to the popular and technical press and his skill in gathering and presenting statistics on lead and zinc production. He had the latter feature well organized and the results were considered reliable and representative. As a leader in local mining news circles, his loss is keenly felt and his place difficult to fill.

Hollinshead W. Taylor, senior member of the N. & G. Taylor Co., manufacturer of tinplate, died suddenly July 7 at his residence, Chestnut Hill, Philadelphia. He was born in Philadelphia in 1850 and is survived by his widow and two children. He was a member of the Union League of Philadelphia, the Down Town Club and the Philadelphia Cricket Club. He was the last of the third generation of Taylors connected with this old company, established in 1810 by his grandfather, William Taylor, and his great uncles, George and Tracy Taylor. He began his connection with the firm under his father, and his business activity in this line falls just short of half a century. It is an interesting fact that the art of tinning was introduced into England about the year 1720 by one of Mr. Taylor's ancestors, Major John Hanbury, of the Hanbury-Tracy family, at Pontypool, Wales, who established the first permanent plant for the production of tinplate on British soil. The Taylors, 170 years later, were pioneers in the tinplate manufacture in this country.

Editorial Correspondence

SAN FRANCISCO—July 12

Yuba No. 15 Dredge, at Hammonton, in the Yuba Basin field, started digging July 3. This is the eighth all-steel placer dredge built in California by the Yuba Construction Co. and the fourth all-steel dredge owned and operated by the Yuba Consolidated Gold Fields. It has 17-cu.ft. buckets and the hull is 165 ft. long, 68-ft. beam, 11 ft. 6 in. deep; this is 10 ft. greater length and beam than Yuba No. 14. Total weight of the hull is 1,700,000 lb. Total weight of dredge is more than 2,900 tons, which is about 900 tons heavier than No. 14. The dredge is designed to dig 82 ft. below the water line and has a yardage capacity of over 300,000 cu.yd. of material a month. Digging ladder is 154 ft. long; tailing stacker, 175 ft. long; the spuds 70 ft. long, including 10-ft. points. It is equipped with General Electric motors. Construction was begun Feb. 3, 1916; the dredge was launched on Mar. 26, and the same foundation and ways will be used for construction of No. 16, for which material is now being assembled. No. 16 will be of the same bucket and yardage capacity and design as No. 15, but will be equipped with two tailing stackers for the purpose of reclamation of the channel of the Yuba River.

BUTTE—July 13

Bursting of Butte & Superior's Tailing Dam on July 11 let a torrent of slime, mud and water down a Meaderville street, completely demolishing one and damaging several other homes. A number of people had a narrow escape from death by drowning. As a result of the flood, Main St., Meaderville, was impassable for 150 ft. all day long and though the flood lasted only a short time, due to the great amount of tailings deposited in the creek and around buildings, it will be several days before it has completely drained off. The break in the dam was promptly repaired.

In the Butte-New York Property, Butte & Superior is continuing development but the work is rather slow, as it is all being done on the 1,200-ft. level from the Black Rock shaft and under difficulties because of lack of facilities for handling the waste. The Butte-New York owns four claims, in which the Butte & Superior obtained a controlling interest through a contract to do a certain amount of development work. The crosscut from the Black Rock shaft has gone through the Sellers and into the Florence claim, and is now being extended for the purpose of developing the Pollock.

New Federal Tax on Copper Production—Mining, business and labor circles in Butte are thoroughly aroused over the proposed Federal tax on the copper industry, incorporated in the bill that has just passed the House of Representatives at Washington, in spite of all efforts of Montana representatives to get this body to deal with the subject on its merits. Having failed in their attempt, Montana senators propose to make a vigorous fight to bring about the elimination of the tax on copper from the Kitchin revenue bill when it comes up for consideration by the Senate. The merits of the bill and its effect upon the copper and other industries of the state form the foremost topic of conversation among Montana mining men. It is held that the passage of such a measure would be a staggering blow to Montana mining; that the tax on gross receipts for copper would not only be a heavy burden, but that the terms of the tax would be inequitable, unjust and unfair. It would hit particularly hard Butte's larger mining companies. At current prices, the tax imposed upon the Anaconda company alone would be approximately $3,000,000 a year, an increase of more than seven times the present Federal income tax. Upon a normal copper market the tax would amount to more than 10% of the total net income of the company. While all the copper companies operating in Montana and particularly in Butte are willing to bear their share of any burden of taxation levied by the Federal government, they want to see the levy laid in equity and so devised as to reach all the country's industries that are properly classed in the group which includes the production of copper. As the proposed bill reads now, the discrimination against copper is so manifest that Montana's citizens will make every effort in their power to prevent the final passage of such a bill. Emphatic protests were sent to Washington by business and trade organizations and by citizens generally in many Montana communities, and Montana's men in the House of Representatives and in the Senate were instructed to use their utmost endeavors to have this heavy burden, threatening Montana's copper-mining industry, eliminated from the measure now pending in the Senate.

DENVER—July 13

Roosevelt Tunnel Heading, in the Cripple Creek district, is again being pushed, after about a month's cessation of work at the breast while the large station at the Elkton shaft and the sump were being excavated and timbered. The breast is now about on the line between the Ramona and the Crank lode claims northwest of the Elkton.

Drainage of the Fryer Hill Section, Leadville, undertaken by the United States Smelting, Refining and Mining Co., through the Harvard shaft, is accomplished. Sampling of the old mine workings is being done by Carl Allen, mining engineer. Extensive development will be undertaken at once. This is the second important drainage project to have attained its purpose this season, and the benefit to the district will be marked.

The American Coal Refining Co., which erected a plant in Denver during the last two years to handle 500 tons of raw lignite per day, has decided to proceed immediately with the doubling of its plant. The coal is crushed to 1 in. before being charged into air-tight rectangular ovens wherein it is subjected to ordinary distillation for about 2½ hr. at a temperature rising gradually from normal to 500° C. The volatiles pass through the usual types of collectors, scrubbers, etc., and are finally reduced to commercial forms of ammonia, creosote, tar, toluol and various grades of oil for flotation use. The residue remaining in the ovens after distillation is the fixed carbon with any ash or other non-volatiles in the raw coal. This residue is, to ordinary visual test, exactly like the original lignite, but its specific gravity is markedly less. It is next ground to ¼ in. in a ball mill mixed with some of the tar previously extracted as well as a dry substance the identity of which is a trade secret, and finally manufactured into a form of briquette to which the trade name of "carbonets" has been given. These are remarkably permanent in character and withstand both rough handling and weathering and, when burned in a furnace, retain their shape until actually consumed. Charles O. Hoover is chief engineer as well as manager of the company.

SALT LAKE CITY—July 14

A New Catalog of Utah Minerals and mining districts, prepared by Maynard Bixby, has just been issued by R. H. Officer & Co., assayers and chemists, of Salt Lake. The different counties of the state are taken up, and under them the various kinds of minerals found in each. There is a descriptive list of minerals and notes for collectors. This is the fourth edition of the booklet, which has been enlarged and revised.

The Output of the Gilsonite Mines near Duchesne for the first half of 1916 has been heavier than for the corresponding period last year, when the total output was 35,000 tons. The properties operating are the Rainbow, Temple, Country Boy, Big Bonanza and the Duchesne mine. The Castle Peak property has been taken over by Denver interests. About 120 men are employed in the five properties operating. Experiments are being made by the U. S. Geological Survey with the oil-bearing shales of the Uinta basin and have demonstrated that these shales will yield a good percentage of oil. The oil-bearing shales are 18 ft. thick and occur over an area 175 mi. long by 50 to 60 mi. wide.

Utah Operators Are Protesting against the tax on copper as set forth in the proposed revenue act, and Utah delegates in the Senate and in Congress are being urged to use every effort to defeat the measure. It is felt that the singling out of copper is an unjust discrimination, inasmuch as such a tax would cause copper-producing sections—a relatively small area—to carry a disproportionate amount of the whole taxation. The proposed new law would place a tax of 1% on copper output from $25,000 to $1,000,000, 2% from $1,000,000 to $10,000,000 and 3% on more than $10,000,000. Operators at present are paying 6 to 7% of the taxes in this state. The Utah chapter of the American Mining Congress and individuals have made protests. R. C. Gemmell, of the Utah Copper Co., in a telegram to Senator Smoot, points out that such a tax on copper would mean an output tax for the first time in the history of the country, and draws attention to the fact that other industries besides copper (wheat, cotton, steel, etc.) have enjoyed extraordinary prosperity on account of the war. He urges that systems of taxation should not be based on temporary conditions, but upon broad and universal principles, and that the basis of all taxation should be a just and equitable distribution of the burdens of government among those benefited, the proposed tax being class legislation affecting only seven states—Arizona, California, Michigan, Montana, Nevada, New Mexico and Utah. It is mentioned that, due to the increased price of copper, wages have been raised three times, so that employees have benefited, and also that since the war began materials used by mining companies have advanced from 25 to 300%. Many millions of dollars have been invested in copper-mining properties, and in some cases millions have been invested without any return as yet to the investors. The prosperity of the seven states mentioned and the welfare of the inhabitants of these states would be disastrously affected if this unjust tax should become a law. Copper prices for the 10 years prior to 1915 averaged 13¼c. per lb., while the average cost of producing copper is close to 11c. per lb. At the beginning of the war and for six months subsequent thereto, copper companies were operating on a 50% basis, and many of them were losing instead of making money in an effort to keep their plants going and their men employed. At this time copper was selling at 11 or 12c. per lb. The proposed tax would seriously retard the electrification of railroads, would affect every telephone, telegraph and electric light company and, in ordinary times, would put many copper companies operating on a close margin out of business.

DOUGLAS, ARIZ.—July 14

Reopening Sonora Mines was discussed at a meeting of managers of mines in Sonora, including J. S. Williams, Jr., of the Moctezuma Copper Co., George Kingdon, of the Cananea Consolidated Copper Co., L. R. Budrow, of the El Tigre company, and Gen. P. Elias Calles, military governor of Sonora. General Calles stated that he had ordered his volunteer army demobilized and invited the managers to return to Sonora and reopen their mines, assuring them personal safety and protection for their properties. This the managers stated they were willing to do, providing the embargo on explosives is lifted or modified, but to return without being able to import explosives, they said, would be useless, as most of the companies have only enough dynamite on hand to last them a week or so. And some of this supply was confiscated by Gen. Calles' army when the war talk was strongest. Still some of the employees have already gone back and others are making preparations to return, hoping that the embargo will be raised within a few days Gilbert Melcher, superintendent of the Washington mine at Huepec, Harry Brown, superintendent of the Catalina mine at Cananea, nine foremen of the Moctezuma at Nacozari, and others have already gone south.

OATMAN, ARIZ.—July 10

The Main Activity of This Camp is still confined to the southern portion; in fact, practically the entire development of the camp, if the big mines be eliminated, is confined to this end. Perhaps the property that is making the most improvement is the Oatman Pioneer, and this is noteworthy as the company is a close corporation with not a share of stock for sale, so does its work quietly and is somewhat adverse to publicity. The main development in this property is confined to the 400 level, where both drifts are being extended with crosscuts. In the south drift crosscuts have been run both east and west. The east crosscut picked up the orebody after a fault and is now extended about 8 ft. in the ore and shows a face of about 4 ft. The orebody in the west drift is now thought to be from a different vein, known on the Arizona Tom Reed as the Snowball. The crosscut is now 16 ft. in this ore and has not struck the other wall. It shows a different trend from the main vein, coming more from the south. With the discovery of these two orebodies this property has become a center of interest in this part of the district.

JOPLIN—July 15

Curtailment in Output to the extent of 1,000 tons weekly has been brought about by closing down of numerous mines. Accident at plant of local electrical company partly responsible but a number of the mines are working ore faces too thin to return a profit with ore below $80 a ton. Nine of the principal producers of the West Joplin sheet-ground camp are down, and four or five of the big producers of North Webb City. A number of the larger mines in the Oklahoma camp also are down.

Two Important Mining Deals were recently consummated in this district. The Quick Seven and three other properties at Neck City were sold for $129,500 to the Missouri Zinc Mines Co., composed of Minnesota and North Dakota men, and the Princeton mine at Carthage was sold for $60,000 by Drake, Stone and associates to Ball & Hardy, of Webb City. The Quick Seven was opened in 1908 and produced over 37,000,000 lb. of high-grade blende; and the other mines, the Nineteen Nine, the Tessie M and the Texmo, have all been good producers; three concentrating plants are included in the deal.

Furnaces Were Lighted at the Fort Smith Spelter Co.'s new plant at South Fort Smith during the last week, when connection was made with the natural-gas field at Clear Creek, and blocks Nos. 2 and 3 will be charged in a day or two. Connections also was made with the city water mains last week; delay in getting this done has caused the starting of the smeltery later than had been expected. The new plant has four blocks, 610 retorts to the block; construction was started about Mar. 1. The company is a subsidiary of the Trumbull Steel Co., of Warren, Ohio.

DULUTH, MINN.—July 15

The Strike Is on the Wane on the Mesabi range; many miners have deserted the ranks of the I. W. W. and are returning to their places, a number of mines having resumed operation. This week the North Eddy, Laura, Utica and Albany properties started mining again, after being closed down for a month. Other underground mines will shortly commence work again. No new agitators have arrived on the range to take the places of those who are in the St. Louis county jail, in Duluth, charged with murder, and it is believed that it is useless to continue the fight. There were a number of arrests for picketing and intimidation this week, some strikers being taken into custody in Chisholm and others in Nashwauk. The few strikers who are trying to save the day seem to have lost heart and thus far no strike benefits have been paid to the men, although they were promised a certain amount each week. Pit properties are still working to capacity and there is no let-up in the movement of ore from the mines to the docks. The stockpiles are supplying their share, every shovel on the range now being in operation. Some underground mines will not be opened again this year, as the operators can get enough ore otherwise to fill their contracts.

TORONTO—July 14

New Gold Strike on Wells Claim, near Tashota station, is reported by Percy E. Hopkins, assistant provincial geologist of Ontario, who is making an examination of the Tashota district. The discovery is on location T. B. 2892, 2 mi. east of Tashota station and ¼ mi. south of the railroad. The ore is rich in free gold, one piece being as large as a pea. The Devanny claim is being actively developed and work is shortly to be resumed on the King Dodds claim in the Kowkash area.

Absolute Prohibition of Nickel Exports has made much headway since the announcement that the German merchant submarine "Deutschland" was about to ship a cargo of nickel at Baltimore. The belief is general and widespread that the nickel must be the product of Canadian matte refined by the International Nickel Co., and the Canadian government is being denounced by journals of all shades of opinion for its nickel policy. The result of a by-election in North Perth, Ont., where a Conservative majority of 1,117 at the previous election, was converted into a Liberal majority of 627, is quoted as an evidence of the popular sentiment on the question, but too much importance should not be attached to it as other issues were involved, though the nickel question undoubtedly had some influence on the result. The Canadian government has endeavored to reassure the public by the issue of an official statement repeating what has been said on former occasions as to the measures taken early in the war to prevent the export of Canadian nickel to Germany with the full approval of the British government which regards these precautions as sufficient. The allegation that the nickel secured by the Germans is from Canadian mines, is based upon the statement that no nickel is refined in the United States except what is derived from Canada. That this is a misconception is shown by the following report from Major Graham A. Bell, who has had the duty of examining and supervising the destination of nickel refined in the United States from Canadian ore:

> There is a considerable quantity of nickel ore obtained through various copper mines in the United States, and this ore is refined principally by the American Smelting and Refining Co. There is also nickel ore obtained from New Caledonia, which is refined by the United States Nickel Co., of New Brunswick, N. J. The quantity, of course, does not compare with the tonnage manufactured from Canadian ores, but there are some hundreds of tons of refined nickel produced yearly from these sources.

The possibility of the Germans obtaining nickel manufactured from Canadian ore is also strenuously denied by Hon. G. Howard Ferguson, Ontario Minister of Mines. He further states that the Provincial Government has in view the establishment of a nickel-refining industry, having secured patents for two processes, one of which is electric. A large sum of money has been spent by the government in testing these processes which, having been proved successful in the laboratory, are now being tested on a commercial scale.

The Mining News

ARIZONA

Cochise County

REPUBLIC (Johnson) Has installed Sullivan sharpener and Case oil forge for heating steel.

COPPER CHIEF (Johnson)—New 200-hp. oil-burning boiler and steam hoist being installed to supplant gasoline power, after which will increase output.

RED BIRD (Cochise)—Gold ore struck at 150 ft.; San Antonio men operating as Cochise Mining and Milling Co. have bonded mine and are working two shifts. Mine only 3 mi. from S. P. station.

Gila County

IRON CAP (Globe)—Struck good ore recently on 900-ft. level; ore heretofore came from 800-ft. level and up; enlarging surface equipment and Iron Cap shaft from collar to 600-ft. level.

INSPIRATION NEEDLES COPPER (Miami)—Grading roads for churn drill machines and erecting camp buildings. Hole No. 1 reported in ore for 55 ft.; pipe water from Southwestern Miami property for the churn drills. John S. Cook, of Nevada, interested. New York office, 110 Nassau St.

Mohave County

OATMAN CRESCENT (Oatman)—Tunnel now in over 200 ft.; making about 10 ft. daily.

TOM REED (Oatman)—Sinking both in Red Cloud and Grey Eagle shafts; last week 50 ft. was made. All 20 stamps again dropping, crushing 140 tons daily.

ARIZONA TOM REED (Oatman)—Drills will be added for sinking the main shaft, air for the drills being piped from the Oatman Pioneer. George Moser, superintendent.

BIG JIM (Oatman)—East drift on 400 level driven 57 ft. and west drift 31 ft.; the east drift on 500 level is 108 and west drift 37 ft. All reported in good ore. An average of $28.56 shown by 5-ft. samples in the 80 ft. of drifts on the 400 level.

CHLORIDE MINING (Chloride)—F. C. Smith has interested O. B. Willcox and associates, of 14 Wall St., New York, in development of this property; Hidden Treasure also included in the deal.

BLACK RANGE (Oatman)—Inclined shaft will be abandoned and new three-compartment shaft started 442 ft. northeast; expected to cut vein at 620 ft. The 60-hp. Western hoist will be moved to new site but compressors will remain at old shaft. A minimum of $4,000 per month is to be spent under new arrangement with E. McNeal & Co. Charles Arkins, consulting engineer.

Yavapai County

MINGUS COPPER (Jerome)—Will resume operations at once; W. W. Thomas, manager; situated in Copper Chief district.

STODDARD MILLING CO. (Stoddard)—Concrete walls and foundations for 100-ton flotation plant completed; 10 carloads machinery at Mayer. Expect to start mill early in August.

PITTSBURGH-JEROME (Jerome)—Building 2-mi. road to property; will install new compressor and other heavy machinery; electric power will supplant gasoline; 2-mi. transmission line will be built.

COMMERCIAL (Skull Valley)—W. Tovote, of Bisbee, representing the Phelps-Dodge interests, is examining property to ascertain advisability of constructing 6-mi. railroad from Skull Valley, and erecting leaching plant.

GREEN MONSTER (Jerome)—Preparing to sink two-compartment shaft 1,000 ft. on the Brad claim; will be equipped with electric hoist, compressor and 12 drills. The 3,000-ft. road for delivery of machinery to be completed by August.

CALIFORNIA

Amador County

TREASURE (Amador City)—New mill started first week in July.

KENNEDY (Jackson)—Preparing to sink the vertical shaft to the 4,400-ft point and to make a station at the 4,000 level.

PLYMOUTH CONSOLIDATED (Plymouth) — William Saraba, skip tender, was killed by falling into shaft on July 1.

ARGONAUT (Jackson)—Construction of new mill well under way. Old 40-stamp mill east of shaft will continue in steady operation, until part of old machinery is required in new plant.

CONSOLIDATED AMADOR (Sutter Creek)—Progress of 20 ft per day in unwatering and repairing Old Eureka shaft. Water now 240 ft below collar. Many shaft timbers found in excellent condition.

Butte County

MANGANESE DEPOSITS being actively prospected in vicinity of Clipper mills. At Binet property developing to open extension of the Bear Canon's orebody. A. A. Davis and T. F. Hornung have uncovered promising ore and are sinking a shaft High-grade ore shipped to Heroult electric smeltery in Shasta County.

Calaveras County

EASY BIRD (Mokelumne Hill)—Installing compressor and electric hoist; may erect [illegible]-ton electric-driven mill. Ore stated to average about $9 per ton. Three-compartment shaft contemplated. Now operated by Mokelumne Mines Co., controlled by Los Angeles men.

Inyo County

TUNGSTEN MINES ARE ACTIVE at Bishop. Tungsten Mines Co. milling plant rapidly nearing completion. Development recently disclosed additional ore deposits. Locomobile engine being installed on truck for hauling ore cars from the portal of the tunnel, a distance of 1,700 ft. to the mill. Standard company has its 50-ton mill completed and will increase it to 100 tons; bucket tramway will be installed.

CERRO GORDO (Keeler)—Will soon be shipping 500 tons per month. The 8-mi. aërial tramway delivering ore from the mine to Keeler is operating regularly. New assay offices being completed.

Kern County

RANDSBURG-ATOLIA TUNGSTEN PRODUCERS' ASSOCIATION, formed by owners and operators in Randsburg-Atolia districts, held second meeting July 1, and elected following officers and directors: P. J. Osdick, president; A. M. Sweeney, secretary; J. A. Waltman, Val Schmidt, U. S. G. Todd, W. L. Jones, Robert Gunderson, T. W. Sanborn, directors.

PAGE (Randsburg)—Property in Stringer district recently purchased by Roschl, Lawrence, Coleburn, Illingworth and Davis. Equipment of tanks, hoists, ore bins, etc., being installed. Reported that gravel carries from 5 to 100 lb. of high-grade tungsten concentrates to the ton and $10 to $20 in gold. Will be worked through large sluice box; fines amalgamated. Water will be furnished from 21,000-gal. tanks filled from water cars on the Osdick siding. There are 5 full claims and a fraction. Bedrock at 5 to 20 ft.

Shasta County

MOUNTAIN COPPER (Keswick)—Three men killed and three injured by explosion of acetylene welding apparatus.

Sierra County

PLUMBAGO (Alleghany)—Another bonanza strike reported. Five stamps being added to 20-stamp mill. W. B. Pearson, superintendent.

SOVEREIGN (Sierra City)—Bonded to Lowe and Mitchell, of Denver; developing in Nevada tunnel, and overhauling machinery. G. D. Bodfish in charge.

ROCK CREEK (Downieville)—Long payshoot showing free gold ready for stoping. Ten-stamp mill and rock crusher being installed. Dolan & Bell, own and operate.

MORNING GLORY (Alleghany)—More bonanza ore encountered; reserves being increased. Air compressor, hoist and five-stamp mill to be installed. John Marthaler, superintendent.

MONARCH (Sierra City)—Purchased Ladies Cañon gravel mine, crossed by Monarch ledge, and will run lower tunnel to tap, 150 ft. below bottom of present shaft. D. McGonigal, manager.

COLORADO

Boulder County

LUCKIE 2 TUNGSTEN CO. (Boulder)—Completed its 30-ton concentrating mill, July 1.

SUN TUNGSTEN MINING CO. (Boulder)—New organization will operate the Lucille properties.

U. S. TUNGSTEN CO. (Boulder)—Has acquired holdings of Colorado Tungsten Co., including mill at Nederland.

TUNGSTEN METALS CORPORATION (Boulder)—Developing the Red Sign No. 2 and Ferberite properties. Mill under construction.

TUNGSTEN GIRL MINING CO. (Ward)—Organized by Joseph Conners and associates of Denver to take over Blue Bird and Burnt Mountain properties near Ward.

BOULDER-GILPIN TUNGSTEN MINING CO. (Boulder)—Has acquired 100 acres; operations will be carried on through Walter shaft. N. H. Brown, general manager.

EAGLE ROCK TUNGSTEN PRODUCTION CO. (Eagle Rock)—Mill being increased to 75 tons and will handle custom ore. Developing 150 acres of company ground.

GRIMM MILL (Boulder Cañon)—New 40-ton mill being built by S. A. Grimm and son at God Cliff; cost, $10,000. Mill will be operated by electricity and will treat ore from Chappell and neighboring properties.

DEGGE-CLARK MILL (Boulder Cañon)—About 30 men at work completing this 100-ton plant. Mill bins holding 400 tons now full of ore. Company owns the Brace tungsten tract of 320 acres in Beaver Creek district where 12 sets of lessees are at work.

VICTOR TUNGSTEN CO. (Nederland) — Developing property adjoining the Wolf Tongue. Drifting on vein at depth of 125 ft. Hoisting and compressor equipment will be installed capable of sinking to 1,000 ft. M. B. Rapp, of Cripple Creek, general manager.

PRIMOS (Lakewood)—Many leasers and prospectors have left recently on account of the relatively low price of tungsten. About 200 men are still at work on leases in and about the company's properties. Many of these are working over old dumps. New set of rolls being installed in Lakewood plant to replace some of the stamps.

CARIBOU MINES & MILLS CO. (Cardinal)—About 60 men are at work, two shifts being worked at mine and three in mill. Many surface improvements recently made, including new assay office and bunkhouse. The 1,000-ft. shaft is equipped with a 75-hp. electric hoist· surface bins have capacity of 350 tons. A 100-hp. compressor supplies air for drilling. Ore treated at 125-ton mill now running at capacity. Milling equipment includes a 10x16-in. Blake crusher, 16x36-in. rolls, one 6-ft. Hardinge mill, one 4.5-ft. Hardinge mill, one 5x5-ft. regrinding mill, classifiers, six concentrating tables, and a two-unit 12-cell flotation plant.

Park County

HOCK HOCKING (Alma)—A 10-stamp mill is being erected. George W. Logan, Denver, principal owner.

San Juan County

SHIPMENTS of crude ore and concentrates from Silverton during month of June were: Sunnyside, 42 cars; S. D. & G. Lease, 16; Gold King, 14; Iowa Tiger, 13; Dives Leasing Co., 10; Kittimac, 3; Davey Leasing Co., 3; North Star, 2; St. Paul, 2; Big Giant, Dora, Sultana, and Andrew Jackson Lease, 1 car each; miscellaneous, 5; total, 114 cars.

BIG GIANT (Silverton)—Ore treated in Contention mill.

GALENA MOUNTAIN GOLD AND SILVER CO. (Silverton)—Development to be resumed.

KITTIMAC (Eureka)—Forest fire destroyed five towers of tramway, resulting in shut down of about two weeks in mill.

HAMLET (Silverton)—New mill nearing completion; will contain flotation and electrostatic zinc-separating equipment.

Summit County

MUDDY (Breckenridge)—This Galena Gulch mine bonded by Kansas City men.

GOVERNOR (Breckenridge)—Reopening this old silver mine on upper Blue River, 8 mi. south of Breckenridge. Concentrating plant at mine.

DUNKIN (Breckenridge)—Lessees shipped 27 tons to Globe smelting plant, Denver, netting $30,000. Free gold in coarse flakes is found in mine; separated and shipped to mint.

Teller County

AJAX (Victor)—During June ten sets of lessees produced 586 tons; average value $18. Experiments in flotation in progress at mill.

ANNIE P. MINING CO. (Victor)—Developing First Chance property on Mineral Hill. Steam hoist installed. Seepage water is being bailed from shaft.

EL PASO (Victor)—Lessees opened new orebodies in old workings near surface. Daily production varies from 65 to 100 tons, value from $20 to $30 a ton.

ROSE NICHOL (Victor)—Ed Gaylord and associates have five-year lease; main shaft and adjacent workings cleared of tailings, which ran in from the Victor mill, and active development resumed.

GOLD SOVEREIGN (Victor)—First shipment of bullion made from Reed mill on the Dante. Now treating from 45 to 50 tons daily of dump ore from Gold Sovereign mine; ore averages from $3 to $4 a ton; estimate 90% saving.

PUZZLE (Cripple Creek)—This property on western slope of Gold Hill being developed through Ophelia tunnel by Thomas Tibbetts, of Cripple Creek. Drifting on 3-ft. vein containing 10-in. streak running about 1 oz. gold, 10 oz. silver and 12% lead.

IDAHO

Shoshone County

NATIONAL COPPER MINING CO. (Mullan)—Ore too low grade to pay. Mine and mill closed. Charles McKinnis, Wallace, secretary.

STEWART (Kellogg)—Company doubled capital stock on July 8 and will explore other fields, local mine being practically exhausted. Two properties in Nevada, examined by Supt. William A. Beaudry, will probably be taken over. Three Idaho properties now being examined.

GEORGIA

MARIETTA MINING CO. (Marietta)—Incorporated by Houston & Liggett, of Lewisburg, Tenn., to operate pyrite deposit near here. Equipment for 50-ton operation purchased from Allis-Chalmers Manufacturing Co. of Milwaukee, Wis.

MICHIGAN

Iron

PURITAN (Ironwood)—New steel headframe to be erected. New idlers also to be put in. Shaft house will be 90 ft. high; American Bridge Co. has contract.

HOLMES (Ishpeming)—Foundations being put in for steel headframe, 142 ft. high, highest in district. There will be two crushers; now on ground. Shaft now down over 500 ft.; will go to 950 ft.

DOBER (Iron River)—Residents have protested to Oliver Iron Mining Co. about fumes from sulphide fire burning underground for several months. It has been decided to flood the workings; ditch being dug to mine from Iron River.

ASHLAND (Ironwood)—Mining will be discontinued in a few weeks. Deposits are about worked out. Effort to locate more ore unsuccessfull so far. About 250 men working. Has been producing, with only a few stops, since 1884. Operated by Hayes Bros.

HANOUSEK (Wakefield)—Stripping completed across one 40-acre tract. About 900,000 tons of overburden removed; 315-ton Bucyrus shovel being used. Shovel works on face 40 ft. high; can work up to 50 ft.; loads cars on tracks 40 ft. above level of steam-shovel track. Some ore may be shipped this year.

MINNESOTA

Mesabi Range

HILL (Marble)—Three shovels engaged in this openpit development.

HOLMAN (Taconite)—Drainage shaft now nearing completion. Two shovels stripping.

ARCTURUS (Marble)—One shovel stripping at this mine. Less work than was carried on last winter.

JUDD (Holman)—This small openpit property shipped 50,000 tons this season but is now closed.

TROUT LAKE CONCENTRATOR (Coleraine)—This Oliver washery is operating four units on day shift and two at night—about 60% of capacity. The five units are capable of handling 40,000 tons in 24 hr.

CANISTEO (Coleraine)—Stripping at east side of pit. Four shovels mining ore, largely of wash quality. Pit about 3,400 ft. long by 2,500 ft. across; greatest depth, 225 ft. Mine one of largest producers on the Mesabi.

MISSOURI

MISSISSIPPI VALLEY IRON CO. (St. Louis)—Has completed its blast furnace at Broadway and Soper St. and 100,000 tons of Mesabi ore is being received pending shipments from company's mines at Waukon, Iowa. Docks at foot of Kansas St. About 500 men employed.

Joplin District

CAVE-IN at Babcock mine on July 17 imprisoned four men, 40 ft. from shaft, for about 40 hr.

AT PEACOCK CAMP dike completed, protecting against floods, 1,200 ft. in length, 15 ft. high. New mill of Childress & Sheldon well under way. Three centrifugal pumps have drained water to depth of 80 ft.

MARY C (Prosperity)—New mill of Breigel-Conklin interests started.

WALKER (Commerce, Okla.)—New mill about completed. Ore from 142 to 160 ft.

MAHATMA (Prosperity)—New mill started by Hornbrook & Federman. Ore from 40 to 200 ft. Upper level being worked first.

MERCHANTS (Commerce, Okla.)—Two good drill strikes on Jarrett land, 4 mi. north. Second hole showed over 70 ft. of ore.

CUMBERLAND (Prosperity)—Record for mill building made by F. C. Wallower in this plant, which replaces one burned in May. Mill erected and started in 39 days. Capacity 500 tons per 10-hr. shift. Twelve slime tables. Electrically operated throughout.

MONTANA

Fergus County

BARNES KING (Kendall)—June report states little gold was produced due to shutdowns, necessary to prepare for increased output. At North Moccasin, plant was closed from June 15 to July 1; during first half of June treated 945 tons of ore, yielding $7,800 or $8.25 per ton. At Piegan-Gloster, in Lewis and Clark County, mill operated eight days and shut down without a cleanup; 700 tons treated. At Shannon mine, delay caused by bad weather and slow delivery of construction material. At Woodrow Wilson in Rimini district, 105 ft. of tunnels were driven.

Silver Bow County

EAST BUTTE (Butte)—Pushing development work on 1,800; will sink to the 2,000 level. High-grade ore on 1,500 level; average ore from mine now about 4% copper.

BUTTE & ZENITH CITY (Butte)—Shaft now down 830 ft. but going rather slowly owing to hard rock. Company expects to reach 1,000-ft. level in three months. Pump installed at 800-ft. level.

BUTTE & BACORN (Butte)—Will install new steam hoisting plant for depth of 1,500 ft., and two boilers of 150 hp. capacity each. Calumet shaft will be sunk from 1,000- to 1,500-ft. level.

DAVIS-DALY (Butte)—New hoisting engine for Colorado mine on its way to Butte; of Nordberg type, able to hoist from depth of 4,000 ft. with capacity of over 1,000 tons in 16 hr. from that depth. Management expects to have engine in operation by September.

NORTH BUTTE (Butte)—June production largest in past year. With both Granite-Mountain and Speculator shafts in use total tonnage for month was 44,136 tons, about 1,500 tons per day. Realized 2,096,326 lb. copper, 90,713 oz. silver and 142.23 oz. gold.

ANACONDA (Butte)—Heavy rains reduced deliveries to Great Falls reduction plant in June, making total output of company fall 1,900,000 lb. below May production. Total June output was 28,100,000 lb. Nettie mine in extreme western section of Butte camp shipping about 50 tons daily of rich silver ore from 500 level; carries some zinc; between 20,000 and 40,000 tons blocked out. Company has let contract for sinking Nettie shaft from 500 to 1,500 level.

BUTTE & SUPERIOR MINING CO. (Butte)—June output slightly less than in May; milled 52,600 tons from which 14,400 tons of zinc concentrates and 540 tons of lead concentrates were secured. Zinc realized amounted to 15,200,000 lb.; recovery approximately 91%. Silver production 310,000 oz. A verdict for $177,704 in favor of Elm Orlu Mining Co. against Butte & Superior was rendered July 2 by Federal Judge Bourquin for ore taken by Butte & Superior from Elm Orlu ground prior to starting suit.

NEVADA

Esmeralda County

MUCKING CONTEST at Goldfield, July 4 and 5, was won by Finnish shovelers. Two tons of assorted rock, ranging in size from 3 to 6 in. in diameter, was placed in a box 6 ft. long by 30 in. deep by 30 in. wide. Shoveler was thus compelled to begin on top of pile and in most cases nearly two-thirds of the rock was removed before bottom was uncovered enough to permit the use of a square-pointed shovel. Twenty-four entries competed for the prizes of $100, $50 and $25, the winning time being 19 min. and 51 sec., just 3 min. better than second place and 10 min. less than the slowest time.

Humboldt County

RAGGED TOP MINES (Jessup)—Tungsten property in Trinity Mountains about 20 miles south of Lovelocks; 35 men employed. Shipping about 20 tons per day to leased mill in Utah where test is being made to determine equipment for local plant.

ROCHESTER MINES (Rochester)—Has resumed sinking Codd winze; south drift on West vein still in ore; in north-end workings good results continue to be obtained. Work begun on foundations for machinery doubling capacity of mill.

SEVEN TROUGHS COALITION (Seven Troughs)—Breaking 8 in .of high-grade ore in north drift on 1,660-ft. or "1700" level; in south drift shoot is low grade. New Chicago Pneumatic 395-cu.ft. air compressor now being installed will double air supply and expedite development planned.

Lincoln County

PRINCE CONSOLIDATED (Pioche)—Shipping about 65 cars per week.

CONSOLIDATED NEVADA-UTAH (Pioche)—Mill operating regularly at capacity of about 60 tons per day; mainly on dump material. New crosscut started from 1,400-ft. level, No. 1 shaft, to prospect west of Black Ledge winze.

Nye County

TONOPAH ORE PRODUCTION for week ended July 8 was 8,038 tons, valued at $170,764, compared with 9,043 tons for week previous. Producers were: Tonopah Extension, 2,200 tons; Tonopah Belmont, 2,115; Tonopah Mining, 2,000; West End, 605; Jim Butler, 600; Halifax, 181; Rescue-Eula, 159; miscellaneous, 126 tons.

WEST END (Tonopah)—On July 3, Supreme Court of Nevada affirmed decision of lower court in the "apex" suit in favor of this company; suit was brought by the Jim Butler.

CALIFORNIA-TONOPAH (Tonopah)—Tonopah Mining Co., which has been actively developing property since December, has relinquished option. Some ore shipped from above 300-ft. level.

Storey County

ALPHA AND EXCHEQUER (Virginia)—On 200 level, Imperial shaft, extracted 34 cars low-grade ore.

ANDES (Virginia)—Saved 16 cars of ore from development on 350 level; completed a run of 140 tons of ore at the Kinkead mill.

MEXICAN (Virginia)—South drift from west crosscut advanced 10 ft., face in porphyry. Alterations continued in winze station on 2,700 level. Mexican mill received 392 tons custom ore, averaging $36.43 per ton.

CROWN POINT-BELCHER (Gold Hill)—Prospecting continued on 300 level; 46 cars of ore saved. Electric equipment from lower levels taken to the surface and being overhauled. Repairs made to Jacket shaft and incline. Jacket mill received 790 tons dump rock.

UNION CON. (Virginia)—Ore extraction totaled 392 tons; value over $14,000. From 2,400 level 207 tons, $50.06; 2,500 level 64 tons, $18.70, and 120 tons, $14.51. Reopened northeast drift, 2,500 level, 50 ft. Repairs continued in Sierra Nevada-Union 2,500-2,900 winze. Union shaft reopened from 143-ft. point to 155-ft. point below 2,500 level and repairs continued to 2,400 and 2,500 stations.

PENNSYLVANIA

BETHLEHEM STEEL (South Bethlehem)—New appropriation of $70,000,000 for enlargement of plants, during next three years, expected to be applied mainly to Sparrows Point, Md., Steelton and South Bethlehem.

UTAH

Juab County

TINTIC SHIPMENTS for first six months of year amounted to 4,211 cars, estimated at 219,550 tons. During June there were shipped 1,069 cars.

CHIEF CONSOLIDATED (Eureka)—June shipments amounted to 221 cars.

IRON BLOSSOM (Silver City)—In June shipped 100 cars; net profit stated to have been $30,000. Approximately $325,000 in treasury.

TINTIC MILLING (Silver City)—Additional Holt-Dern roasters ordered will not be completed before 90 days, owing to manufacturing delays. Excavation finished and concrete work is in progress. Mill capacity at present 100 tons daily, with three Holt-Dern roasters; to be increased to 360 tons.

Salt Lake County

ORE HAULING IN BIG COTTONWOOD is to be done by five caterpillars and sixty trailers, in place of teams. The Cardiff will furnish most of the ore. Hauling is in charge of Abe Meeking, Jr., and C. S. Austin.

NEW UTAH BINGHAM (Bingham)—Marsden lease shipped 52 tons, averaging 13.7 oz. Ag, 36.9% Pb, 15.6 SiO_2, 14.6 S and 15.3 Fe; average value, $16.72; treatment cost, $5.44; freight and hauling, $2; net returns, less sampling, $38.15 per ton.

SOUTH HECLA (Alta)—Dividend No. 1 of 15c. a share, amounting to $10,000, has been declared payable Aug. 10, and a good surplus remains in the treasury. During the last two weeks in June approximately 700 tons of ore, valued at $15,000, was shipped.

UTAH COPPER (Bingham)—Production and earnings for the first six months of 1916 amounted to 85,000,000 lb. and $17,250,000, as compared to $6,525,000 for the first half of 1915. A new record of production was made on July 9 when 44,000 tons of ore was handled in 24 hr., as well as 25,000 tons of overburden. June production is estimated at 17,500,000 lb. or greater.

Summit County

PARK CITY SHIPMENTS for June amounted to 8,714 tons. Those for the week ended July 7 were 1,229 tons, as compared with 1,413 tons the week preceding, the falling off having been due to the Fourth of July holiday.

DALY-JUDGE EXTENSION (Park City)—Gasoline hoist to be installed preparatory to beginning work.

DALY (Park City)—Shipments are being made both by company and lessees. Including latter there are about 70 men employed.

SILVER KING CONSOLIDATED (Park City)—Preliminary work begun on 14,000-ft. tunnel to prospect Thaynes Cañon section of property. Preparations being made to install new machinery in recently purchased Grasselli mill. Flotation as well as regular concentrating equipment will be used. Most of material for the 10,000-ft. aërial tramway is delivered.

WASHINGTON

Stevens County

WALTER J. NICHOLLS and associates of Spokane have acquired a group of claims on Gladstone Mountain, adjoining the Electric Point lead mine, near Northport.

ELECTRIC POINT (Northport)—A motor truck and 30 horses being used to transport ore to railroad at Boundary. Trail smelting plant has offered to take 100 tons daily if carbonate and galena are kept separate. No. 2 chimney proving better than the first.

CANADA

Ontario

RED JACKET (Cobalt)—Long idle; now being dewatered.

MALOUF (Sesekinika)—Half interest sold to Boston Creek operators.

TRETHEWEY (Cobalt)—Shipped two cars concentrates, first since mine was closed two years ago.

COBALT GEM—Company being wound up. Tenders asked up to July 21 for sale or lease of property.

TEMISKAMING (Cobalt)—A 14-in. vein, being opened on 500 level, is stated to carry 8,000-oz. ore.

ADANAC (Cobalt)—Control sold to Larkins and Sangster, of St. Catherines, Ont., and Buffalo, N. Y.

LAKE SHORE (Kirkland Lake)—Mine shut down to install larger plant. Rich ore in the new shoot on 300 level.

SYLVANITE (Kirkland Lake)—One of properties tied up in litigation is expected to resume work. New directors elected

DOME LAKE (Porcupine)—Will again increase capital to pay off debt and enlarge mill. Developments stated to be satisfactory.

NIPISSING—During June $294,669 worth of ore was mined and bullion shipments from Nipissing and customs ore were estimated at $193,403.

RELIANCE (Cobalt)—Option held by the Peterson Lake will not be exercised. Some high-grade ore discovered but occurrence was spotty.

SCHUMACHER (Porcupine)—Net profits in June, $8,793; highest yet made. Reserves estimated at 64,900 tons, averaging $6. Costs for June were $3.80 a ton.

AUGARITA (Porcupine)—Recently organized to operate properties in Dome section. Has let contract for diamond drilling. Main vein stripped for 1,700 ft. William G. Barney in charge.

DOME MINES (Porcupine)—June production $179,000 from 36,700 tons of ore—an average recovery of $4.88. Operating costs $2.62 a ton. Record production in July expected, crushing capacity having been increased by new Hardinge mills.

INTERNATIONAL MOLYBDENUM (Renfrew)—Work begun on 100-ton molybdenum mill for the mines at Mount St. Patrick, Enterprise, Wakefield and Sudbury. Concentrates will for some time be sent to a refinery at Orillia, but as soon as electrical energy can be obtained, company will establish its own refinery.

HOLLINGER CONSOLIDATED (Porcupine)—Initial report since consolidation, period Jan. 1-June 16, shows profits of $1,261,900. Mill treated 263,356 tons, running 92.5% of possible time; average value of ore treated, $8.80 per ton; working cost, $3.36 per ton Considerable delay obtaining apparatus for mill extension and not yet been able to bring capacity up to 1,900 tons per day. Output not quite sufficient as yet to meet dividend requirement of consolidated companies.

MEXICO

Hidalgo

SANTA GERTRUDIS (Pachuca)—Crushed 22,432 tons in May; estimated profit, £15,000; April profit, £24,450.

Mexico

ESPERANZA (El Oro)—Profit in 1915 was £28,700, from treatment of 22,684 tons. Reserves Jan. 1, 1916, 156,000 tons, estimated to yield normally a profit of £109,000; tailings, 40,000 tons; estimated profit, £30,000. Milling started this year on small scale Apr. 22; foreign staff went to Mexico City during recent trouble, Mexican staff continuing to run mine and mill.

Sonora

CANANEA CONSOLIDATED (Cananea)—Remainder of American staff returned on July 17 and took charge of operations that had been continued by the native staff with only comparatively small curtailment of production, copper output for June being about 4,500,000 lb. Dynamite shipments passed when approved by President Wilson. Southern Pacific company has again taken charge of railroad.

PANAMA

SHIPMENT OF 1,000 TONS MANGANESE ORE recently made to New York from Madinga mine, Gulf of San Blas From development previously mentioned; inability to get ships caused suspension of operation.

AUSTRALIA

GOLD PRODUCTION in Queensland in May was 27,797 oz. fine, a decrease of 2,872 oz. from May, 1915. For five months ended May 31, it was 107,304 oz. in 1915, and 99,893 oz. in 1916; decrease, 7,411 oz. this year. Quarter ended Mar. 31 production of minerals other than gold and coal was valued at £495,523, an increase of £205,203 over 1915. Copper increased £191,502 and tin £11,878 in value.

RUSSIA

IRON MINING CONCESSION granted for opening of new iron mines in Krivoi-Rog district in South Russia, near Zelionaia on the Kharkoff-Nikolaieff R.R. Concession covers 16,000 acres and is for 24 years on a royalty 0.9 kopek per pood—about 17c. per short ton—of ore taken out; minimum rental, 6,000 rubles yearly.

The Market Report

Metal Markets

NEW YORK—July 19

Copper continued very dull, but both in lead and in spelter there was a good deal more activity than in the previous week, and in spelter there was a sharp rally in price.

Henry R. Merton & Co., Ltd., of London, issued the following circular under date of July 1: "We beg to inform you that the shares in our company which were hitherto held by German firms have now all been acquired by British subjects. Negotiations were authorized and entered into as long ago as July, 1915, but only came to a successful conclusion early in February of this year. The terms of the transaction were submitted to the Board of Tradè and High Court of Justice for their approval, which was granted. The company has altered its articles of association, which now contain very stringent provisions by virtue of which the company is now and will always remain under exclusively British control."

Copper, Tin, Lead 'and Zinc

Copper—On Thursday and Friday there were some fairly large sales of copper for export—September-October and September-November shipment—the business being taken at lower prices than had previously been quoted, but sellers welcomed the opportunity to do some business. Subsequent transactions, so far as reported to us, were small and quotations were more or less nominal. The noteworthy feature of the week was the request from a good many consumers for the deferral of shipment of copper bought for July and August delivery; or in the event of inability to arrange for postponement the offering of surplus copper for sale. The quantity of copper thus involved was considerable. Various reasons were assigned for this action, but the long and short of the matter was that several consumers had over-bought their July and August requirements. The readjustment of this condition naturally relieved the tension with respect to early deliveries from some selling quarters. On the other hand, in other quarters selling agencies found themselves still embarrassed in keeping up with their contracts. Consumers offered July-August copper at 24c., regular terms, but agencies were sellers at 23c. Transactions were light for the reason that nobody seemed to want early copper anyhow.

Copper Sheets are nominal at 37.5c. for hot rolled and 38.5c. for cold rolled. Copper wire is 29@30c. per lb. for large lots at mill.

Copper Exports from Baltimore for last week included 1,862,464 lb. copper and 351,573 lb. brass disks to Marseilles, France.

Visible Stocks of Copper in Europe on July 15 are reported as follows: Great Britain, 4,079; France, 3,385; afloat from Chile, 1,850; afloat from Australia, 3,500; total, 12,814 gross tons, or 28,703,660 lb. This is a decrease of 1,014 tons from the July 30 report.

Tin—This market was quiet, prices fluctuating from day to day in general conformity with the London market.

Tin Production covered by the statistics for the 12 months ended June 30, 1916, is estimated by Messrs. Ricard & Freiwald as follows: Straits, 64,531; Australia, 2,993; Banka and Billiton, 17,759; standard—chiefly Chinese—10,617; total, 95,900 long tons. Deliveries covered for the same period were: United States, 59,577; Great Britain, 19,071; Holland, 1,974; other Europe, 12,943; total, 93,565 long tons. These figures do not include South Africa, Nigeria, Bolivia or Cornwall.

Lead—A rather large business was reported—much larger than in the previous week—but conditions were considerably mixed. The price of the A. S. & R. Co. was undercut right along, and sellers who cut lost business to others who cut more. Missouri producers were cheap sellers. Late in the week the principal producer began to realize again its quoted price for desilverized lead.

The situation appears to be something like this: The statistical position is still excellent. Stocks are very low and are not accumulating, but producers are averse to allowing them to accumulate. Consequently, when buyers do not come forward, producers hunt them up and cut prices to get their business. On the other hand, when buyers are in need of lead for prompt delivery, or of a kind other than Missouri brands, they are likely to have to pay a stiffer price. This situation simply reflects the dearth of stocks on hand.

Sales during the last week comprised some large transactions for export, both to Canada and to Europe. The politicolabor trouble in Spain, of which news was received on Friday, was considered to be likely to interfere with the supply of Spanish lead, and this was viewed as a factor of great potential important in the market, it being regarded as unlikely that the Australian producers can fill the demand in the absence of the Spanish.

Spelter—With the beginning of our week of record this market was turned and a sharp rally ensued. When the price had fallen to about 8c., it was considered that the mar-

DAILY PRICES OF METALS IN NEW YORK

July	Sterling Exchange	Silver, Cts. per Oz.	Copper	Tin	Lead		Zinc
			Electrolytic, Cts. per Lb.	Spot, Cts. per Lb.	New York, Cts. per Lb.	St. Louis, Cts. per Lb.	St. Louis, Cts. per Lb.
13	4.7569	62⅞	22½ @23¼	39⅛	6.30 @6.40	6.12½ @6 25	8 00 @8 37½
14	4.7569	62⅝	22½ @23¼	38⅝	6.30 @6.40	6.12½ @6.25	8 12½ @8 50
15	4.7569	61⅞	22½ @23¼	38⅝	6 25 @6.35	6.05 @6.15	8 12½ @8 50
17	4 7569	62⅞	22½ @23¼	38¼	6 25 @6.35	6.05 @6.15	8.25 @8.75
18	4.7569	62⅜	22½ @23¼	37½	6 25 @6 50	6 12½ @6.25	8 37½ @8 87½
19	4 7575	62⅛	22½ @23¼	37½	6 25 @6.50	6 12½ @6.25	8.37½ @8.87½

The quotations herein are our appraisal of the average markets for copper, lead, spelter and tin based on wholesale contracts for the ordinary deliveries of the trade as made by producers and agencies; and represent, to the best of our judgment, the prevailing values of the metals, reduced to basis of New York, cash, except where St. Louis is given as the basing point. St. Louis and New York are normally quoted 0.17c. apart.

The quotations for electrolytic copper are for cakes, ingots and wirebars. Electrolytic copper is commonly sold at prices including delivery to the consumers and is subject to discounts, etc. The price quoted for copper on "regular terms" (r t.) is the gross price including freight to the buyer's works and is subject to a discount for cash. The difference between the price delivered and the New York cash equivalent is at present about 0.25c. on domestic business. The price of electrolytic cathodes is 0.05 to 0.10c. below that of electrolytic. Quotations for lead represent wholesale transactions in the open market for good ordinary brands. Quotations for spelter are for ordinary Prime Western brands. Only the St. Louis price is herein quoted, St. Louis being the basing market. We quote the New York price at 17c per 100 lb. above the St. Louis price.

Silver quotations are as reported by Handy & Harman and are in cents per troy ounce of silver bars 999 fine.

Some current freight rates on metals per 100 lb. are: St. Louis-New York 17c.; St. Louis-Chicago, 6.3c.; St. Louis-Pittsburgh, 13.1c.

LONDON

July	Silver	Copper				Tin		Lead		Zinc	
		Standard		Electrolytic							
		Spot	3 Mos.	£ per Ton	Cts. per Lb.	Spot	3 Mos.	£ per Ton	Cts. per Lb.	£ per Ton	Cts. per Lb.
13	30	90½	89	125	26 61	169¾	170¾	28¼	6.02	45¼	9 63
14	29⅞	91	89½	124½	26 45	169	169¾	28¼	6.02	47	10.01
15	29 9/16	.....	......	.....	......	....	...	....	......	.....	.
17	29 15/16	88	86½	122	25 98	166½	167¼	28¼	6 02	48	10 22
18	29¾	88	87	122	25 98	163½	164¼	28½	6.07	48	10 22
19	29⅝	89	87	122	25 98	163	163½	28½	6.07	50	10 65

The above table gives the closing quotations on London Metal Exchange All prices are in pounds sterling per ton of 2,240 lb., except silver which is in pence per troy ounce of sterling silver, 0.925 fine. Copper quotations are for standard copper, spot and three months, and for electrolytic, price for the latter being subject to 3 per cent discount. For convenience in comparison of London prices, in pounds sterling per 2,240 lb., with American prices in cents per pound the following approximate ratios are given, reckoning exchange at 4.80. £15 = 3.21c., £20 = 4.29c.; £30 = 6.43c.; £40 = 8.57c.; £60 = 12.85c. Variations, £1 = 0.21⅜c.

ket had become unduly depressed and support was given from powerful quarters. The advance was assisted by short covering and also by some buying from abroad. Some purchases were made also by domestic consumers, including galvanizers, but on the whole this business was not large. However, the aggregate of business of all kinds attained considerable proportions. With the advance in price producers who had previously been sellers withdrew and the market is now in the position of waiting to see if a more general buying movement will develop among consumers that will carry the advance further or at least hold prices where they are. At the close July spelter was quoted at about 8⅞c., August at about 8⅞c. and September at 8⅞@8⅝c. Producers continue to be sellers for delivery in the fourth quarter at relatively low prices. The market closed dull and barely steady.

It was reported on July 19 that Hayden, Stone & Co. had acquired a predominant interest in the American Zinc, Lead and Smelting Co., and that changes in the board of directors thereof would be announced in the course of a few days.

The United Zinc Smelting Corporation plans to erect a new smeltery on the Ohio River about 10 mi. from Wheeling. The first unit of the new plant will have capacity for smelting about 20,000 tons of ore per annum, producing about 8,500 tons of spelter. The plant will comprise a sulphuric acid department.

Zinc Sheets continue in good demand and firm. The price is unchanged, the base being $15 per 100 lb., f.o.b. Peru, Ill., less 8% discount.

Other Metals

NEW YORK—July 19

Aluminum has been rather more active, with moderate sales and more inquiry. Prices are a little firmer, the current quotation being 59@61c. per lb. for No. 1 ingots, New York.

Nickel—There is no change, demand for domestic use being about as usual, with some inquiries for export. Quotations are 45@50c. per lb. for ordinary forms, according to size and terms of order. Electrolytic nickel brings 5c. per lb. premium.

Antimony—One order for about 400 tons was reported placed by munition manufacturers, but in view of the large stock on hand this business did not relieve the market, which declined further. We quote 14¼@14¾c. for spot, and 12½c. in bond for shipment from China within 30 days.

Quicksilver—This market was dull and lower. We quote $80, New York. San Francisco reports by telegraph $80, market dull. London is unchanged at £17 10s.

Gold, Silver and Platinum

Silver—The market shows a slight sagging tendency owing to lack of inquiry on Eastern account. Supplies in London seem sufficient to meet current mintage orders without advancing price.

Mexican dollars were quoted in New York on July 13 at 48⅜@51⅜c.; July 14 at 48⅛@51⅛c.; July 15 at 47¾@57c.; July 17 at 48¼@52¼c.; July 18 at 48@52c.; July 19 at 47¾@52c. Pesos are not very plentiful just now.

Platinum—This market was quiet and but little changed. Early in the week sales at $62 were reported. At the close the quotation was $60. We quote $61 as the average for the week.

PLATTEVILLE, WIS.—July 15

The base price paid this week for zinc ore was $65@60 per ton 60% zinc for top grades down to $53 per ton for medium grades, assaying down to 50%. The base price paid for lead ore was $74 per ton for 80% ore.

SHIPMENTS, WEEK ENDED JULY 15

	Zinc Ore, Lb.	Lead Ore. Lb.	Sulphur Ore, Lb.
Week	5,490,000	130,000	966,300
Year	130,306,000	4,643,840	31,791,900

Shipped during week to separating plants, 5,086,000 lb. zinc ore.

JOPLIN MO.—July 15

Blende, high price, $77.30; per ton 60% zinc, premium ore, $75; medium, $70@60; low, $55. Calamine, per ton 40% zinc, $55@45; average selling price, all grades of zinc, $68.24 per ton. Lead, high price $77.70; base, $75 per ton 80% metal content; average selling price, all grades of lead, $73.20 per ton.

SHIPMENTS WEEK ENDED JULY 15

	Blende	Calamine	Lead	Values
Totals this week	11,061,6[illegible]	309,430	2,170,710	$467,460
Totals this year	382,4[illegible]	30,121,490	65,753,240	23,399,960

Blende value, the week, $38[illegible],330; 28 weeks, $19,416,950.

Calamine value, the week, $6,650; 28 weeks, $1,063,880.

Lead value the week, $79,480; 28 weeks, $2,919,130.

Another drop in production was made by closing down additional mines, and it is now under 7,000 tons per week. Sellers were seeking buyers this week at any price, and buying of grades free of lead was increased slightly, but the bulk of the purchasing agencies are on light buying orders, with representatives of the smaller smelters out of the market entirely. The bin stock, around 25,000 tons, prevents any hopes for an advancing ore market, even though spelter should become firmer.

OTHER ORES

Manganese Ore for 1917 delivery is held by Brazilian producers at 40c. per unit at port. At current rates of freight this is equal to about 75c. per unit at Baltimore or Philadelphia. Indian manganese ore has been offered at 70@72c. per unit at Atlantic ports.

Antimony Ore—Buyers are reluctant to enter into contracts except on the basis of the price for antimony metal during the month of delivery. The proposed ratio, however, makes it ultimately impossible to produce antimony ore in Bolivia and South America in general and no new business has been done from that quarter for some time.

Tungsten Ore—The ideas of buyers and sellers appear to be as far apart as they were last week, but sales effected enable the market to be more accurately gaged. A 20-ton lot was sold during the week at $27 per unit. There were bids for a 30-ton lot, besides some smaller lots, at $25, but those orders could not be executed, the sellers holding for higher prices. In all of these cases spot delivery was required. France is reported to be in the market for tungsten ore at about $20 per unit, and as the quantity wanted is believed to be considerable this underlying demand is regarded as likely to prevent prices from receding much further.

Iron Trade Review

NEW YORK—July 19

The only new business of any size during the week has been for export, no domestic orders of importance having come forward.

The only incident is the placing of large contracts by manufacturers of agricultural machinery. It is understood that most of these were taken at 2.35c. for bars and 2.50@2.60c. for small shapes. The contracts were hardly as large as usual at this season. It is understood that there were objections to the prices.

Structural steel is still rather backward and slow. New construction projects seem to be held back. Some large ones are under discussion, but have not reached the order stage.

Pig iron has been rather quiet, which seems unusual in view of the large output of steel. The most pressing demand just now is for bessemer pig for export. The right quality is scarce.

Iron and Steel Exports from the United States in May and the five months ended May 31 are valued by the Department of Commerce as below. The figures also include the tonnage of those commodities which are reported by weight:

	May		Five Months	
	1915	1916	1915	1916
Iron and steel, tonnage...	263,736	540,591	944,589	2,109,602
Machinery, value.... ...	$10,214,062	$21,984,961	$46,280,561	$84,025,614
Total value.....	$26,536,612	$72,918,913	$144,683,288	$431,839,320

The total value includes that of all iron and steel products. Imports of iron and steel in May so far as reported by tonnage were 28,917 tons in 1915 and 32,113 in 1916. For the five months ended May 31 they were 114,604 tons this year.

Exports from Baltimore for the week included 2,828,069 lb. steel bars and wire rods and 162,000 lb. tinplate to Great Britain; 16,977,025 lb. steel billets, 5,181,875 lb. steel bars to France; 3,533 long tons pig iron, 50 tons scrap and 1,235 tons barbed wire to Italy.

PITTSBURGH—July 18

There is a further curtailment in steel production on account of still hotter weather, some mill managers estimating their output in the past three or four days as fully 20% below the normal rating, entirely on account of the heat. The demand for steel is not correspondingly reduced and the pressure upon the mills is very heavy.

The steel market itself is still quieter, being practically stagnant. There is not the slightest weakness in the regular steel mill prices for forward deliveries, but if anything a trifle more strength and a stronger conviction that these prices will not yield at any time this year. Even in this dull market the mills are selling considerable steel, whereby it will take a long time to catch up with deliveries when they are already filled for months.

A feature of the steel market for two or three months past has been the decrease in premiums demanded for certain steel products for early delivery. The latest development is a stiffening in some of these premiums. Plates for early shipment, for instance, are stronger at 4.00c. than they were two or three weeks ago, and bars and shapes are not offered at base prices for as early deliveries as a month ago.

The export demand continues very heavy. There is constant inquiry for bessemer pig iron, while all unfinished steel offered, in the form of ingots, billets, sheet bars, etc., both soft steel and of shell quality, is eagerly bought up if the delivery is early enough. From neutral countries there is continued heavy demand for regular steel products.

Pig Iron—The market is stagnant, but with prices well maintained by furnaces. Bessemer iron is being sold almost daily for export, generally in lots of 1,000 to 5,000 tons, and sometimes higher than $21, Valley, is realized. Ella Furnace at West Middlesex went out of blast Friday through an accident, the bell dropping into the furnace. Struthers is not yet in, although expected by July 1. We quote: Bessemer, $21@21.50; basic, $18@18.25; foundry and malleable, $18.25@18.50; forge, $18@18.25, f.o.b. Valley furnaces, 95c. higher delivered Pittsburgh.

Steel—The market for unfinished steel continues strong and on the whole is stronger than a month or six weeks ago. The export demand is very heavy and prospects are that in the second half of this year considerably more than 1,000,000 tons will be exported, in soft steel and shell quality, in the form of ingots, blooms, billets and sheet bars. Domestic demand is light and is limited to very early deliveries, but it is hard to buy steel at any price. We quote soft steel at $42@43 for bessemer and $44@45 for openhearth, rods being $55@60 and forging billets $65@70 per ton.

FERROALLOYS

Ferromanganese—The market continues very quiet, with prompt at $200@225 and contract at $175. Earlier deliveries than formerly are offered at the contract price.

Production of Ferromanganese and Spiegel in the United States in the six months ended June 30 is estimated at 88 571 tons in 1915, and 184,434 tons in 1916; an increase of 95,863 tons this year.

Imports at Baltimore for the week included 1,832 tons ferromanganese from Liverpool.

Spiegeleisen continues in good demand but is more plentiful for early delivery. Quotations for ordinary 20% grade are $45@50 per ton at furnace.

Ferrosilicon continues steady at $83@85 per ton at furnace for 50% grade. Bessemer ferrosilicon ranges from $33 for 10% up to $43 for 16% per ton at furnace.

FOREIGN IRON

Italian Iron and Steel Imports in 1915 were 690,499 metric tons in 1915, against 669,412 tons in 1914 and 741,847 tons in 1913. The larger items in 1915 were 261,696 tons scrap, 240,365 tons pig iron, 72,391 tons bars and rods and 64,032 tons steel billets and blooms.

Pig-Iron Production in Germany in May is reported by the German Iron and Steel Union at 1,112,574 metric tons, being 38,868 tons more than in April and 126,606 tons more than in May, 1915. For the five months ended May 31 the total was 5,413,525 tons in 1916, against 4,540,841 tons in 1915 and 7,756,534 tons in 1914. The make this year was 69.8% of that in the first part of 1914, before the war began.

IRON ORE

Of the Lake iron ore shipments in June, 7,823,404 tons, or 82.3% of the total, went to Lake Erie ports. Receipts at South Chicago for the month were 1,180,368 tons; at Gary, 317,148 tons.

Shipments from Lake Erie docks to furnaces in June were 5,698,128 tons. Dock stocks of ore on July 1 were 3,983,197 tons, a decrease of 2,137,327 tons from last year.

Imports of iron ore in the United States in May were 148,599 gross tons, being 49,625 tons more than in May, 1915. For the five months ended May 31 the imports were 432,996 tons in 1915 and 501,873 tons in 1916; increase, 68,877 tons. Of the imports this year 277,126 tons, or about 55%, were from Cuba.

SAULT STE. MARIE CANALS

Freight pasing through the Sault Ste. Marie canals in June was 12,960,409 net tons. For the season to July 1 the total freight was: East bound, 21,978,577; west bound, 5,490,730; total, 27,469,307 tons, an increase of 10,325,173 tons over last year. The total number of vessel passages this year was 7,597, showing an average cargo of 3,616 tons. The mineral freights included in the totals were, in short tons except salt which is in barrels:

	1915	1916	Changes
Anthracite	678,852	616,558	D 62,294
Bituminous coal	3,022,437	4,372,197	I. 1,349,760
Iron ore	11,072,607	18,481,159	I. 7,408,552
Pig and manufactured iron	75,205	70,585	D. 4,620
Copper	43,272	30,807	D. 12,465
Salt, bbl.	232,173	288,090	I. 55,917

Of the vessels passing this year 1,981 went through the Canadian canal and 5,576 through the United States canal.

COKE

Coke production in the Connellsville region for the week is reported by the "Courier" at 359,330 net tons; shipments, 362,692 tons. Shipments of Greensburg and Upper Connellsville districts, 34,054 tons. Production was kept down by holidays and by the extreme head.

Coke production of the Connellsville region for the six months ended June 30 was 7,336,544 net tons in 1915, and 11,313,322 tons in 1916; an increase of 3,976,778 tons, or 54.2%, this year. The half year closed with practically no coke stocked.

Connellsville—Coke continues scarce, on account of production being curtailed by hot weather, and most operators and merchants are having some difficulty in maintaining full shipments under contract. Brokers have been buying spot furnace coke in a limited way, paying $2.65@2.75, while consumers art not in evidence. Production is expected to increase somewhat as the men become more accustomed to the heat, while within two or three months there will be additional byproduct capacity completed. We quote: Prompt furnace, $2.65@2.75; contract, $2.35@2.50; spot foundry, $3@3.25; contract, $3.25@3.50, per net ton at ovens.

Coal Production in Spain for the year ended Dec. 31 is reported as below, in metric tons:

	1914	1915	Changes
Bituminous coal	3,905,080	4,234,798	I. 329,718
Anthracite	228,302	252,483	I. 24,181
Lignite	309,473	347,072	I. 37,599
Total	4,442,855	4,834,353	I. 391,498

Imports—chiefly from Great Britain—were 2,875,763 tons in 1914, and 1,930,000 tons in 1915; a decrease of 945,763 tons.

Chemicals

NEW YORK—July 19

The usual midsummer dullness is on the general market and only moderate business is reported. There has been some reselling of speculative holdings of heavy chemicals, which has tended to demoralize the market.

Arsenic—Demand has been light but stocks are small and prices are fairly well maintained. Quotations are $6@6.25 per 100 lb., according to size and terms of order.

Copper Sulphate—Demand has been on a small scale and prices are again weaker. Quotations are $9@10 per 100 lb. for large lots. There are reports of lower prices made on speculative holdings, but they are not verified.

Magnesite—Imports at Baltimore for the week included 900 tons magnesite from Port Spain.

Nitrate of Soda—Advices from South America report that prices there are weak, owing to heavy stocks and trouble about securing vessels. The market here has been rather quiet but firm, and a fair business has been done at $3.05@3.10 per 100 lb. for both spot and future.

Sulphate of Ammonia—Demand is not active and the market holds at about $3.40 per 100 lb. for domestic. Imports have been light. The production of sulphate of ammonia in the United States in 1915 was 220,000 short tons.

Sulphuric Acid—The market has been easy owing to increased offers, but prices are steady, 60-deg. acid selling at $20 per ton at works, and 66-deg. acid at $35 per ton for spot.

PETROLEUM

The Interior Department has approved the new leases of the Osage Indian oil lands in Oklahoma as recently put up at auction. Under the terms of the new leases the Osages will receive in royalties one-sixth of the output from wells producing less than 100 bbl. per day, and one-fifth that from wells flowing over 100 bbl.; also a rental of $1 per acre yearly on undeveloped land. Sales at auction of about 15,000 acres of producing lands formerly leased to operators realized about $3,233,000 in addition to the royalties.

New gas leases have also been made, covering about 900,000 acres. Under the old leases the rental was $100 yearly for each producing well. Under the new leases the royalty is 3c. per 1,000 cu.ft., which will produce a much higher rental.

Assessments

Company	Delinq	Sale	Amt.
Algomah, Mich	May 18		$1 00
Blue Bell, Ida	July 8	Aug. 5	0 002
Bullion, Ida	July 10	July 31	0 01
Cedar Creek, Ida.	July 5	Aug. 5	0 01
Clear Grit, Ida	Aug. 7	Aug. 25	0 002
Columbus Ext., Utah	July 13	Aug. 8	0 02
Cons. Imperial, Nev	July 18	Aug. 10	0 01
Cons. Virginia, Nev.	July 27	Aug. 07	0.05
Crackerjack, Nev	July 3	Aug. 1	0 01
Four Timbers, Ida.	July 26	Aug. 26	0.002
Friend, Ida	June 30	July 20	0 002
Gold Mt. Champion, Utah	July 20	Aug. 10	0 0025
Gould & Curry, Nev.	July 14	Aug. 3	0 03
Great Western, Nev	July 24	Aug. 15	0.005
Hope, Calif	July 17	Aug. 14	0 01
Hugo, Ida	July 29	Aug. 30	0 002
Independence, Ida	July 8	July 29	0 001
Iron Spar, Ida	July 17	Aug. 15	0 003
Jack Waite, Ida	July 27	Aug. 28	0 01
Kewanas Reor., Nev	Aug. 2	Sept. 6	0 01
Lucky Calumet, Ida	July 20	Aug. 21	0 005
Morgan Argentine, Utah.	July 15	Aug. 5	0.01
Nevada-Douglas, Nev.	July 15	Aug. 16	0.10
North Lake, Mich.	June 14	....	1 00
Old Veteran, Ida	July 8	Aug. 5	0 002
Sierra Nevada, Nev	July 11	Aug. 3	0 10
Silver Moon, Ida.	July 8	Aug. 3	0 005
Silver Pick, Nev	July 5	Aug. 14	0.01
Southern Swansea, Utah	July 17	Aug. 5	0 001
Spearhead Reor., Nev.	July 3	Aug. 3	0 01
Sunrise, Ida	July 27	Aug. 28	0 002
Swansea Ext., Utah	July 10	Aug. 1	0 0025
Tar Baby, Utah	Aug. 3	Sept. 4	0 01
Tarbox, Mont	July 25	Aug. 12	0.005
Tiberius, Ida	July 8	Aug. 1	0 001
Tintic Central, Utah	July 12	Aug. 8	0 005
Ton. Gypsy Queen, Nev	July 11	Aug. 15	0 01
Uvada, Nev	June 24	July 27	0 02
Victoria, Utah	July 8	Aug. 2	0 005
Wallace, Ida	June 29	July 29	0.0025
Wasatch-Utah, Utah	June 19	July 22	0.0025
West Mercur, Utah	July 8	July 31	0.025
Wolf Mt. Copper, Utah	Aug. 2	Sept. 6	0.005

Stock Quotations

SAN FRANCISCO Name of Comp.	July 18 Bid.
Alta	.05
Andes	.11
Best & Belcher	.05
Bullion	.02
Caledonia	‡ 44
Challenge Con.	.05
Confidence	18
Cons. Imperial	‡ 01
Con. Virginia	.08
Gould & Curry	.03
Hale & Norcross	.07
Jacket-Cr. Pt.	.02
Mexican	.15
Occidental	.70
Ophir	22
Overman	.05
Savage	.05
Seg Belcher	02
Sierra Nevada	.31
Union Con.	71
Utah Con.	.01
Belmont	4 00
Jim Butler	85
MacNamara	.04
Midway	.19
Mont.-Tonopah	25
North Star	.12
Rescue Eula	.25
West End Con.	.90
Atlanta	10
Blue Bell	.01
Booth	14
C.O.D. Con	02
Comb. Frac	06
D'field B.B.	.02
D'field Daisy	02
Jumbo Extension	76
Pitts.-Silver Peak	06
Round Mountain	50
Sandstorm Kendall	03
Silver Pick	10
Central Eureka	10
Argo	.07
Ariz. Central	13
Big Jim.	67½
Lazy Boy	10
Oatman No. Star.	‡ 17
Tom Reed	1 60
United Eastern	3 50
United Western	09

SALT LAKE Name of Comp.	July 18 Bid.
Alta Con.	35
Black Jack	05
Colorado Mining	17
Crown Point	.04½
Daly-Judge	7 05
Emma Cop.	43
Gold Chain	24
Grand Central	62
Iron Blossom	1 50
Lower Mammoth	04
May Day	12½
Opohongo	01½
Prince Con.	1 30
Seven Troughs	02½
Silver King Coal'n	3 02½
Silver King Con.	3 25
Sioux Con.	10
Uncle Sam	06
Yankee	20

COLO. SPRINGS	July 18
Acacia	02¾
Doctor Jack Pot	08½
Elkton Con.	15
El Paso	.75
Findlay	03½
Gold Sovereign	03½
Golden Cycle	2 07
Granite	64
Isabella	.17½
Jack Pot	05
Jerry Johnson	04½
Mary McKinney	30
Portland	1 67½
Vindicator	2 00

LONDON	July 6
Alaska Tre'dwell	£5 17 6
Burma Corp.	3 1 3
Cam & Motor	0 14 3
Camp Bird	0 9 3
El Oro	0 9 6
Esperanza	0 11 0
Mexico Mines	4 0 0
Nechi, pfd.	0 14 9
Oroville	0 17 6
Santa Gert'dis	0 14 0
Tomboy	1 3 0

TORONTO	July 18
Adanac	1 85
Bailey	06
Chambers Ferland	20
Coniagas	4 50
La Rose	56
Peterson Lake	22
Right of Way	03
Seneca Superior	35
T. & Hudson Bay	50 00
Temiskaming	52
Trethewey	‡ 21
Wettlaufer-Lor	12
Dome Exten	24
Dome Lake	31
Foley O'Brien	50
Hollinger	29 00
Imperial	‡ 03
Jupiter	27
McIntyre	1 4[illegible]
Porcu Crown	68½
Preston E. D.	‡ 03
Vipond	40
West Dome	.34

N. Y. EXCH. Name of Comp.	July 18 Clg.
Alaska Gold M.	18
Alaska Juneau	8
Am.Sm.&Ref.,com	92½
Am. Sm. & Ref., pf.	110
Am. Sm. Sec., pf. A	93
Am. Sm. Sec., pf. B	85
Am. Zinc	32½
Am. Zinc, pf.	62
Anaconda	78½
Batopilas Min.	1½
Bethlehem Steel	435
Bethlehem Steel, pf.	130
Butte & Superior	65
Chile Cop.	20
Chino	46⅞
Colo. Fuel & Iron	42½
Crucible Steel	66
Dome Mines	25⅞
Federal M. & S.	12
Federal M. & S., pf.	38
Great Nor., ore ctf.	34½
Greene Cananea.	46
Homestake	130
Inspiration Con.	47¼
International Nickel	44¼
Kennecott	45½
Lackawanna Steel	68½
Miami Copper.	34½
Nat'l Lead, com.	63½
National Lead, pf.	113¾
Nev. Consol.	16
Ontario Min	6⅞
Quicksilver	2¼
Quicksilver, pf	4½
Ray Con.	21⅞
Republic I&S, com.	43⅞
Republic I&S, pf.	108
Sloss-Sheffield	39½
Sloss-Sheffield, pf.	94½
Tennessee Copper.	24⅞
Utah Copper	75⅞
U. S. Steel, com	84⅞
U. S. Steel, pf.	117⅞
Va. Iron C. & C.	40

N. Y. CURB	July 18
Beaver Con.	36
Buffalo Mines	.80
Butte & N. Y.	1¼
Butte C. & Z.	4⅞
Caledonia	.66
Can. Cop. Corpn.	1⅞
Cashboy	.05
Cerro de Pasco	35
Con. Ariz. Sm.	1 3/16
Con. Coppermines.	2½
Con. Nev.-Utah	5/16
Crystal Cop.	.90
First Nat. Cop.	4¼
Florence	.45
Goldfield Con.	.88
Goldfield Merger	.09
Granite	28
Hecla Min.	5 1/16
Howe Sound	4⅛
Jerome Verde	1 5/16
Joplin Ore & Spel.	2⅞
Kerr Lake	4¼
Magma	13⅞
Majestic	⅞
McKinley-Dar-Sa	.55
Mother Lode	.27½
Nevada Hills	.15
N. Y. & Hond.	15¾
Nipissing Mines	6¾
Oro	.04
Ray Hercules	3⅞
Rochester Mines	.57
St. Joseph Lead	14¾
Standard S. L.	1½
Stewart	.25
Success	.58
Tonopah	5⅞
Tonopah Ex.	5¾
Tribullion	5/16
United Zinc	6½
White Knob, pf.	1½
Yukon Gold	2¼

BOSTON EXCH Name of Comp.	July 18 Bid
Adventure	2½
Ahmeek	92
Algomah	1⅞
Allouez	57½
Ariz. Com., ctfs.	8⅞
Bonanza	.25
Butte-Ballaklava	2
Calumet & Ariz.	66⅞
Calumet & Hecla	515
Centennial	13½
Copper Range	55½
Daly West	2½
East Butte	11½
Franklin	6¼
Granby	81
Hancock	11
Helvetia	.20
Indiana	2¼
Island Cr'k, com.	45
Island Cr'k, pfd.	88
Isle Royale	25
Keweenaw	3¾
Lake	11
La Salle	‡1
Mason Valley	1½
Mass.	11½
Mayflower	2½
Michigan	2½
Mohawk	80¼
New Arcadian	5½
New Idria	‡11½
North Butte	20½
North Lake	1½
Ojibway	75
Old Colony	1½
Old Dominion	61
Osceola	80
Quincy	82
St. Mary's M. L.	72
Santa Fe	1½
Shannon	7½
Shattuck-Ariz.	25
So. Lake	4¾
So. Utah	.16
Superior	12½
Superior & Bost.	3⅞
Tamarack	38
Trinity	4½
Tuolumne	.37
U. S. Smelting	67¾
U. S. Smelt'g, pf.	49¾
Utah Apex	3¾
Utah Con	12¾
Utah Metal	6⅞
Victoria	3
Winona	4½
Wolverine	48
Wyandot	1½

BOSTON CURB	July 18
Bingham Mines	9¾
Boston Ely	1 1/16
Boston & Mont.	96
Butte & Lon'n Dev.	.67
Calaveras	4½
Calumet-Corbin	.03
Chief Con.	1½
Cortez	.40
Crown Reserve	.50
Davis-Daly	1⅞
Eagle & Blue Bell.	1⅞
Houghton Copper	1⅞
Iron Cap Cop., pf.	5½
Mexican Metals	.23
Mines of America.	2⅞
Mojave Tungsten	4
Nat. Zinc & Lead	1¼
Nevada-Douglas	1
New Baltic	1⅞
New Cornelia	12¾
Ohio Copper	.10
Oneco	80
Raven Copper	.05
Rex Cons.	.18½
Rilla	.23
United Verde Ext.	28½

‡Last Quotations.

Monthly Average Prices of Metals

SILVER

Month	New York 1914	New York 1915	New York 1916	London 1914	London 1915	London 1916
January	56 572	48 855	56.775	26.553	22.731	26 960
February	57.506	48.477	56.755	26.573	22.753	26 975
March	58 067	50 241	57 935	26 788	23 708	27 597
April	58 519	50 250	64 415	26.958	23.709	30.662
May	58.175	49 915	74.269	26.704	23.570	35.477
June	56.471	49.034	65 024	25.948	23.267	31 060
July	54 678	47.519	...	25.219	22.697	......
August	54 344	47.163	...	25.979	22.780	......
September	53 290	48.680		24.260	23.591	
October	50.654	49.385	......	23 199	23 925	......
November	49 082	51.714	......	22.703	25.094	......
December	49.375	54 971	......	22.900	26.373	......
Year	54.811	49 684	......	25.314	23.675	......

New York quotations cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

COPPER

Month	New York Electrolytic 1915	New York Electrolytic 1916	London Standard 1915	London Standard 1916	London Electrolytic 1915	London Electrolytic 1916
Jan.	13 641	24.008	60.756	88 083	65 719	116 167
Feb.	14 394	26.440	63 494	102 667	*	133.167
Mar.	14.787	26.310	66.152	107.714	*	136.000
April	16.811	27 895	75.096	124 319	*	137 389
May	18.506	28.625	77.600	135 457	*	152.522
June	19.477	26 601	82 574	112 432	95.333	137 455
July	18.796	......	76 011	......	91.409	......
Aug.	16.941	......	68.673	......	82.333	......
Sept.	17.502	......	68.915	......	85.250	......
Oct.	17 686	......	72.601	......	88 000	......
Nov.	18 627	......	77.744	......	93.273	......
Dec.	20.133	......	80 773	......	100 43	......
Year	17 275	......	72 532	......	......	......

TIN

Month	New York 1915	New York 1916	London 1915	London 1916
January	34 260	41 825	156.550	175.548
February	37 415	42.717	176.925	181.107
March	48.426	50.741	180.141	193.609
April	47.884	51.230	166.225	199.736
May	38.790	49 125	162.675	196.511
June	40 288	42 231	167.636	179 466
July	37.423	......	167 080	......
August	34 389	......	151.440	......
September	33 125	......	152.625	......
October	33 080	......	151.554	......
November	39.224	......	167.670	......
December	38 779	......	167.000	......
Av. year	38.596	......	163.960	......

LEAD

Month	New York 1915	New York 1916	St. Louis 1915	St. Louis 1916	London 1915	London 1916
January	3.729	5 921	3.548	5.826	18.606	31.167
February	3.827	6.246	3.718	6.164	19.122	31.988
March	4.053	7.136	3.997	7.375	21.883	34.440
April	4.221	7.630	4.142	7.655	21.094	34 368
May	4 274	7 463	4.182	7 332	20.347	32 967
June	5.932	6 936	5.836	6 749	25.170	31 011
July	5 659	......	5.531	......	24.611	......
August	4 656	......	4.520	......	21.946	......
September	4 610	......	4.490	......	23.151	......
October	4 600	......	4.499	......	23.994	......
November	5.155	......	5 078	......	26.278	......
December	5.355	......	5.266	......	28.807	......
Year	4.673	......	4.567	......	22 917	......

SPELTER

Month	New York 1915	New York 1916	St. Louis 1915	St. Louis 1916	London 1915	London 1916
Jan.	6.386	16.915	6.211	16.745	30.844	89.810
Feb.	8.436	18.420	8.255	18.260	39.819	97 762
Mar.	8.541	16.846	8.360	16.676	44.141	95 048
April	10 012	16.695	9.837	16.525	49.888	99.056
May	14.781	14.276	14.610	14.106	68.100	94 217
June	21.208	11.752	21.038	11 582	100 614	68 591
July	19.026	......	18 856	......	97.250	......
Aug.	12.781	......	12.611	......	67.786	......
Sept.	13.440	......	13.270	......	67 841	......
Oct.	12.800	......	12.596	......	66 536	......
Nov.	15.962	......	15.792	......	88 409	......
Dec.	15.391	......	15.221	......	89 400	......
Year	13.230	......	13 054	......	67.553	......

New York and St. Louis quotations, cents per pound. London, pounds sterling per long ton. * Not reported.

PIG IRON IN PITTSBURGH

Month	Bessemer‡ 1915	Bessemer‡ 1916	Basic‡ 1915	Basic‡ 1916	No. 2 Foundry 1915	No. 2 Foundry 1916
January	$14.59	$21.60	$13.45	$18 78	$13.90	$19.70
February	14.55	21.16	13.45	18.93	13.90	19.51
March	14 55	21.81	13.45	19.20	13.95	19.45
April	14 55	21 65	13.45	18 95	13.95	19.45
May	14 61	21.78	13.60	19.11	13 83	19 58
June	14 70	21 95	13.67	18.95	13.77	19 34
July	14 94	......	13.91	......	13 68	......
August	16.01	......	15.31	......	14 75	......
September	16.86	......	15.95	......	15.70	......
October	16.95	......	15.96	......	15.80	......
November	17 57	......	16.47	......	17 20	......
December	19.97	......	18 44	......	18.95	......
Year	$15.82	......	$14 76	......	$14.95	......

‡As reported by W. P. Snyder & Co.

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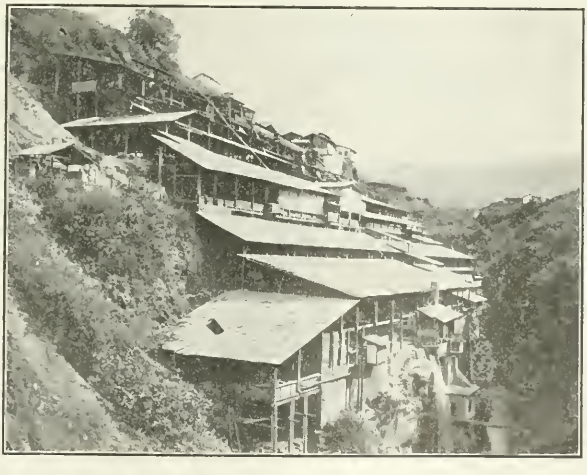
The Gold Mines of Brazil

By Benjamin Le Roy Miller* and Joseph T. Singewald, Jr.†

SYNOPSIS—Brazil has two remarkable gold mines, but generally speaking, gold mining has received little development. Placers received first attention when Portuguese opened the country, but are of little importance today. Morro Velho mine of St. John del Rey Mining Co. is the world's deepest gold mine and the oldest now in operation on Western Hemisphere.

The great country of Brazil, where gold mining has been carried on continuously for over 200 years and where gold has been found in every one of the states comprising the republic is not particularly known for its mineral wealth. Notwithstanding its inferiority in comparison with some of the other countries of South America, where more mines have been worked, Brazil is of peculiar interest to the mining profession because of some most unusual gold mines which it possesses. It can lay claim to the oldest gold mine now in operation in the Western Hemisphere, the deepest mine in the world and two of the best-managed gold mines to be found anywhere. The gold deposits of Brazil belong to the two major classes—alluvial, or placer, deposits and lodes. As is true in practically every country of the world where gold has been obtained, the placers of Brazil received first attention and evidently were worked in a primitive manner by the aborigines who were found in possession of the country by the earliest Portuguese explorers. The Portuguese early began their search for gold, but not until the last years of the Seventeenth Century did they discover the rich alluvial deposits in what is now the state of Minas Geraes, the chief mining state of Brazil.


PASSAGEM MILL OF OURO PRETO GOLD MINES OF BRAZIL, LTD.

Placer mining was extensively carried on for many years, but was gradually superseded by lode mining. Small placer operations still continue; several companies during the last few years have investigated the placers of the Jequitinhonha River, and two dredges have been operated there but without success. While placer mining in a small way will undoubtedly be carried on for many years to come, conditions do not appear very favorable for large operations.

Placer mining was followed by the working of the *jacutinga* ores, which consist of layers of loose flakes of specular hematite and quartz containing thin veins of gold. By hydraulic methods much work of this kind was done. Along many streams, especially near Cattas Altas, deposits of the specular hematite waste 15 to 20 ft. in thickness cover many acres. Mines of this character were of such low grade that they could be worked with profit only where water could be brought economically to the site of the working. In places these old abandoned ditches winding among the hills are many miles in length. Ordinary quartz-vein lodes were later worked in many places, but especially near Diamantina and in the vicinity of Ouro Preto. In most cases the mines were continued until considerable water was encountered, when they were abandoned. Several mining men are confident that some of these old mines might be reopened and worked with profit, yet the capital necessary for such work is not forthcoming although on a small scale some of these quartz lodes are now worked intermittently.

At present, however, gold mining in Brazil is practically confined to two operations—the Morro Velho and the Passagem mines, both in the state of Minas Geraes. These mines have produced an enormous amount of gold and seem to have many years of prosperity ahead of them. In a country as large as Brazil, with gold found in hundreds of places, it seems strange that only two important deposits should be known and it is to be expected that systematic search may result in the discovery of other deposits equally rich. At present, however, one might well profit by the experiences of numerous saddened individuals and not place too much reliance in some of the glowing accounts of the wonderful opportunities for gold mining in Brazil.

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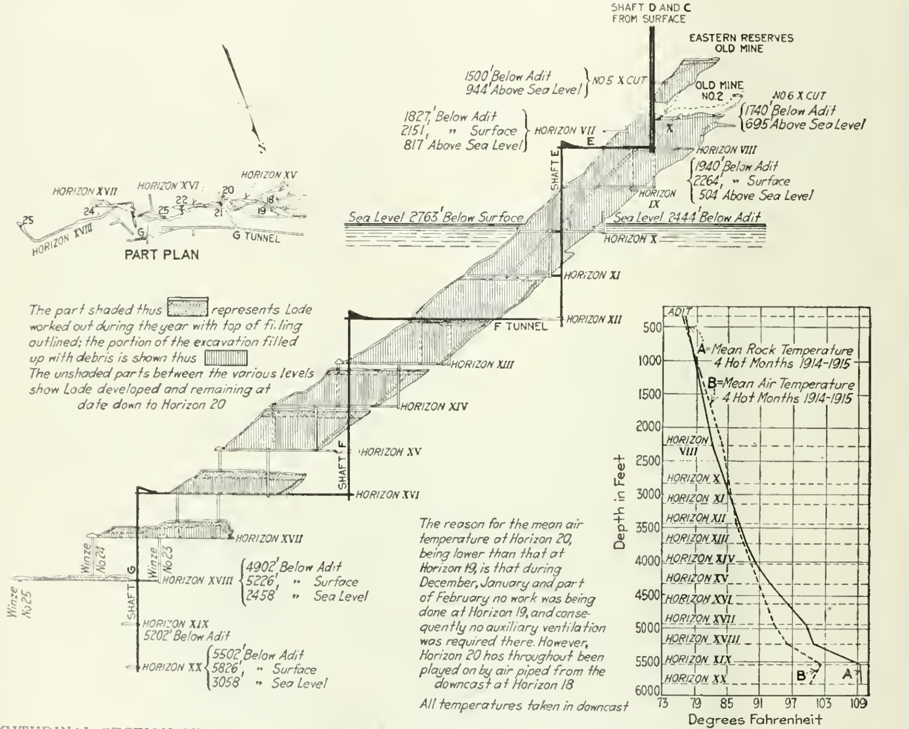
*Professor of geology, Lehigh University, South Bethlehem, Penn.

†Associate in economic geology, Johns Hopkins University, Baltimore, Md.

MORRO VELHO—THE WORLD'S DEEPEST GOLD MINE

The Morro Velho mine of the St. John del Rey Mining Co., at Villa Nova de Lima in the State of Minas Geraes, is the most interesting mine in all South America and in some respects one of the most remarkable in the world. The company is the oldest registered English mining company, having been organized in 1830 for working a gold mine in Brazil. In 1834 the company acquired its present property, the Morro Velho mine, which, with few interruptions, has been operated ever since.



LONGITUDINAL SECTION OF MORRO VELHO MINE OF ST. JOHN DEL REY MINING CO. ALSO TEMPERATURE CHART, AT THE RIGHT

At present the mine claims the world's record for depth, the deepest workings being 5,826 ft. below the surface, and the end is not yet, as plans are now being prepared to sink another shaft 1,200 ft. below the present lowest level. George Chalmers, the able and optimistic mine superintendent, who has been in charge for 32 years and is mainly responsible for the great success of the company, states in his last annual report that "it appears that at any rate (of temperature increase) supposing the lode continues the same in size and value to horizon 26 (a vertical depth of 7,626 ft.), it could be worked profitably to that point and even to a much greater depth." The persistence of the orebody and the absence of any material change in the tenor of the ores with depth are of especial interest, as both are in disagreement with ideas commonly held by mining men.

Leaving Rio de Janeiro on the Central R.R. at 7 p.m. we reached Raposos station the next morning. There we transferred to the narrow-gage trolley line, 8 km. in length, built by the mining company, and in half an hour reached the mine. Although the mine staff consists almost entirely of Englishmen, some Brazilian customs have been adopted and after meeting our hosts we were accordingly asked to partake of black Brazilian coffee before going to visit about the property.

No one can visit the Morro Velho without being impressed with the order and neat appearance of the plant. Situated in a hilly region at an elevation of 2,774 ft. above sea level, with surrounding hills considerably higher and the steep slopes covered with tropical vegetation, the whole effect is most pleasing. One is reminded of Grass Valley, Calif., the most beautiful mining camp in the United States, although there are many important differences. While the shrubs and small trees covering the slopes make a pleasing setting to the camp, they are to be avoided as much as possible, as they harbor the tiny pestiferous *garrapatos* (a species of ticks), which are so poisonous to most persons that a high fever may result from the bites of a number of them. Other insects that burrow beneath the toenails of the workmen, whence they are extracted with difficulty, and still others that lay their eggs beneath the skin, where the grub feeds upon the tissues, make one think at times that tropical scenery and physical comforts are incompatible and it would be well to sacrifice the former for the latter. The insect pests do not confine their attention to the workmen, but also ravage their houses. Only recently the Casa Grande and company offices had to be repaired at the cost of about $5,000 because of the white ants having eaten the heart of the supporting timbers until only shells remained, although to all outside appearances the supports were perfectly sound.

Vein Dips at 45° and Gold Occurs Chiefly with Arsenopyrite

The country rocks of the Morro Velho region consist of calcareous schists which have been greatly sheared in places with the development of considerable mica and chlorite. The orebody, which is lenticular in a vertical direction, dips into the earth at an angle of about 45°. The accompanying longitudinal section shows a side view of the workable parts of the vein. The vein, however, continues farther but becomes too narrow to be worked profitably. The average width of the orebody is 10 to 12 ft., with a maximum width of 33 ft. In certain places it has been found profitable to follow the vein until the width decreases to 1 ft. The stope length throughout most of the mine is about 600 ft., but in the recently opened levels is almost 1,000 ft. While the orebody is, in the main, approximately vertical, there are occasional irregularities, and at certain places a vertical cross-section would appear much like the letter S.

There is no gouge present, and the schistosity of the rocks being parallel to the orebody although away from the vein, the strike of the country rocks is quite different in direction, indicating that the region suffered greatly by compression after the deposition of the ore.

The orebody consists mainly of quartz, siderite, dolomite, calcite, forming the gangue materials and containing the sulphides—pyrrhotite, pyrite, arsenopyrite and a small amount of chalcopyrite. The arsenopyrite carries most of the gold; free gold is rarely seen. Bands of quartz with practically no sulphides are sometimes found.

Mine Now Worked Through Series of Shafts and Adits

In the early operations of the mine the opencut mining method was employed and the walls were supported by heavy timbers. With increasing depth it became more difficult to support the walls, and after a serious fall of rock which closed the mine for some time, two parallel shafts were sunk in the country rock near the vein. From the bottom of these shafts a cross tunnel was run to intersect the vein some distance below the old workings. An adit strikes these shafts 324 ft. from the surface. As shown in the longitudinal section, in order to reach the bottom of the mine, one goes through the adit to Shafts *C* and *D* and then descends in a vertical shaft 1,940 ft. to Horizon 8. Passing through Tunnel *E* about 500 ft. to the top of Shaft *E*, which is 1,160 ft. deep, one descends to Horizon 12. In succession, through Tunnel *F*, Shaft *F*, Tunnel *G* and Shaft *G*, Horizon 20, which is 5,826 ft. below the surface, is finally reached. Every 300 ft. drifts are run to the orebody. When we visited the mine, the drifts at Horizons 19 and 20 had not yet reached the orebody. It is expected that ore will be taken from Horizon 19 by June, 1916, and from Horizon 20 in April, 1917.

The ore as mined is brought to the surface at once, as it has been found that the contact of the surface air fanned into the mine for ventilation quickly oxidizes the broken ore with the formation of sulphuric acid and consequently more cyanide is required in the treatment of the ore. The pressure in the deeper horizons that are now being worked is so great that the stopes must be filled at once. Formerly the mill tailings were used for filling, but as considerable heat was generated in the oxidation of the pyrite which continued after the refuse had been returned to the mine, it became necessary to use other material. Rock quarried near the mouth of the mine is now used for this purpose.

Hydraulic winding engines are used in Shafts *C* and *D*, but below are engines driven by compressed air. About 30 mules are used in the mine, but as the mortality among these animals is in some years as great as 50% and besides in the hot mine the conditions are less sanitary because of them, it is planned to substitute accumulator electric locomotives made by the General Electric Co.

The men employed in the mine are native Brazilians, mixtures of the aboriginal Indians, the negroes brought from Africa as slaves, and the Portuguese. As there are practically no race distinctions in Brazil except in some of the larger cities, the three races have intermarried to a greater extent than in any other country in the Western Hemisphere. In general the laborers are both lazy and inefficient, and in addition the supply was decidedly deficient until the European War caused the cessation of railroad building throughout the country. To remedy this condition the company tried the experiment of importing some Japanese workmen a few years ago, but this proved to be a failure, as the men soon deserted in spite of the fact that the company employed all possible means to make them comfortable. On an average there are about 2,500 natives employed by the company, and they are paid about $1 a day for ordinary work. The men working on the surface receive less; some women employed at the picking tables receive about 25c. a day.

In the upper levels there was considerable water, but in the lower workings it is necessary to sprinkle the passageways to keep down the dust. The dust from the drills has had some effect in causing lung trouble among the workmen, but by no means to the same extent that it has on the Rand.

Ventilation Now One of the Chief Problems

One of the most interesting problems that the company has had to solve is that of ventilation. With increasing depth the mine has continually grown hotter, although fortunately at a rate lower than that prevailing in some parts of the world. The average rate of increase is about 1° F. for every 125 ft. of increase in depth. Nevertheless, at this comparatively low rate, in the lowest workings the temperature of the rocks is 110° F. and the air pumped from the surface is slightly more than 100° F. The workmen are covered with perspiration all the time they are in the mine, and it has become apparent that their efficiency is reduced. Up to the present the air driven into the mine by Sirocco fans has been the ordinary air of the surface. During the hot months of December, January, February and March this air has a temperature above 70° F. at the surface. As it is forced into the mine, it increases in temperature, owing to compression, at the approximate rate of 1° F. for every 180 ft. increase in depth and consequently is very hot when it reaches the bottom of the mine, and its cooling effect upon the workmen is mainly due to the evaporation of the perspiration. At times, however, the humidity of the air before being fanned into the mine is high and the evaporation of the water used to sprinkle the mine further increases the humidity until its cooling effect is greatly reduced. As the air is forced to the bottom of the mine directly and then rises through the upper levels, the hottest stopes are those a short distance above the lowest workings.

For some time the company has been working on a system for cooling and drying the air before introducing it into the mine, and no doubt this will soon be in operation.

In his latest report Mr. Chalmers states: "There are many other causes for increase in temperature in the mine—those due to the friction of the air, heat from machinery, lights, decomposition of mineral, heat from the bodies of men and animals, etc.—but the heating effect from the rock and that due to the compressing of the atmosphere as it descends into depth are, in the case of this mine, the most serious, and it is evident that unless the air as it enters the mine is made considerably cooler than the average surface temperature, it would in descending into depth arrive at a point below the present bottom, where its temperature would not allow men to work."

ORE CYANIDED AFTER MECHANICAL CONCENTRATION

The ore treatment is divided into two parts—the mechanical, where concentrating tables are used, and the chemical, or cyanide, treatment. Only the mechanical concentration will be described.

The ore is brought out through an adit 324 ft. below the mouth of the surface shaft and taken up an incline to the mill. It first passes through a Blake crusher and then over a trommel with 3-in. openings. The oversize goes to a revolving circular picking table where women pick out the pieces of country rock. The ore left on the table passes through a smaller Blake crusher and joins the undersize of the trommel. It is then fed automatically to the stamps. There are one hundred and twenty 750-lb. and ten 1,200-lb. stamps. The feed of the stamps is 8 or 9 of clear water to 1 of rock, and the drop of the stamps is 9 in. The stamp pulp passes through 60-mesh phosphor-bronze screens and thence to three-deck canvas tables.

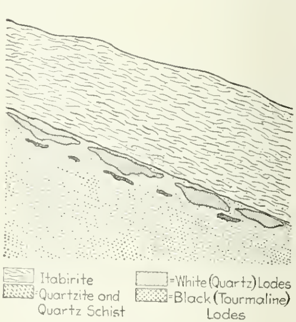
There are 46 tables in this first line, the tailings from these going to the tube mills while the concentrates are further treated on 36 tables on the second line, where again the tailings go to tube mills and the concentrates to 10 more tables in the same line. The concentrates from the 10 tables pass over four other tables in the third line. From the canvas tables about 70% of the gold is recovered. The tables are cleaned by being tipped to a vertical position and automatically washed by sprayers that travel across the rows of tables from one end to the other every half-hour.

Before going to the tube mills, the tailings from the tables pass through conical separators, the overflow going directly to the cyanide plant and the settlings to the mills for further grinding. In the tube mills the company has recently substituted for the foreign flint pebbles, formerly used, some extremely hard low-grade gold ore from its Cuiabá mine on the Santa Barbara branch of the Central R.R. The ore is partly ground in a rough tube mill at Cuiabá, where there is available power, and in that way a freight saving is effected.

HYDRO-ELECTRIC POWER ESSENTIAL

The power used by the company is hydro-electric, obtained from the Rio de Peixe, which supplies about 3,500 hp. During the dry months some auxiliary steam and gas power is required. During the last few years the rainfall has been inadequate, the total for the year ended February, 1915, being only 42.54 in., while the average since 1875 was 65.34 in. This reduction, coupled with the necessity of additional power on account of the increased depth of the mine, will shortly compel the company to build another hydro-electric plant along the same river. As all the coal consumed must be brought from England or the United States at great expense, the company must continue to rely almost exclusively on water power.

During the year ended Feb. 28, 1915, there was a total of 199,234 tons of ore mined; 4.11% was rejected and 191,500 tons crushed. The gold and silver from this was sold in London for $2,215,805, an average of $11.57 per ton of material milled. The profits amounted to $700,287. At that time the ore reserves totaled 699,704 tons, a supply sufficient for 3½ years' work. When the tunnels being driven at Horizons 19 and 20 reach the orebody, an approximately equal amount of reserves will be added, so that the mine bids fair to continue its long and prosperous career for years to come.



GEOLOGIC SECTION AT PASSAGEM MINE

The Passagem mine of the Ouro Preto Gold Mines of Brazil, Ltd., is about 8 mi. east of Ouro Preto and a few miles from Mt. Itacolumi, from which the name itacolumite (flexible sandstone) has been derived. Incidentally, it is interesting to know that North Carolina produces finer specimens of itacolumite than can be obtained at the type locality.

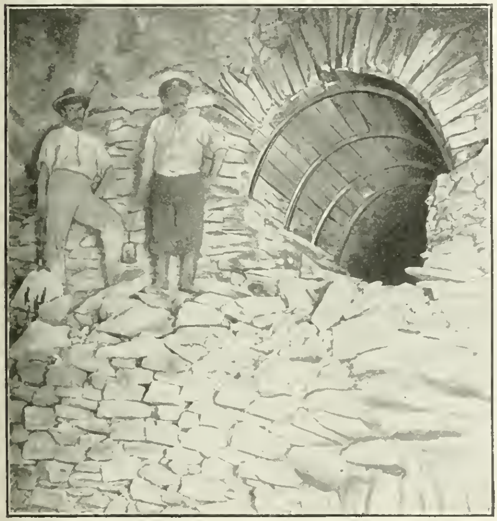
The town of Passagem has a population of about 3,000, all dependent upon the mine. About the mining property the superintendent, Arthur J. Bensusan, has directed and encouraged the planting of flowers of all kinds, and few places can boast of such magnificent roses, fuchsias and poinsettias.

The Passagem mine is the second gold mine in Brazil in importance and, like the Morro Velho, is very old, yet shows little indication of approaching exhaustion. Baron von Eschwege, a Prussian mining engineer who was employed by the Portuguese government to investigate the gold mines of Brazil, opened the Passagem mine in 1817 and, it is said, installed there the first stamps used in that country.

The country rocks of the region consist of quartz schists or quartzites overlain by itabirite, a rock consisting of alternating laminæ of specular hematite and fine quartz sand. In places the itabirite consists of loose flakes of specular hematite (*jacutinga*), while the same formation a few miles distant contains extensive deposits of high-grade iron ore that have recently attracted the attention of the world.

Ouro Preto Works Two Lodes, Separated Usually by Several Feet of Barren Quartzite

The ore horizon is found at the contact of the quartzite and itabirite and dips to the southeast at varying angles, but in most places from 15° to 20°. The lodes are of two kinds: Close to the contact are the white lodes, consisting mainly of a white-quartz gangue, while below these are the black lodes, containing principally black tourmaline. The white lodes are practically continuous and lie in the quartzite close to the itabirite, separated from it by a thin layer of altered itabirite ranging in thickness up to 18 in. This band of altered rock is known as *guia* (guide rock). The lodes are irregular, varying in thickness up to 36 ft. and extending through two or three levels in certain parts of the mine. The gold is irregularly distributed throughout the quartz, occurring in dark streaks or patches associated with tourmaline, pyrrhotite and arsenopyrite. The gold is principally in the arsenopyrite as in the case of the Morro Velho mine.



ROCK WORK AT PASSAGEM MINE

The black lodes consist mainly of black tourmaline, pyrrhotite and arsenopyrite, with some quartz. These lodes are smaller, seldom more than 3 ft. in thickness, and are found beneath the white lodes. In places the two lodes are in contact, but in most instances several feet of barren quartzite separate them. The black lodes are much richer, but the expense involved in searching for them and their small size decrease their importance.

The ore as taken from the mine averages about $7 a ton. Occasionally ore running only $5 a ton is removed, but this is only done when it is obtained with little additional expense while driving levels and stopes.

At the 920-m. level a pocket of ore containing about $2.50 a ton was recently found in the overlying itabirite, which is of considerable interest, as previously no gold had been found in that rock by the present company. However, in the early days considerable mining was done in the itabirite in this vicinity, as shown by the extensive dumps.

Much cyanite is found in the quartzite a short distance below the black lodes, but no gold. When the cyanite is encountered, no further search is made for ore. However, near Ouro Preto, a few miles distant, numerous quartz veins have been worked in that rock.

The ores have been formed by ascending highly heated waters that replaced the quartzite, and in places one can see the lines of stratification passing from the quartzite into the orebodies, both the black and also the white lodes. The presence of some minerals commonly found in pegmatites indicates that the veins are, in part, at least, of a pegmatitic character and somewhat different from the ordinary quartz veins. There is no doubt of the continuity of the orebodies to depths below the levels now being worked.

At the 770-m. level a disturbed zone has been encountered that in direction corresponds with a prominent valley that cuts across the country. There are here numerous folds and a few small faults, so that it is difficult to keep the inclined shaft in the foot wall a short distance beneath the orebodies except by occasional changes in slope. The value of the ore in the disturbed area is lower on account of much rock being mixed with it.

Mine Opened Through Three Inclined Shafts

The mine is worked by means of three inclined shafts that start at the mill and diverge underground. Crosscuts from the shafts are driven, keeping near the contact of the quartzite and itabirite. When ore worth stoping is encountered, a 6-ft. slice is taken above the drift level and the old openings are filled as the work advances. Practically no timber is used in the mine; the *guia* forms a good roof in most places, but where it is broken through the itabirite scales off badly. The rock used for filling consists of the quartzite in part obtained in running drifts in search of the black lodes. The quartzite breaks readily into thin slabs well adapted for the construction of retaining walls and arches, such as shown in an accompanying illustration. In the upper levels there is some water, but this is carried out through a tunnel into the deep gorge that cuts through the property.

The gently inclined shafts, following the orebodies and approximately parallel with the slope of the hill, have been extended so far from the mill that a vertical shaft has recently been sunk which strikes the ore horizon at a depth of about 200 m.

The power for mine and mill is supplied from the Carmo River. During the dry season the supply is inadequate so that a new hydro-electric plant is in process of construction a short distance below the mill. A ditch and tunnel are being excavated along the side of the stream through which the water will be diverted and a 120-ft. fall obtained that will furnish an addition of 500 hp. to that already possessed.

The mill is picturesquely situated along one side of the gorge of the Carmo River, which Doctor Derby has likened to Watkins Glen. The lower part of the mill almost fills the gorge, and as it is extended, as it will be soon, it will entirely bridge the river.

No new features are involved in the mill. After passing across a picking table, where about 10% is rejected, the remaining ore is passed over a grizzly with 2-in. openings. The oversize passes through a Blake crusher and then, joining the undersize from the grizzly, is fed to the stamps. The pulp from the stamps passes over blankets 4 ft. long and 20 in. wide, where much of the coarser sulphides and gold is collected. At intervals the flow of pulp is shut off while boys replace the old blankets with clean ones. The further mechanical treatment consists of passing the material over vanners where fine sulphides and gold are collected. The final process of gold recovery is by cyanidation.

The production figures for 1914 are the latest available. During that year there was a total of 80,138 tons of ore treated in the mill from which 27,085 oz. of gold were recovered. This bullion sold for $556,800, an average of a little less than $7 per ton of ore milled. The reserves on Dec. 31, 1914, were 112,678 tons.

Decision on Extralateral Rights

By Arthur L. H. Street*

To the body of mining law the Montana Supreme Court lately added an instructive discussion of the history of extralateral mining rights, at the same time making clearer the rules which are to determine conflicting claims to orebodies in that state. The opinion appears in the case of Anaconda Copper Mining Co. vs. Pilot-Butte Mining Co., 156 Pacific Reporter, 409.

After declaring that the effect of Sec. 2322 of the United States Revised Statutes is such that discovery upon a vein of ore which cuts at least one of the parallel end lines of a claim and has its apex within the surface lines of the claim extended downward vertically gives to the locator exclusive possession of the surface and of all veins, lodes and ledges therein throughout their entire depth, although such veins, lodes or ledges so far depart from a perpendicular in their course downward as to extend outside the vertical side lines of such location, the court says:

> The common law would give to each of these claims all orebodies beneath its surface. The right which a locator has to follow his vein on its dip beneath the surface of another claim is purely of statutory origin. The statute is but the outgrowth of mining rules and regulations in force in California, Nevada and other Western territory before the Congress enacted the first statute in 1866; and these rules and regulations were largely the result of the application to existing conditions of the Spanish ordinances in force in Mexico, with possibly some ideas borrowed from the customs of the High Peak of Derbyshire and the laws of Prussia. . . . The doctrine of extralateral rights had its origin in the theory that it is the vein which is actually located and that the surface is a mere incident, necessary for the convenient development of the mine.

After applying the provisions of Sec. 2336 of the Revised Statutes, to the effect that where two or more veins unite, the oldest or prior location shall take the vein below the point of union, including all the space of the intersection, the court proceeds:

> By some of the courts and text-writers it is said that to entitle a claimant to extralateral rights there must be continuity of vein from the apex to the ore in dispute; by others that there must be identity of vein. It is of little moment here which of these statements is correct; but that there must be continuity of right in the locator who seeks to follow a vein from the apex within his claim to the ore beneath the surface of another claim is in effect the holding of this court, and its correctness in our judgment cannot be gainsaid.

Brazilian Mineral Exports, 1915

Of all Brazil's ores, manganese is the only one that has found a place among the more important of the country's exports. The United States has always been Brazil's best customer for manganese ore, and the trade within the last few years, and especially since the establishment of the Steel Corporation's United States & Brazil Steamship Line, has increased considerably. The line seems not only to have solved the problem of securing return cargoes, which in past years had been the difficulty of all shipping ventures between the United States and this coast, but it has built up a substantial trade for the Brazilian state of Minas Geraes, and supplied much freight to the government-owned Central Railway of Brazil. Of the 288,671 tons of manganese ore exported by Brazil in 1915, the United States took 266,271 tons.

The export of gold bars, valued at $2,390,719, the annual output of the only two important gold mines in the republic—owned and operated by British capital—was greater than during either 1913 or 1914, and all of it went to Great Britain.

Monazite sand, exported almost entirely from the port of Victoria, state of Espirito Santo, from which is extracted the component thorium used in the manufacture of gas mantles, declined in 1915. The exports amounted to only 439 tons, or less than one-third the shipments in 1913. France, which imported more than 50% of the total in 1913, imported none in 1914 or 1915, the entire export going to the United States.—*Commerce Reports* of United States Department of Commerce.

War Tax Borne by Transvaal Gold Mining Industry

In an address delivered by W. H. Dawe, president of the Transvaal Chamber of Mines, at the annual meeting held in Johannesburg, Mar. 27, 1916, the following statement was made relative to the war burdens that are being borne by the Transvaal gold mines:

> At the last annual meeting reference was made to the subject of the special war levy of £500,000 on the profits of the gold-mining industry. The president stated that no protest had been entered against this special tax, as it had been made perfectly clear that it was not to be of a recurring nature. The chamber has now been notified that the government proposes to levy the same amount again this year on the mining industry, in addition to the ordinary profits tax. Your executive recognizes that the gold-mining industry has to bear its fair share of taxation, permanent or temporary, but submits that that is not the position which obtains. Last year the increased taxation, in addition to the special levy on the gold mines, was estimated at £1,464,000—that being the amount of the estimated extra yield from customs and excise and from the income tax. Thus, while the direct government revenue from the gold-mining industry was increased approximately from £1,500,000 to £2,000,000—or 33⅓%—the increase in the revenue borne by the rest of the country was approximately from £9,500,000 to £11,000,000—only 16%—and beyond question a large part of this 16% was also borne by the gold-mining industry directly and indirectly.

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*Attorney at law, 829 Security Building, Minneapolis, Minn.

The Engle Furnace for Redistilling Spelter

By Robert H. Engle*

SYNOPSIS—An improved form of furnace designed for zinc redistillation is the result of the strong demand for high grade spelter since the beginning of the war. The design takes advantage of experience that has shown the desirable points to be incorporated. The form of furnace is described, as is also the kind of retorts used, methods of charging and discharging and the condensers used.

Ever since the beginning of the European War there has been an unprecedented demand for high-grade spelter, which has been met in part by redistilling common spelter and galvanizers' dross. The furnaces commonly employed for this purpose are uneconomical. An improved furnace designed, patented[1] and successfully used by me is shown in the accompanying illustration. This furnace was first built and developed in a dross smeltery at Trenton, N. J.

The illustration shows an eight-retort furnace. While a furnace of this type admits of several modifications, it has been found in practice that one of that size gives the best results as regards time, quantity and quality of product. The efficiency of this type lies, by reason of its construction, in the proper distribution of heat at vital points, where the maximum effect of fuel is obtained.

The retorts are grouped around a central stack having an upward draft, with flues of equal area and length leading thereto; hence if all the retorts are charged with the same grade of material, they will in practice usually finish at the same time.

The most effective point of heating is at the heel, or bottom, of the inclined retort. This is accomplished by a shoulder in the down-draft flue, running parallel with the bottom of retort, which deflects the flame against the retort and temporarily detains it by a contraction of the flue leading to the exit flue to the chimney. This feature is peculiar to this furnace, and therein it differs entirely from furnaces of the ordinary type. The retention of the flame at this crucial point, with its impingment against the bottom of the retort and the complete combustion of the fuel, is entirely due to proper flue construction. It is essential to keep the heel of the retort the hottest part in order to avoid the chilling of matte and heavy metals that constitute the impurities collecting there and the consequent formation of heavy crusts, largely iron, that tenaciously adhere to the surface of the retort and are with difficulty removed if allowed to harden; oftentimes at the sacrifice of a retort. Moreover, the accumulations of such crusts seriously handicap the heating effect and result in decreased production of spelter. The retort ordinarily used in this furnace is bottle-shaped and is made of graphite with a clay binder. The No. 8 size, ordinarily employed, will hold 750 lb.

The production of a furnace of the type shown may be generalized as follows: Eight retorts, each charged with 700 lb. dross = 5,600 lb., which is distilled in 18 hr., or 7,161 lb. in 24 hr. = 933 lb. per retort, with an approximate yield of 75% to 88% of high-grade spelter analyzing from 99.90% to 99.98% Zn. This duty depends somewhat upon the grade of dross treated—whether previously sweated (in which case iron is the dominating contaminant, lead being practically absent by reason of the liquation or sweating process), when the yield is low but the quality high; or unsweated, when lead predominates as the contaminant, and there is a higher yield on account of the dross not having been subjected to the sweating process, in which case the quality of the metal produced is dependent upon the skill and experience of the operator of the furnace.

Practice and Operation

In practice the furnace is operated in two shifts of 12 hr. each, two men on each shift, for the convenience of the furnace permits one man to look after four retorts, do his own firing, draw metal, etc. An overhead trolley encircling the furnace (not shown in the illustration) carries a supporting cradle in which rests a bottom-pour graphite crucible, whereinto the condensed metal is drawn from the condenser of each retort in succession, and thence poured into iron molds previously blackleaded, the bottom pour obviating the necessity of skimming. Hence the molten metal, generally drawn at a high temperature, never comes in direct contact with iron, for which it has a strong affinity, and is therefore uncontaminated.

This furnace in practice has done the best work with the use of a heavy bituminous coal (coke serving equally as well) low in sulphur, volatile matter and ash—a coal of the George's Creek or Pocahontas grade being admirably adapted for service. Such fuel, under normal conditions, is required at the rate of about 1,500 lb. per 2,000 lb. of dross or metal distilled. The furnace is adaptable also to the use of natural gas as fuel; in fact, a modification of it has been tried out on 18 charges, and in points of economy, cleanliness, regulation of temperature and ease of operation was found to leave little to be desired.

On the other hand, natural-gas firing has proved a formidable foe to graphite and most deleterious in its effects upon retorts of graphite composition, their life being shortened by at least 75%. This being considered, together with the high and ever-increasing cost of retorts, owing to unsettled conditions abroad, whence the materials used in their construction are obtained, it is expedient to protect the outer surface of the retorts with a flame- and gas-resisting compound that under continued heat will eventually glaze and offer the slightest friction to draft. In practice, even with the best of coal or coke as fuel, I have found a great saving in retorts by an application of a thin covering of infusible oxides in combination with silicates that form an efficient protection whereby the life of the retorts has been caused to average 65 charges; on the other hand, without this protection it has rarely exceeded forty.

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*Metallurgist, Clarksburg, W. Va.

[1] U. S. patent, No. 1,180,118.

The retorts used in this furnace have an approximate composition of 68% Ceylon graphite and 32% of German clay as binder. The German clays are apparently given the preference over domestic or other foreign clays on account of their tenacity, thorough incorporation and refractory qualities. Since the beginning of the war the stock of manufacturers here has been exhausted and they have been compelled to substitute domestic clays, which after experimentation may be found to be equal to the imported article, but this is yet conjecture and in the meantime the user must take chances with the manufacturer. Should it be proved that our own clays are equally adaptable to this class of work, we shall have been taught a good lesson.

Somewhat less than five years ago a No. 8 retort (the size preferably used in this furnace by reason of its strength and efficiency) was purchased for $17.50 f.o.b. factory. Since then the price has soared until it is now almost threefold, and manufacturers are unable to fill orders within what used to be considered a reasonable time, owing to the unprecedented demand for graphite crucibles from the steel makers for the production of munitions of war.

The outside dimensions of a No. 8 retort (Dixon's number) are: Length, 35½ in.; diameter at neck, 8⅞ in.; diameter at bilge (or widest dimension), 20 in.; and diameter at bottom, 14 in. The thickness varies from 2½ in. at bottom to 1¾ in. at bilge and 1⅛ in. at neck. A perpendicular line drawn from the center of the bottom through the center of the neck would represent an inclination of 25°, as shown in the drawing. A molten charge of 700 lb. of metal or dross in a clean retort, will fill it to a level about 1½ to 2 in. below the inner bottom of neck, which is a sane and safe method of charging, for the ebullition of the metal will not then throw any of the unrefined charge into the condenser, which is situated on the outside of furnace and inclined at the same angle as the retort. Perfect heat regulation in this furnace permits an increase of 50 to 100 lb. over and above the usual charge without danger of contamination of the distillate; but this depends largely upon the skill and care of the operator.

Discharging the Retorts

The finish of distillation is easily discernible by the disappearance of the greenish-white flame at the vent of condenser, a small yellowish flame taking its place. The condenser is then detached from its luting with the retort, and all residues, accretions and crusts are removed with a long-handled hoe or scraper. This function, both as to safeguarding the life and efficiency of retorts and as to economizing fuel, is all-important. A negligent and inefficient furnaceman will produce metal of a nondescript character and lower the efficiency of retorts as well as the coal pile. In this connection it may be well to add that the average furnaceman is too much given to the butchering of retorts by the too ready application of sledge and bar, and prying upon the neck of the retort to remove crusts. The formation of crusts of undetachable nature is wholly unnecessary if taken in time. The retorts produced by reputable makers in this country leave little to be desired as regards quality, but none will stand abuse at the hands of the unskilled and careless operator.

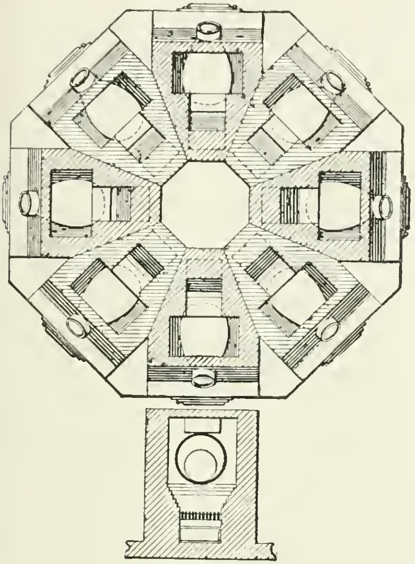
When the market prices of construction materials were normal, say as recently as three years ago, it was possible to construct a furnace of the type herein described at approximately $100 per retort, or $800 for the furnace complete, equipped with retorts, ready to fire, with a liberal allowance for labor and material. Under existing conditions it would be wise to figure on an increase of at least 50%.

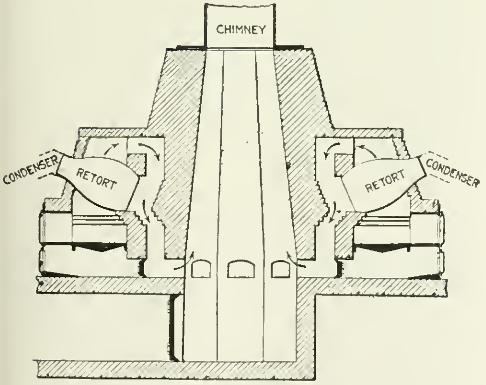
The Condensers Used

The bottle-shaped graphite retort was originally designed for retorting silver-zinc scum obtained from the desilverization of base bullion by the Parke's process. About 1895 this type of retort was used by me in the distillation of galvanizers' dross, in coke furnaces, and as condenser another retort of the same size was employed by sawing off the open end of same obliquely, some distance down, to fit over the neck of the retort and to incline at the same angle as the retort when luted on with a fire-clay mixture. This condenser was provided with a 1½-in. tap hole at the bottom, which was plugged with fire-clay when in use, and with a vent hole, slightly smaller, immediately above. In order to minimize rupture and breaking of these improvised condensers it was found necessary to protect them with a reinforcement of hoop iron in the form of a cage, which was not only a clumsy contrivance, but also was expensive. Not long after this I devised a condenser of cylindrical shape, composed of chamotte with a raw fire-clay binder and had the original model made by the Tacony Crucible Co., of Philadelphia. This new form, by reason of its easy shape to fit, lent itself very readily to the protection of a jacket made of sheet steel, hinged longitudinally and opening in halves, and would outlast several condensers, hence could be used over and over again. Unfortunately I failed to secure patent protection, and this pattern of condenser has been adopted by all distillers of zinc dross. It may be described as having a thickness of walls of 1½ in., a bottom of 2 in., internal diameter of 9 in., extreme length on top of 33 in., extreme length on bottom of 27 in., with a tapered or funnel-shaped opening of 10½ in. for attachment to retort, allowing about ¾ in. all around for luting on. Both smaller and larger sizes of condensers than the dimensions here given have been tried out, on the same size retort, with more or less negative and unsatisfactory results, so it would appear that the dimensions given satisfy working conditions. A condenser of the same composition as the graphite retort, made by Dixon or Bartley, will give much better results, inasmuch as it is less absorbent and less likely to crack and lose metal, but at present its price is prohibitive, unless it is used by exceptionally careful furnace operators, in which case it will outlast five or six fire-clay condensers, than which it is easier to clean and far more satisfatcory in every way.

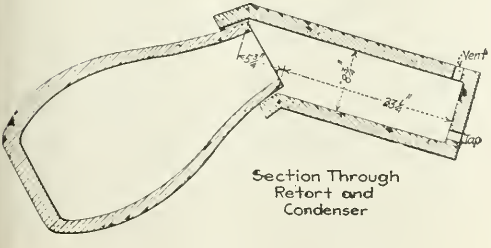
Cadmium Recovery

In the distillation of the residual dross (galvanizers') from Prime Western spelter containing more or less cadmium it is sometimes profitable to save the cadmium. That may be done almost completely by heat control by a fractional distillation performed as follows: After the retort has been charged, the charge melted down and the condenser luted on, there emanates first from the vent moisture in the form of steam, shortly followed by a deep-brown smoke, which represents the partial combustion of organic matter; following this, and shortly preceding the characteristic green-white flame of zinc, will appear the light-brown fumes of cadmium oxide. At this juncture, if that metal is to be saved, the vent is partly closed and the heat controlled to permit a condensation of cadmium in conjunction with the zinc vapors, forming an alloy that practically decadmiumizes the charge in the retort. The major part of the cadmium will be collected in the first drawing of metal, usually contained in a slab of about 50 lb.; the second drawing seldom contains more than 0.0045% Cd. The first drawing is put aside for redistillation and is subsequently enriched by repeated treatment, without appreciable loss of either metal, until cadmium form the principal and zinc the negligible factor in value.


Sectional Plan



Vertical Cross-Section



Section Through Retort and Condenser

ENGLE ZINC-DISTILLATION FURNACE

Qualities Required of Concrete to Resist Action of Sea Water*

In order to construct concrete that will have the greatest resistive power against the action of sea water (and also probably of alkali waters), it must possess especial characteristics. The addition of puzzolan in some form is widely practiced in Europe and appears to be theoretically correct. It has not been tried in America, to the author's knowledge, but is worth an exhaustive test. The amount should not be over one part for each part of cement, nor less than one-half part.

Waterproofing with substances that combine chemically with the free lime ought to be successful and is worth testing. Between the extreme limits of high and low tides the concrete surfaces should be faced continuously, without joints, with about 3 in. of 1 : 1½ or 1 : 2 mortar, made with sand as specified below, well cured before coming in contact with the sea water. Facing must be placed simultaneously with the backing. The cement should be low in lime and alumina and contain as little gypsum as possible.

Sand must be siliceous, uniformly graded from fine to coarse, with not less than 50% nor more than 70% passing through a 20-mesh sieve and not more than 3% passing a 100-mesh sieve, and must have no organic matter coating the grains. It must be free from roots and easily disintegrated grains, such as feldspar, shells, limestone and mica. It should be washed free from clay and should show a tensile strength for 1 : 3 specimens not less than the following percentages of the strength of Standard Ottawa sand of the same consistency, using the brand of cement that is to be used on the work:

Age	Strength, %
1 day	85
3 days	90
7 days	95
28 days	100

Where concrete must be exposed to sea water without mortar facing, gravel should not be used. Broken stone should be hard, durable trap, granite or other dense, hard, insoluble stone. It should not exceed ¾ in. in size and should be free from crusher dust, sand, dirt, organic matter or other foreign substances. Mixture should be 1 : ½ : 3 or 1 : 2 : 4, or should be proportioned for maximum density.

Pure, fresh water should be used in sufficient quantity to permit the materials to be well puddled and spaded, so that no later surface treatment or patching will be required, but not sufficient to materially retard the setting of the cement. Care must be exercised, however, to prevent the formation of laitance or pockets of neat cement or very rich mortar. Forms should be tight to prevent leakage of cement or, where concrete must be submerged immediately, to prevent contact with the sea water.

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*Extract from a report by W. Walters Pagon, submitted to J. E. Greiner and printed in the "Journal" of the Engineers' Club of Baltimore.

The facing should be reinforced with steel well covered with mortar and securely anchored to the backing. No surface treatment should be given. The work should be allowed to harden two weeks, if possible, before coming in contact with sea water. Two months is better. Sea-water work should never be done in cold weather, with temperature below 40° F. Where possible precast, mortar-faced blocks, cured in damp sand for at least one month, should be used. The facing should extend back at the joints to prevent saturation of the backing. The joints should be pointed with 1 : 1 mortar of coarse sand. The most durable surface will be obtained if granite or other dense stone be used as facing. This should be not less than 6 in. thick, anchored back with wrought-iron clamps and pointed with 1 : 1 mortar of coarse sand and cement as already noted. On mortar or concrete surfaces the growth of barnacles, moss, etc., will frequently afford protection. This has usually been considered destructive, but really acts as a protection.

All of the foregoing can be sumarized into these statements: Use materials that cannot be attacked by the sea-water salts; mix these so as to obtain the maximum density; have no stones near the surface of concrete but use mortar face 3 in. thick.

Calumet & Hecla Celebration*

At the Calumet & Hecla 50th anniversary celebration Major Henry L. Higginson, who was one of the principal speakers, said in part:

Fellow countrymen—born in many countries but now all Americans—I am glad to meet you. I am one of the few men who saw the beginning of Calumet & Hecla and who have been with it ever since. There are not many of us left. You are the men who have made this wonderful corporation, who have made it what it is physically and morally. You have done it by working together.

It was in 1869 the last time I was here. Mr. Shaw was working in a little bit of a house, and there was no promise then of the great community I see today. Mr. Shaw had help in developing his company, and not the least help was from John Simpkins, who sold the copper. You cannot get far with a copper mine unless you sell the copper.

It is useless to talk to you men about this mine. You have made it the tremendous success that it is. The officers and men have always worked together. In the early days there was need of money and Mr. Agassiz had to get help from many friends, but the help you gave him was the greatest help of all. You will remember that he was never content with what the mine had in the way of machinery. He always wanted the best, and it is for this reason that you have today the wonderful machinery that is yours to work with.

This has always been a family company. You and the officers have been the family, and you know now a member of the third generation of Shaws who is working with you. Mr. Agassiz, your president, is of the second generation of his family. The Calumet & Hecla, officers and employees, always has been a great family. That is the good of the whole thing. The officers and men have worked together, and that is the best thing of all.

The officers have given you comfortable homes, good schools, libraries, bathhouses, all the comforts. You have in return given your best services, your loyalty. You have done your share and they have done theirs. It is a splendid example of teamwork.

A few men wanted to meddle in your affairs a couple of years ago. You told them to go away, that you wanted no meddlers in the affairs of the Calumet & Hecla family. Then came hard times through the war, and you promptly told the officers you would help by accepting half time for a while. Then came good times and the officers remembered you. I cannot repeat too often that it is the relations of the men and officers of this company that have made it what it is.

My father was a director in the beginning of this family. His father succeeded him. When our family quits the Calumet & Hecla, we will let you know beforehand.

No one not of the family can realize the labor that has brought this great corporation to its present stage of prosperity and success. I do not mean the labor of the men seated behind me nor the labor of you men, but the labor of both; one would have been no good without the other. That is the way you have succeeded. And I am proud also to remember that you are all Americans, no matter what country you may have come from. This is your home now, it is our home, it is for us to look after it.

Think of the old countries across the water. There homes have been despoiled, industries have been wrecked and there is nothing to work for. Suppose that should happen here? You must be ready to help and to defend your country when she is in trouble. Get ready.

Suppose 500 new and untried men came here to work. They would ruin the mine in a week. They would have to be trained to be effective members of our family. So must soldiers be trained. A dozen men working together are strong; separated they are weak.

Remember to keep high your ideals as citizens and as Calumet & Hecla men. Remember your country and leave the rest to God.

Argentine Tungsten Deposits

In the western provinces of Argentine, the wolframite deposits of the Andes continue to be worked on a small scale, according to "Commerce Reports" of the United States Department of Commerce. Ore is extracted largely by individuals and carried considerable distances on muleback. In certain regions, owing to more favorable communications, Argentine mining products are exported by way of Chile. The great distance from the coast and the difficulty and expense of transporting ore and supplies have in most instances made operations undertaken on a large scale by foreign companies unprofitable.

The Hansa Sociedad de Minas, which works wolfram deposits in the province of San Luis, resumed operations during the latter part of 1915, after suspending at the outbreak of the war. During 1915 Argentine exported 158 metric tons of wolfram (65% WO_3). Exports in 1914 amounted to 394 tons, and in 1913 to 536 tons. It is interesting to note that while the export value of wolfram was placed at 4.38c. per lb. in 1913 and 1914, it was valued at 40.35c. per lb. in 1915.

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*"Boston News Bureau," July 19, 1916.

Mining Ore from Pillars

By H. H. Hodgkinson*

SYNOPSIS—A method of removing ore from pillars, by means of which a much greater quantity is recovered than by the processes formerly used. The pillars are crosscut and top-sliced, the ore being drawn through chutes.

To devise and carry into effect a mining system that would permit the extraction of a high percentage of the orebodies with safety and economy, a method was introduced at the New Jersey Zinc Co., Franklin, N. J., which is really a combination of two old systems—transverse stope slices, beginning at the bottom of the orebody and raising by shrinkage stopes from level to level, drawing the broken ore and filling the open space with waste, and repeating the same performance from level to level, thus leaving pillars from 30 to 50 ft. wide between the slices. To win these pillars the ordinary top-slicing system was applied. There is no patent or special secret process connected with the system, which has now been in daily operation for several years with perfect satisfaction.

In the case at hand the ore was produced by means of back-stoping slices 17 ft. in width, which were carried transversely across the vein from foot to hanging wall and upward, to a height of 50 ft., the operation beginning at the bottom of the orebody. A pillar of ore averaging 35 ft. in width was left between each stope slice. After the ore allotted to be mined by the stopes at one extremity of the orebody was removed and the stopes filled with rock filling, the work of extracting the ore from the pillars in that section was begun. The operation started at the top of the orebody, mining the ore on downward, slice after slice, allowing the rock filling to cave from above and from adjacent stopes on the sides as work progressed.

Top Slicing and Shrinkage Stoping

The method here described for removing ore from the intermediate pillars is a combination of both the shrinkage stope and top-slice methods, devised by R. M. Catlin and developed by me with the object of giving a larger and more uniform production of ore from the pillars at a lower cost than if the pillars were mined exclusively by the top-slice method. When the ore is removed from the pillars entirely by top-slicing, only a limited tonnage is produced daily from each working place in ground that does not cave and break up into small pieces readily, as only a comparatively small tonnage can be broken and removed at one time, all of which must be shoveled and handled twice before it arrives in the ore chutes in the pillars. This is naturally slow and expensive, unless a great many raises for ore chutes are driven to handle this ore, which would likewise be a matter of considerable expense, as tramcars are in most cases impracticable. Then too, set timbers must be placed from time to time to support the timber mat left exposed by the removal of the ore, which means that both the drill runners and muckers must stop their work of production to erect these timbers, the supply of ore being temporarily stopped. The sublevels used in this case are 10 ft. apart and the slices 10 ft. as it was found the ore did not cave or break up small enough to be easily handled through the set timbers in the sublevels; quite different from mines where the ore is soft and caves readily, which permits the sublevels to be placed 14 ft. or more apart, a large portion of the ore in each slice being removed from above the set timbers in the sublevels.

The method here described was planned with the idea of top-slicing 77% of the ore in the pillars after 23% of it had been mined by a shrinkage-pillar stope carried up through the middle of the pillars, which will then permit not only a larger and more steady production of ore from the portion top-sliced, but will aid materially in reducing the cost of that ore. In addition the 23% mined by the shrinkage stope in the pillar does not cost much more than the ore mined in the regular stopes. Inasmuch as the pillars, as stated previously, average 35 ft. in width and extend from foot to hanging wall, having a vertical height of 50 ft., the crosscut *M*, Fig. 1, 10 ft. high and about 8 ft. wide, was first driven through the pillars across the vein so as to leave 13½ ft. of ore on each side. Let us assume that the vein has a width of 120 ft. in this case. The two 4x4-ft. raises should then be erected in the 13½-ft. pillars from two short drifts, as shown in Figs. 1 and 3, at an inclination of from 50° to 60° with the horizontal until the timber mat above is reached. One raise has been used successfully, but two are better, as will be shown later, since they give more points from which to attack the pillar. Small crosscuts, 5x5 ft., are then driven from the raises at convenient intervals, preferably every 10 ft., since the slices are 10-ft. slices, toward the center of the pillar and only far enough so that the pillar stope when brought up will hole through these crosscuts and thus afford entrance and exit to the pillar stope after the chutes in the set timbers in the pillar stope are full of broken ore and are no longer available for this purpose.

Short Crosscuts Started and Bratticed Off

As the back-stoping proceeds in the pillar stope and the level of broken ore rises, these small crosscuts are bratticed off to prevent the broken ore from running in the raises. These short crosscuts also serve as suitable places from which to start each successive slice. In the meantime the work of erecting set timbers and the placing of broken ore behind them in the crosscut *M* is progressing, and when finished, chutes are installed in the set timbers for the removal of the excess ore from the pillar stope in tramcars. The two raises *C* and *D*, when finished, are equipped with ladders and air lines and are not used as an outlet for ore from the pillars. The work of mining the 8-ft. pillar stope is begun from on top of the set timbers, which are covered with lagging. The pillar stope is mined up by back-stoping through the pillar until the mat is encountered, as shown in Fig. 4, the miners entering and leaving by means of the short crosscuts *K* and the raises *C* and *D*, Fig. 2, in the new pillar *A*.

When the pillar stope has been finally mined up to the mat, the broken ore is lowered a little below the level of the first slice ,as shown in Fig. 1, and as the broken ore moves down, the sill timbers *S* are placed in hitches on the sides of the new pillars *A* and *B*, which later serve as caps in the next slice, as S, Fig. 1, to support the timber mat, the caps being supported by 10-in. legs, as shown.

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*Mining Engineer, New Jersey Zinc Co., Franklin, N. J.

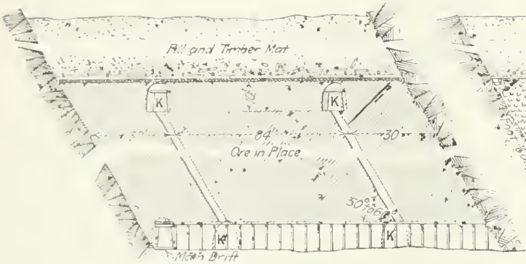


FIG. 3. SECTION THROUGH RAISES IN NEW PILLAR "A"

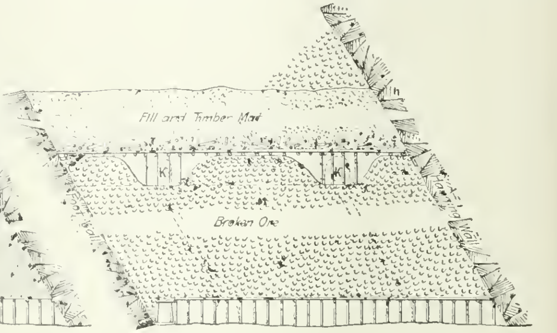
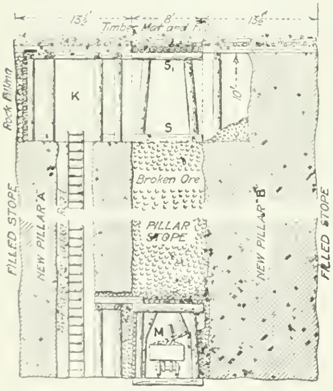
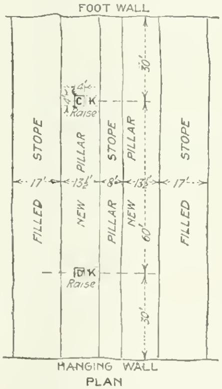


FIG. 4. SECTION THROUGH PILLAR STOPE, SHOWING CAVING ON BROKEN ORE





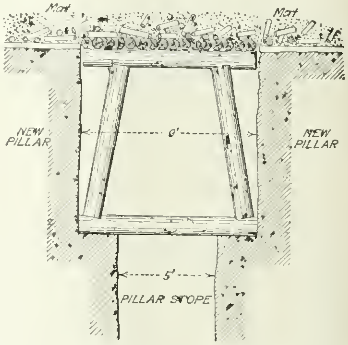


FIG. 1. SECTION OF PILLAR STOPE FIG. 2. PLAN OF PILLAR STOPE FIG. 5. MODIFICATION OF PILLAR STOPE

The work of pulling the muck down begins at the small crosscuts KK from the raises and progresses in both directions from each raise, as shown in Fig. 4, being closely followed by the method of timbering just mentioned, until the mat over the pillar-stope is entirely supported. The work of top-slicing the new pillars A and B is then started by one crew of men at the foot-wall and another at the hanging-wall end of the pillars, retreating respectively in the direction of the raises C and D, caving the set timbers as they retreat until the raises are reached. In addition the work of top-slicing may also be begun at the point X, Fig. 2, midway between the raises, proceeding in both directions, each crew again retreating toward its respective raise, the set timbers being blasted down and the filling caved as before.

The essential of this method lies in the fact that the pillar stope must be left full of broken ore to within a few feet of the slice being worked, for the purpose of supporting the two new pillars A and B on the inside and thus prevent them from crushing in. The outside surfaces of these pillars are already firmly supported and held intact by means of the rock filling placed in the two adjacent stopes. This filling by the way, is breasted off from time to time as it is encountered in slicing the new pillars A and B. As the ore is removed from each successive slice, a new mat of lagging is laid down on the sills over the pillar stope and across the floor of the new pillars; the broken ore is also lowered in the pillar stope to accommodate the ore from the next slice after the timbers and fill from above have been caved, the sills S being propped so that the new mat is safely supported by the broken ore in the pillar stope, thus relieving the timbers from this excessive strain later. This is the same as the condition indicated in Fig. 4. The mat rests upon the broken ore, which supports it temporarily the same way that it would if the mat and fill from above were caved.

Besides supporting the new pillars, the pillar stope serves as an outlet for the broken ore produced from the new pillars instead of using raises. This not only makes it possible to break the ore in the new pillars in such a way that a large percentage will fall directly into the pillar stope without being handled, but permits the portion of broken ore which must be handled to be shoveled directly into the pillar stope, which in this capacity serves as a big ore chute with a large reserve, extending from one end of the pillar to the other and easily accessible for the removal of ore from any point of the two new pillars A and B and the pillar stope itself. The broken ore in the pillar stope is lowered from time to time to allow the ore from the top-slicing of the new pillars to be thrown in the pillar stope. This also accounts for the method of supporting the mat over the pillar stope, whereas if the set timbers rested upon the muck, the ore could not be lowered until the slice was finished and would necessarily have to be heaped up in the pillar stope, adding unnecessarily to the cost without giving any particular advantage. The pillar stope also serves as a traveling road from one end of the pillar to the other after the ore has been lowered and the mat securely supported.

Raises driven at an angle of from 50° to 60° seem to be both the most economical and safest for making into ladder roads, which would save the increased cost of raises at a flatter angle because of their additional length. Then again, long flat raises would have a tendency to weaken the pillars somewhat. Two raises permit much better ventilation in the pillars; the smoke and gases after blasting are removed much quicker than if a single raise were used, thus permitting the miners to return to their work sooner. Then too, it seems best to have two raises arranged so that the miners are but a short distance from their work, there being one in case the other should ever become blocked off and inaccessible, as shown in Fig. 2; here the miners are never more than 30 ft. from their respective raises. A 4½x4½-ft. raise affords ample space to permit timber, drills, steel, etc., to be brought up into the slices and does not affect the pillars *A* and *B*, which are supported firmly on each side, as stated previously. The practice is, however, aways to drive the raises before putting up the pillar stope.

ADVANTAGES AND DISADVANTAGES OF THIS METHOD

In conclusion, the advantages of this method over the regular top-slice method for mining a 10-ft. slice are: (1) Minimum handling of broken ore; (2) cheaper production of ore; (3) larger output and complete recovery of ore; (4) small number of raises required for men and supplies only; (5) easy access to all points in the pillar; (6) no drifting or crosscutting necessary on each slice; (7) immediate production of ore from surplus of pillar stope; (8) more points of attack in mining ore from pillars; (9) a more uniform production of ore; (10) good ventilation; (11) safe retreat in case of danger; (12) cars and wheelbarrows unnecessary for handling ore; (13) men and ore do not use same raise.

The disadvantages are: (1) Time and expense of cutting hitches for sills in pillar stope; (2) an occasional breakage of sills in pillar stope; (3) a reserve of broken ore temporarily tied up in pillar stopes.

Where any great difficulty is experienced, owing to the breakage of sills in the pillar stope, I suggest that the width of the pillar stope be reduced from 8 to 5 ft., thus permitting the legs of the set timbers to be supported directly by the ground on each side, as shown in Fig. 5. This of course would necessitate enlarging the pillar stope by side rounds to 9 ft. at each successive slice at the time of erecting the set timbers, making a ledge as shown in Fig. 5, upon which to place the sill, thus saving considerable time and labor in cutting hitches. By reducing the size of the pillar stope, a large percentage of the ore in the pillar stope would be taken out by top-slicing instead of by the pillar stope, which would be an advantage in case of pillars, as the new pillars would then be 15 ft. in width.

How To Sell a Mine

The following is reprinted from the *Journal*, Aug. 29, 1908. The intense activity in the mining business at present, with the attendant feverish offering of mining properties, makes the article particularly apropos; although written eight years ago, there is nothing new to be said on the subject and this article tells the whole story now as it did then.

We might perhaps entitle this article "How to Sell a Mine, and How to Finance Development Expense." We receive many inquiries of this character, which we are obliged to answer, as we feel, in an unsatisfactory manner, but we do our best to aid our correspondents. The man who tries to sell a mine or to secure money to continue the development of one is not necessarily aiming to fleece the unwary investor. On the contrary, we prefer to believe that most men are honest and are endeavoring to do a legitimate business. What then can be done to assist the honest owner of mining property who is seeking capital?

Here is a letter recently received, which is a type of many: "Please give me the names of two or three brokers in New York who make a specialty of handling mining stocks and bonds; also names of promoters of mining property."

Another correspondent, whose letter was received in the same mail, desired to have the names of half a dozen good bond salesmen, who might be able to market the stock of a mining company. Both of these correspondents little knew what they were asking. There is an erroneous impression that there is in Eastern cities, particularly New York, a market for mines wherein they may be sold as real estate is sold among the board of real-estate brokers. If there be any such market, we do not know of it.

Nevertheless, there is an active market for mines among the houses that make a business of the development of mineral property, such as the Guggenheim Exploration Co.,[1] the General Development Co., the Mines Selection Co., the Venture Syndicate and several others. These companies are constantly on the watch for good mining property; indeed they do not wait passively for such to be brought to them, but they send out agents to find them. Any property presented for their attention receives careful consideration if it shows merit.

However, when we refer to these companies, the man who asks us how he can finance his mine is apt to draw a long face, and remark: "It is useless to go to them; they will not consider my property unless I will give them the whole of it, and they will not be willing to pay me what it is worth." Now in this respect we do not suppose that the big mining houses are very different from anyone else in the business; everyone aims to drive the best possible bargain. Furthermore, there are few, if any, mining houses that will not insist upon the control of the property that they are going to undertake.

The market for mines is not confined to the big houses. There are many smaller mining syndicates that do not figure so prominently in the public eye. Most of these are represented by a consulting engineer, who advises as to the purchase and operation of mining properties. It is therefore a good plan for the man who wants to sell his mine to address some of the well-known engineers (whose names and addresses are to be found in the professional directory published weekly in the "Journal") and inquire if any of their clients would be interested in what is offered. If the property offered is meritorious, the vendor may be fairly sure of developing interest in this way. But again, he must be prepared to surrender the control of his property and also he must not expect to receive for it any more than it is worth.

This then is the real mining market, and when we have told about it, we have given the best advice and assistance that we can. Any other species of mining market is amateurish or dishonest. By amateurish we mean this: An owner of a mine comes East to raise money, and putting up at the Waldorf, aims to make the acquaintance of some person of means who will be attracted by the vision of great profit. (We refer to the Waldorf merely as an illustration; practically, its opportunities for such business are said long since to have ceased to be good.) After the failure that results nine times out of ten (or 99 out of 100) such persons have no further interest in mining. They are the amateurs. The sharks are the persons who seek anything—a mine, an invention, a manufacturing scheme—that can be offered attractively to the gullible public. Neither the amateur nor the shark has anything to do with the real mining market, although both buy mines, or alleged mines.

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[1] Since this was originally published the corporate existence of some of these companies has changed.

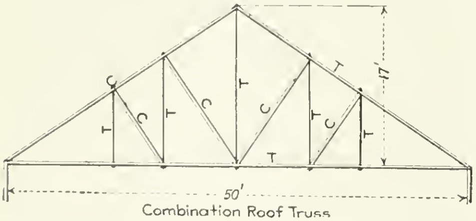
Details of Practical Mining

Timber Roof Coverings

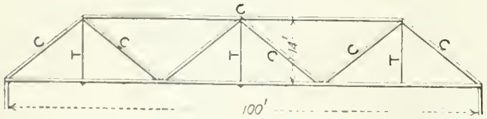
By Frederick W. Foote

The covering of the many sheds, shops and buildings incident to the modern mine plant is important. The covering of sidehill mill buildings will not be discussed, as that comes more in the province of mill design. Buildings up to 12 ft. in width can be conveniently covered with what is commonly known as "shanty" roof, supported on 2x6-in. or 2x8-in. rafters laid on the top plate. Buildings up to 20 ft. in width are easily covered by an "A" roof made of 2x6-in. rafters and a 1x6-in. ridgeboard. Tie-rods or ceiling rafters keep the top plate from spreading. Buildings having a width between 20 and 50 ft., that do not permit the location of intermediate posts, are best covered by what is known as the combination roof truss, illustrated in Fig. 1. Trusses of this type are built up of timber and iron rods. The diagonal members, being subjected to compressional forces, are made of timber, while the vertical members, being in tension, consist of iron rods.

For spans between 50 and 100 ft. the Howe truss, shown in Fig. 2, is used. This is built up similarly to the combination truss, but entails less room under the eaves. One hundred feet is about the limit of timber roof trusses for ordinary use. The combination trusses up to 30-ft. span can be assembled on the ground and hoisted into position by a gin pole. In doing this care must be taken to lift the truss in a sling going under the bottom chord. Recently a truss of this character weighing between two and three tons was being lifted into position by a sling placed around the apex, and when about 20 ft. from the ground, the bottom chord failed, allowing the whole truss to come to pieces. Luckily no one was hurt, but the example is instructive. The weight of the truss (two to five tons), being applied upward at the apex when it is normally applied downward at the extremities, caused a reversal of the internal forces. The lower chord was thus put in compression, with the attendant failure.



Combination Roof Truss



Howe Roof Truss

FIGS. 1 AND 2. TRUSSES FOR 50- AND 100-FT. SPAN

Howe trusses of 75-ft. span were found to be too heavy to be conveniently placed by means of a gin pole. Two stagings were built about 3 ft. lower than the height of the bottom chord, on either side of its location. The lower chord was assembled on the floor between these stagings and hoisted into position and supported by blocks placed on top of the stagings. While this was being done, another secondary staging was built on top of the first one toward the next truss to be erected. This is built up to within a couple of feet of the upper chord, and the upper chord and diagonal members are assembled from these two working platforms. The vertical rods are tightened up so that an arch of a couple of inches is present in the lower chord before the blocks are removed. When this is done, the weight of the truss reduces this to about an inch. The further weight of the roof brings the lower chord about flat. When the truss has been set, the staging is moved over to the next location—the far-side staging being low enough to pass under the lower chord of the truss just completed. This method is continued until the last truss is set.

There are two general methods of covering the roofs of wooden buildings, the choice of which is regulated by the permanency of the structure. The cheaper method consists in covering the rafters with 1-in. boards and some form of roofing or asbestos paper. This costs in the neighborhood of $45 per M sq.ft. in place. Corrugated galvanized sheets make a good roofing. These sheets are laid over 1-in. furring and cost about $60 per M sq.ft. in place. The latter of course lasts longer.

Tar-paper roofs, if properly laid, are water-tight for a couple of years, but if improperly laid, will leak during the first fog. The following details are well to observe: Sweep the roof covering of 1-in. boards carefully before undoing the roll of paper. Lay the paper horizontally and not vertically. Starting about 1 ft. below the ridge, tack a strip on each side of the ridge for its entire length and then put the ridge paper on, tacking it down with "tin dishes" every 3 to 4 in. This ridge piece will lap the first strip by about 6 in. A small tin of a rubber preparation is usually included with rubberoid, while an asphaltum paint is given with tar papers. This should be used on all joints. Each row of paper should lap its successor by at least 2 in., and the work should proceed from the ridge downward so that it is not necessary to walk on the paper after it is laid.

The use of short lengths of paper should be reduced to a minimum, but where used the cut should be made on a diagonal and the ridge side overlapped. Any stack holes, etc., should be well flashed with galvanized iron. Paper is made in 1-, 2- and 3-ply tar paper, rubberoid and asbestos. At least 2-ply or rubberoid should be used for roofing, and asbestos is preferable in a region where forest fires or sparks from stack emissions are possible.

If a more lasting roof is required, 18-gage corrugated galvanized sheet iron laid on 1-in. furring strips is used.

This is laid very much the same as large shingles, allowing an overlap on the sides of one corrugation, and at least 3-in. on the end laps. Nails should be put in the ridges and not in the depressions, as this tends to greater dryness. A ridge roll can be bought in lengths and fitted to the proper length.

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Blasting for Steam Shovels*

The well or churn-drill method of drilling a quarry or opencut face is now common, and the use of large drills is constantly increasing. In fact, the growing tendency is to use large machinery of all kinds such as mammoth crushers, steam shovels, etc. Volume is what is wanted nowadays.

In this method usually holes of from 4- to 6-in. diameter are drilled the full depth of the face from 15 to 20 ft. apart located about as far back from the face, and the whole face shot down at one time. The cost of drilling may vary all the way from 20c. to 75c per ft., and in extremely hard rock up to $1.50 per ft. In the flat laminated rocks of the Middle West as much as 75 ft. of the hole can be drilled per day, while in the harder pitching rocks common in the East, from 25 to 40 ft. per day is considered good.

These well or churn drills are best adapted to work where the strata are flat and the height of the face exceeds 25 ft. When used in the harder rocks, it is best to drill a 5⅝-in. hole because it is possible to concentrate more explosive in the bottom, where it is usually most needed, and the larger hole permits a greater spacing interval and thus a minimum drilling cost results. In softer rocks, such as shale or sandstones or even in some limestones, when working a shallow face, it may be more economical sometimes to use a 4- or 4½-in. bit, because not so much concentration as distribution may be desirable and a considerable saving of explosives can be made. A 5⅝-in. hole requires about 15 lb. of dynamite and a 4-in. hole only about 7½ lb. per ft. of hole.

Spacing of holes depends on the character of the material and the depth of the face. A nice spacing for holes 35 ft. deep is about 12 ft. apart and 15 ft. back. Holes 60 ft. deep can be spaced 16 ft. apart by 20 ft. back. and holes 100 ft. or more deep, 20 ft. apart and 25 ft. back in most rocks. It is rarely advisable to space more than 20 ft. apart.

Holes should be drilled 3 or 4 ft. below the quarry floor, unless there is a natural parting at that level, in which case, if holes are sunk to grade, the bottoms will come clean. Going below the floor insures better breakage, cleaner floor and permits easy access for a steam shovel.

No rule can be given as to the amount of dynamite to load in holes of given depth as all depends on local conditions. The important part is the selection of the proper explosive to produce the desired results. Explosives differ widely in their action, and what would suit one condition may not fit another.

Before loading it is usual to calculate the number of tons or cubic yards available in the blast, and then to get about 5 tons of rock per pound of explosive, varying the load per hole according to the burden or local conditions.

In deep holes considerable saving can be made by breaking the load two or three times, with equally good results. The object in breaking the load, besides saving explosives, is to distribute the charge where the rock is hardest, skipping seams and weak points where it is not needed. It is good policy to arrange the breaks so that they are not all on the same level. This amounts to the same thing as shooting two or more benches simultaneously.

In loading deep holes there is little gained by removing the paper and loading the dynamite loose, or in bulk. In fact, the danger is increased by so doing, as loose powder may be scattered all along the walls of the hole and at the mouth. When this occurs, there is danger of a rock working loose, getting wedged between the tamping block and wall, causing friction and setting off the charge.

As a usual thing well drill holes are driven and blasted in one line, holes being equidistant from the face. Occasionally in very hard ground better results are obtained by staggering the holes. There is also another method known as "buffer" shooting, or shooting against the bank. By this is meant that a line of holes is shot down and then another line drilled and blasted before the débris from the previous shot is removed. This method is well adapted to use in limestone formations where the strata are flat and thinly laminated on top. It is necessary only to loosen or push out the bottom in such a formation, thus eliminating the necessity of lifting and laying tracks or moving the shovel so frequently as when the clear bank method is used.

In hard rocks a combination of 60% and 40% dynamite is recommended. A little 60% should be loaded in the bottom of each hole and 40% used on top. In softer flat limestones a 40% explosive will usually be found strong enough and often a lower grade can be used for top load. If the work is very wet and the toe heavy, it may be necessary to use a gelatin dynamite from 40% to 60% strength.

If holes are double- or triple-loaded at least two electric blasting caps should be used in each charge unit to assure thorough detonation and to afford a way out in case one should be broken or otherwise spoiled during tamping. Electric blasting caps with duplex wire leads have been found a great convenience in loading deep holes. They are handier, stronger and better than those with two single leads. Oftentimes short-length electric blasting caps are used and connecting wire spliced to make the necessary length. A good scheme followed in one big operation is to use wires with colored insulation, splicing a red wire to one leg and a blue to the other. When final connections are made—parallel method—the red wires are connected to one lead and the blue to the other. There is no chance of a mistake if this is done.

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As a Prevention Against Fire being communicated from the surface plant underground, or vice versa, a section of the shaft timbering on the Proprietary mine, Broken Hill, Australia, is cut out just below the surface chairs; heavy plate-iron doors are hinged to the sides and can be closed at short notice. Like all the safety appliances, these are thoroughly tested periodically to insure their efficiency when needed. In conjunction with these, plate-iron doors are provided at all approaches to the shafts to control the air currents in case of fire, according to E. J. Horwood in a paper presented at the February, 1916 meeting of the A. I. M. E. in New York.

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*Excerpt from an article by S. R. Russell, in "Du Pont Magazine," August, 1916.

Test-Pit Sampling of Placers

By Harley E. Hooper

The chief characteristic of the alluvium worked for wolfram in lower Burma is the large number of schist and quartz boulders ranging up to two or three tons in weight interspersed in a sticky yellow clay. The latter is a product of the decomposition of the schist, and as a general rule, the greater the number of boulders the richer is the ground. The depth of the wash varies from 3 or 4 ft. on the hillsides, to 60 or 70 and even to 100 ft. on the flat country, with a water level on the flat country about 30 to 40 ft. down.

For preliminary sampling the ground is usually surveyed into squares of 5-chain sides and a shaft sunk on each intersection. If the sampling results warrant it, intermediate shafts are put down. The shaft sinking is done on contract by Chinese coolies, a typical rate being, for the first 10 ft., 10 annas per foot; for the second 10 ft., 12 annas; for the third 10 ft., 14 annas; for the fourth 10 ft., 1 rupee[1] per foot; for the fifth 10 ft., 1 rupee 8 annas; for the sixth 10 ft., 1 rupee 12 annas, and for the seventh 10 ft., 2 rupees 8 annas per foot. Should water be met with an extra rupee per foot is paid for sinking below water level.

Primitive Methods of Pit Sinking

Owing to the impervious nature of the alluvium, it is usually quite possible to sink 15 or 20 ft. below water level without requiring a pump or other means of removal for the water, the bucket bringing up 20 to 30% of water with its contents. The shaft-sinking rates allow very high wages to be made in favorable ground in order to compensate for the low earnings when a boulder is struck that requires explosives.

The shaft sinker starts by marking out a circle from 2 ft. to 2.5 ft. in diameter and squatting on the ground, works with a small pick having a handle about a foot long, putting the dirt into the bucket with a small basin or half a cocoanut shell. Working thus in a circle, he sinks from 12 to 18 ft. the first day if in favorable ground. An ordinary household bucket is used for hoisting by the sinker's partner, who hauls up hand over hand until about 20 ft. in depth is reached. A rough windlass is then installed, and the sinking goes on to about 50 or 60 ft. At about 25 ft. the CO_2 content of the air becomes high and will not support the combustion of a candle, at 30 to 35 ft., according to the nature of the ground, the air becomes "hot," as the Chinese term it, and a temporary expedient is then effected by tying a big bunch of leafy branches to the end of the hoist rope and rapidly raising and lowering it. When a depth of about 40 ft. is reached, the air usually becomes really bad and fresh air is supplied by means of a portable forge-blower and an oil-coated calico tube of about 4 in. diameter. By this means the coolies will readily sink to 60 ft. provided the water is not too troublesome. The depths mentioned vary widely with the nature of the alluvium. The ascent and descent of the shaft are managed by means of staggered niches cut in the sides of the hole into which the hands and feet are placed.

The advantages of shaft testing over drilling are marked, inasmuch as the equipment is so simple and can easily be carried into distant and hardly accessible places. Then too, with the usual shaft-sinking crew, three or four holes can be worked simultaneously. This method opens up the ground for the personal observation of the sampler and allows a ready resampling when desired.

The sampling is carried out by making a vertical cut up the side of the shaft and allowing the contents to drop into the suspended bucket. This is usually done in 5-ft. sections, the bucket being tipped into a box measuring 8x8x7$^{3}/_{8}$ in., and whose capacity equals $^{1}/_{100}$ cu.yd. The contents of the box are well rammed down and leveled off, the material then being bagged and taken to the nearest creek for washing.

The quantity mentioned is a convenient unit amount to wash, as it completely fills one of the ore bags used in shipping wolfram concentrates and makes a convenient dishful for washing. The sample before bagging is weighed and its weight compared with that of a measured cube of similar ground cut out of some of the workings. The difference usually gives a fairly high conservative factor for valuation, but allowance must be made for the considerable percentage of large boulders not included in the sample. The product of the washing is taken to the laboratory where magnetite is removed by a magnet, the coarse material hand-picked clean and the fines rewashed. In weighing, a specially devised set of weights is used, the unit of which, weighing 70 grains, corresponds to 1 lb. per cu.yd. The weights extend from 3 grains (0.05 lb.) up to 7,000 grains (100 lb.). Thus the value of the washing concentrate is read off directly in pounds per cu.yd.

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[1] A rupee is \$0.32, an anna is \$0.02, United States currency.

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Southern Graphite Mining

Stimulated by the large war demand for graphite crucibles, during the last 18 months, graphite mining in the South has been unusually active. Even before the war, however, a number of Alabama concerns were successfully competing with the product imported from Ceylon and Madagascar.

The present centers of production are in Clay and Chilton Counties, Alabama. Near Ashland the graphitic schists occur in a number of parallel bands in a zone varying in width from one to two miles and known to extend for a length of at least 12 mi. These deposits are weathered to a depth of 50 to 65 ft. and mining is confined, so far, to the weathered material. Four milling plants are now in operation on this weathered graphite material, and two new plants are nearly completed.

A promising deposit of graphite is now being newly exploited at Burnet, Tex., by Los Angeles men, operating under the name of the Texas Graphite Co. The mine is 8 mi. from Burnet, the shipping point on the Houston & Texas Central R.R.

The deposit at this locality is in a band of schist 100 to 200 ft. wide traceable about 4,000 ft. Careful sampling of 1,100 ft. at the west end of the deposit resulted in 11,000 lb. of samples assaying 10.3% graphite. Though the flakes are smaller on the average than those of the Alabama deposits the preliminary examination indicates that the deposit will yield a fair proportion of flakes large enough for crucibles. A mill is now being built at the mine.—*U. S. Geol. Survey Press Bulletin,* July, 1916.

Details of Milling and Smelting

Interesting Belt-Cutting Kink*

In spite of all the belt kinks I have read and the number of times belt men have been cautioned to "cut the belt square" before lacing, here is a good one that insures straight running even though the cut is not made square. In fact, a straight-edge or steel square is not needed at all for jointing narrow belts. J. C. Conn is the discoverer of the method, and he has given me permission to give it to the belting world.

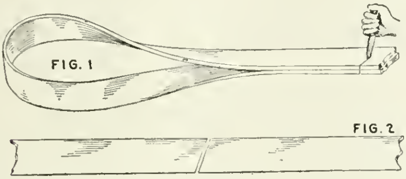

FIG. 1. SHOWS HOW THE BELT IS FOLDED, FIG. 2 HOW IT MATCHES

The sketches show the method plainly—Fig. 1 how the belt is laid for cutting and Fig. 2 how the ends match. Match the two ends, one on top of the other as shown, with both smooth sides either up or down and the sides perfectly even. Then cut both together along a straight line. If cut square, at 45 deg. or any other angle, the joint will be a perfect fit.

In case of double or triple belts, where both sides are smooth, place the "outside" of the belt either up or down. The belt must be twisted so that *the same side is on top* at the point of cutting. The reason is evident.

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Differential Flotation Process

A recent British patent granted to Minerals Separation, Ltd., is designed to aid in the recovery of various sulphides by flotation. The invention comprises certain improvements in which ores are subjected to flotation separation with agitation in the presence of metallic copper or mercury, or of a compound of such metals, for obtaining preferential flotation and securing concentrates relatively rich in certain sulphides, such as zinc. In this invention an alkaline medium or a medium having a bichromate of an alkaline metal in solution is employed. The apparatus used in carrying out the process may be lined with copper or an alloy containing copper, or the apparatus itself may be constructed of this metal or alloy; or alternatively, the metal may be placed in the apparatus in any convenient form or may be introduced with the circuit or pulp in the form of finely-divided metal or compound.

Illustrating the application of the invention, an example is cited in which 250 lb. of a mixed zinc and lead sulphide ore assaying 31.5% zinc, 13.5% iron, and 7.8% lead, were subjected to flotation separation with agitation and aëration at a temperature of 140° F. with an amount of eucalyptus oil equivalent to ½ lb. per ton of ore, treated in a circuit water containing 0.1% of potassium bichromate, the dilution of the pulp being in about the proportion of 1 : 4. The separating vessel was built of wood and lined with copper. A float concentrate assaying 50% zinc, 7.2% iron, and 6.9% lead was obtained and a residue assaying 7.3% zinc, 20.9% iron, and 8.1% lead. In the second experiment, a mixed zinc, iron and lead sulphide ore, assaying 32% zinc, 15% iron, and 8% lead was subjected to flotation at about 130° F., with an amount of cresol equivalent to ½ lb. per ton of ore treated in circuit water containing in solution 0.1% of potassium bichromate, dilution again being 1 : 4. Carbonate of copper equivalent to 1% of the ore was added to and agitated with the mixture. Float concentrates assaying 53% zinc, 6% iron, and 4% lead were obtained, and a residue containing the bulk of the iron and lead sulphides. The patent bears No. 4,974.

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Making Durable Flotation Froth

Since the efficiency of flotation is believed to largely depend upon the quantity, and especially upon the durability of the froth, the following process is designed to accomplish an increase in both for a given quantity of common frothing agent. Its success enables a reduction in the quantity of frothing agent which was previously necessary, a shortening of the duration of the process, and an increase of extraction in a given cell.

These results are attained by adding to the oil employed the necessary percentage of a resinate of an alkali such as soda, potash or lime. As a chemical equivalent of these others, ammonia may be combined with resin to form a resinate of ammonia.

The desired superior flotation oil is obtained by mixing together the following constituents: 50% petroleum, 15% pine oil, and 35% resinate of soda or resinate of ammonia. It is understood that rosin oil may be substituted for rosin in the above mixture, and the proportions may be varied at will to suit different ores. This process is the invention of Homer T. Yaryan, of Toledo, Ohio, granted patent No. 1,191,053 on July 11, 1916.

⁂

Ohrn Flotation Concentrator

With the object of eliminating mechanical agitation provided in the earlier patented apparatus, a steam jet acting as an injector both introduces the ore into the separation cell and provides the necessary aëration and agitation.

The crushed ore fed into the hopper *A*, shown in section in the accompanying diagram, comes in contact with the steam jet from pipe *B*, the combination of hopper and steam pipe acting as a steam injector. Within the steam pipe runs the small pipe *C* connected to the outside funnel *D* into which is allowed to drip the frothing agent, such as oleic acid. The steam jet sucks in the frothing agent and air, and, upon impinging on the ore particles in the hopper, injects them within the separation cell beneath the surface of the water. The steam jet causes a thorough agitation of the mixture of frothing agent, air and ore pulp. The metalliferous particles become attached to the air bubbles, which are deflected toward the surface by the guide plate *E*.

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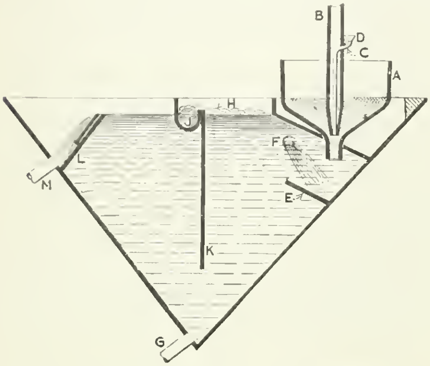
*W. F. Schaphorst, in "Power," July 4, 1916.

As the mineral-coated bubbles rise, they meet jets of water from the spray pipe *F*, which help to remove any gangue particles attached to them. On sinking to the bottom of the cell, the gangue particles are drawn off at spigot *G*. The metalliferous particles buoyed to the surface form a copious froth, which overflows the lip *H* into the launder *J*. The water containing the gangue slimes flows around the dividing partition *K* and up to the lip of the short partition *L*, thence through the outlet *M*. The inventor is G. E. Ohrn, of Stockholm, Sweden, granted Patent No. 1,187,772 on June 20, 1916, which is assigned to Minerals Separation, Ltd.



SECTIONAL ELEVATION, OHRN CONCENTRATOR

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Improvements at Mt. Lyell

Foundations for the new converter plant at Mt. Lyell, Tasmania, are now being placed, but the delivery of the machinery has been delayed by difficulties due to the war, according to Chairman Bowes Kelly, who presided at the recent half-yearly meeting of the Mt. Lyell Mining and Railway Co. in London.

The flotation plant has been operating profitably for several months both on the Comstock ore and on low-grade ore of the North Lyell mine.

Perhaps the most interesting statement the chairman made in regard to metallurgical work was the reference to "the extraction of sulphur from pyrites by means of heat derived from coal and also from the electric current." "Some very pure sulphur," he said, "has already been made, practically on a working scale, but the economic features of the treatment still require further investigation."

If additional time be given in which to organize a company and raise the necessary capital, the directors intend to exercise their options on the Hercules, Tasmanian Copper and Primrose mines. Arrangements have been made with the Tasmanian government for 50,000 hp. from a hydro-electric development, and it is expected that the ores from the West Coast mines will be utilized for the production of electrolytic spelter.

Action of Crude Acetylene on Metals

In consequence of a communication from Wa. Ostwald regarding observations which contradicted the results of H. Reckleben and J. Scheiber and suggested the possibility of the formation of an acetylide by the action of acetylene on metallic copper, the latter repeated their experiments (*Chem Zeit.*, 1916, XL, 325; *Journ.* Soc. Chem. Ind., 1915, p. 214 and May 15, 1916).

Crude acetylene containing polymerization products, hydrogen sulphide, ammonia, etc., was passed over copper foil and the layer produced on the surface examined; it did not exhibit explosive properties on heating, and on boiling another sample with dilute hydrochloric acid, no acetylene could be detected after removal of the hydrogen sulphide from the gaseous products. Prolonged digestion with 15-20% hydrochloric acid resulted in the solution of the copper sulphide in the layer, and eventually the liberation of acetylene, which must therefore have been present in the combined state. The authors were unable to decide by analysis whether the nonexplosity of the product was due to the distribution of the cupro-acetylide in the sulphide, phosphide, oxide and other copper compounds, or to the presence of the more stable cupri-acetylide. It is considered remarkable that an acetylide should be produced in presence of hydrogen sulphide, as copper acetylides are readily converted into sulphide by an irreversible reaction with the liberation of acetylene.

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Uranium in Tool Steel

The latest development in the tool-steel industry appears to be the application of uranium as an alloy in varying quantities, according to a note in *Iron Age*, Apr. 20, 1916. In the accompanying table are shown a number of comparative tests of tools made from uranium high-speed steel as compared with regular high-speed steel. The tools marked *U* are uranium-steel tools; those marked *B, C* and *D* are regular high-speed steels. The tests were made under the direction of the Standard Chemical Co., Pittsburgh, at the works of the Mesta Machine Co. and other large users of tool steel. All uranium tools were $\frac{1}{2}$x$1\frac{1}{2}$ in., except No. 8-U, which was 1x2 in.

COMPARATIVE TESTS OF URANIUM AND OTHER HIGH-SPEED STEELS

Tool	Feed, In.	Speed, Ft. Per Min.	Depth of Cut, In.	Remarks
Cutting 0.50 per cent. carbon 12-in. shaft:				
No. 1-U......	$\frac{1}{16}$	75	$\frac{1}{4}$	Went over once distance of 14 in. On second lap went 3 in.
B........	$\frac{1}{16}$	75	$\frac{1}{4}$	Went distance of 4 in.
D	$\frac{1}{16}$	75	$\frac{1}{4}$	Went distance of 1 in.
Cutting 8-in. shaft 7 ft. 5 in. long:				
No. 1-U......	$\frac{1}{16}$	51	$\frac{5}{8}$	Went over twice. Cut changed to $\frac{3}{8}$ in. on second turn.
C	$\frac{1}{16}$	35	$\frac{5}{8}$	Did not go 1 in.
Cutting 6-in. shaft:				
No. 1-U ...	$\frac{1}{32}$	75	$\frac{5}{8}$	Ran 18 in.
No. 2-U......	$\frac{1}{32}$	75	$\frac{5}{8}$	Ran 13 in. Speed increased to 90 ft. per min. and ran 11 in. Tool still good.
B......	$\frac{1}{32}$	75	$\frac{5}{8}$	Ran 11 in.
Cutting 10-in. shaft:				
No. 4-U........	$\frac{1}{16}$	60 to 65	$\frac{5}{8}$	Went 8 in.
No. 2-U	$\frac{1}{16}$	65	$\frac{3}{8}$	Went 4 in. Speed increased to 80 ft. per min. and went $3\frac{1}{2}$ in.
No. 1-U	$\frac{3}{64}$	55	$\frac{5}{16}$	Wnet 16 in.
B	$\frac{3}{64}$	55	$\frac{5}{16}$	Went $2\frac{1}{2}$ in.
No. 5-U......	$\frac{3}{64}$	55	$\frac{5}{16}$	Went 15 in.
Cutting 12-in. shaft 22 ft. long:				
No. 8-U......	$\frac{1}{16}$	45	$\frac{5}{8}$ to $\frac{3}{4}$	Ran 87 in. Most of time the nose of the tool was right on scale.
Cutting 12-in. forging:				
No. 8-U........	$\frac{1}{16}$ to $\frac{1}{15}$	38	$\frac{15}{16}$	Went 127 in. Time 3 hr. Speed increased to 65 ft. per min. after tool had gone 105 in.
No. 8-U........	$\frac{1}{16}$	60	$1\frac{1}{16}$	Ran 12 in.

Sonoma Magnesite Mines, Calif.

By Lewis H. Eddy*

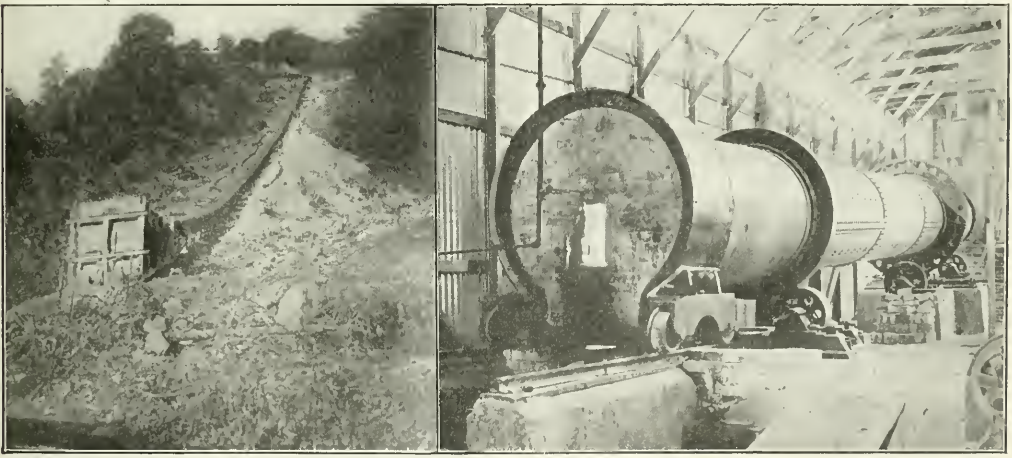
SYNOPSIS—The development of a magnesite property in which the transportation system was the greatest question. Quarrying and underground methods of mining both used. Ore treated in a calcining furnace and product shipped.

The property of the Sonoma Magnesite Co. is situated in the western part of Sonoma County, California, about 60 mi. in an air line northwest of San Francisco. The situation is about 12 mi. by wagon road north of Guerneville, a station on the Northwestern Pacific R.R. The nearest railroad point is Cazadero, 6 mi. south of the property. The company has built a narrow-gage tram road to connect with the Northwestern Pacific at a point called Magnesite, near Watson station. This railroad is 11 mi. long and extends to within 4 mi. of the plant.

The property embraces 30 claims on Austin Creek, extending northwest and southeast for a distance of about 3 mi. The widest part of the holdings is 3,000 ft. The camp is situated in a deep gulch at an elevation of about 500 ft. above sea level, while the ledges and outcrops of magnesite extend for a height of 500 to 1,000 ft. above the floor of the gulch. The calcining furnace is at the southern end and narrowest part of the gulch. The depot, or loading station, of the narrow-gage tramway is about 4 mi. farther south in a broad flat. This station is called Magnesite.

The company has built a good wagon road at a fairly easy grade from Magnesite to the calcining plant and extended it through the camp to the upper mine workings of the property, a farther distance of about 2 mi.; thus making the total of 6 mi. of good wagon road. It is the purpose to extend the railroad from Magnesite along the bank of Austin Creek to the plant and thence to the upper mine workings, parallel to the wagon road.

When this company took over the property about two years ago, the chief problem to be solved was that of transportation. It did not require a great deal of exploration to prove the existence of large deposits of magnesite, nor did the removal of ore offer any difficult problem. Whether removed by drifting and stoping or by quarrying, the ore is obtainable at a sufficiently low cost. The construction of a narrow-gage roadbed and track, a distance of 11 mi., through gulches and around and over hills, presented a more serious problem, which might have been better solved initially, but these errors are being cured by straightening the track and widening the road bed. The track is a 24-in. gage, and the rails are of 35-lb. steel. The equipment consists of a Davenport distillate locomotive and a Joshua Hendy gas-engine locomotive, 10 flat cars, and 6 oil-tank cars. The flat cars are 7 ft. long by 4 ft. wide and 5-ton capacity each, either sacked calcined product or loose crude ore. They are arranged for sideboards and end gates and also may be equipped with top and side covering should such covering be necessary during hauling in winter season. There are some heavy grades from Magnesite to the company's property, but the average possible grade is only about 3% up to the present site of the station at Magnesite. From that point for the next 6 mi. to the extreme northerly workings the grade can be reduced to about the same per cent. by following the bank of the creek. The hauling of the ore from the upper workings, a distance of 2 mi. to the calcining plant, has been done by animal teams; recently motor trucks were substituted. From the plant to Magnesite the haulage is by motor trucks, though it may be necessary to use animal teams during part of the winter for this leg of the haul.



STEEL-LINED CHUTE AND CALCINING FURNACE FOR MAGNESITE

There are three groups of magnesite outcrops in the company holdings, which occur in a large belt of serpentine that extends for a distance of 6 mi. in a northwesterly course from the south end of the company's property. The ledges and veins have been prospected and sufficiently explored, by crosscuts, drifts and opencuts, to satisfy any magnesite miner of an unlimited supply of ore. The lower, or southern, end of the property has been developed by two adit tunnels. The lower one is 200 ft., drifting for a distance of 50 ft. on the outcrop of a vein 9 ft. wide; then run as a crosscut and encountering a small step-faulted vein of magnesite. The upper tunnel, which is supposed to cut the same formation, is a crosscut disclosing a vein of width varying from 6 in. to 12 ft. This magnesite is shown by analyses published by the State Mining Bureau, to be high-grade. The openings are at the site of the calcining plant. Since installing the plant, the company has made an opencut about 50 ft. wide and was taking out high-grade magnesite from what was the outcrop and heavy float from the 12-ft. ledge disclosed by the crosscut tunnel.

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*Associate editor, 3430 Peralta St., Oakland, Calif.

The upper, or northerly, croppings have been opened by quarrying at an elevation of nearly 1,000 ft. above the level of the camp and mill site, and a distance of 2 mi. from the lower workings. The quarrying operation supplies about 50 tons per 8-hr. day. The ore is sorted from the waste and dropped into a steel-lined chute a distance of about 200 ft. at an average pitch of 50° and dumped into loading bins at the lower end, situated on the wagon road. The wagons are automatically loaded and haul from 2 to 4 tons at a load. The chute is illustrated in Fig. 1. This open cut, or quarry, exposes some large veins and ledges, having serpentine for inclosing walls or associated with irregular serpentine formations.

The quarrying method, while it entails the expense of handling a large amount of waste, has been found to be the most economic method of extraction while the property was being developed, and provides for the prompt extraction of ore and haulage. The disclosures in the tunnels at the lower workings are sufficient to warrant the practice of drifting and stoping. At the upper workings, or quarry, a tunnel has been driven through the serpentine for 180 ft., which, if advanced 200 ft. more would tap the ledges at a vertical depth of about 250 ft. below the floor of the quarry.

Formerly the company contemplated the substitution of a bucket tramway for the chute and its extension to the point at which the new roadbed will terminate, about 40 ft. below the portal of the tunnel. But since then a full consideration of the advantages of underground mining instead of quarrying resulted in the determination of the company to advance the tunnel to tap the magnesite ledges and to install proper equipment of compressors and air drills. The ledges will be drifted on and the ore stoped and trammed out to the dumping station, which will be built at the terminus of the railroad extension. This will place the company in a position to carry on ore extraction in three shifts and provide a supply that will necessitate an increase in the milling plant. The tunnel will be driven by hand, which can be done at cost of about $4.50 per ft. Meanwhile quarrying will continue to supply sufficient ore for the present plant.

Ore Calcined and Shipped

All the ore hauled from the upper quarry and the ore extracted from the opening at the treatment plant is sorted. The selected crude is loaded on motor trucks for delivery to the company's cars at Magnesite, and the remainder is crushed in a Gates jaw-crusher, elevated to a feed hopper, where the dust is precipitated to the dust ovens at the bottom of the feed hopper and the ore delivered to an Allis-Chalmers calcining furnace. This furnace is 50 ft. long by 4½ ft. in diameter, having a rated capacity of 35 tons per 24-hr. day. The fuel used for calcining is distillate of California crude oil, commonly termed fuel oil, shipped in 50-gal. drums. It costs $1 per bbl. delivered at Magnesite. The calcined product passes from the kiln to a conveyor chute, built of firebrick on the floor of the mill, extending a distance of 10 ft. to the Meese & Gottfried endless-chain bucket-elevator system that carries it aloft and dumps it into the cooling bins. Fig. 2 shows a longitudinal view of the calcining furnace—the feed end at the extreme right background, the firing end in the left foreground. The cooling and storage bins are built by the Joshua Hendy Iron Works. The testing apparatus is composed of a small jaw crusher and a small grinder. Every 30 min. grab samples are taken and put through the crusher and grinder, the product going to the laboratory. The engine, pumps and shafting are Fairbanks-Morse type.

The plant is in the narrowest part of the gulch, the site being secured by cutting away the ledges of magnesite and their inclosing serpentine walls; in fact, the foundation of the building is a broad bed of magnesite and serpentine.

The calcining furnace was hauled in two pieces and the boiler in one piece by 60-mule teams from Guerneville over heavy grades. A part of this road even in summer, is about the worst example of mountain road that I have ever seen in the state. The hauling was done in the winter season, when the rains made the roadway almost impassable for empty wagons. All the material and machinery going into the construction of the plant was hauled over the same road, to the wonderment of even the management itself. But the demand for magnesite warranted the cost of difficult hauling.

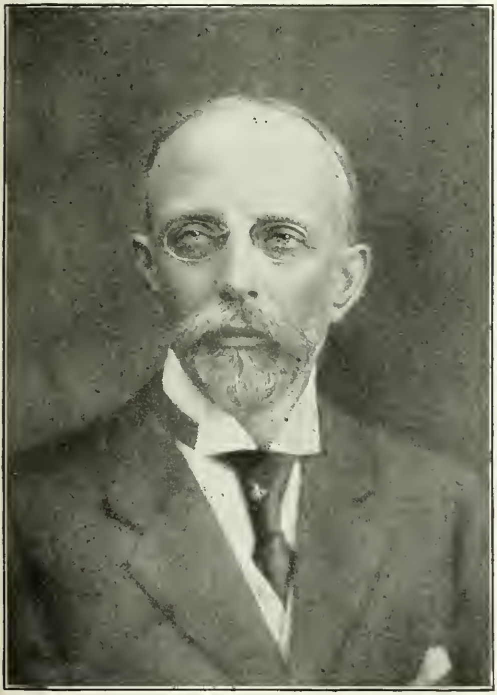
The extraction and shipment of magnesite has been in active progress only about a year, and the little narrow-gage railroad was not completed until Apr. 20, 1916. Prior to that the crude ore and calcined product were hauled to the Northwestern Pacific station at Guerneville by motor truck and animal team.

War Affects German Iron Mines

An announcement of the United States Department of Commerce reports that since the outbreak of the war the demand for iron products has been so great that the industry in Brunswick district, Germany, has been extremely prosperous. One of the greatest difficulties with which the manufacturer has had to contend is the scarcity of manganese, which is mostly imported. The ore used by the Ilseder Hütte, an iron foundry in this consular district near the City of Peine, is so rich in manganese that it is now shipped to other foundries in Germany as a substitute for the imported mineral. The demand has been so great that the greater part of the village of Adenstedt with its church has had to be demolished. The Ilseder company has just declared a dividend of 33⅓% which, the annual report says, was principally earned by the sale of this ore, as the sale of the manufactured products of the company has not been more than two-thirds of that in time of peace.

Charles Kirchhoff

Charles Kirchhoff died at his summer residence, North Asbury Park, N. J., July 22, aged 63 years. He was born in San Francisco, but was educated in New York and passed most of his earlier years there. About 1869 he went to Germany and studied there, graduating from the Bergakademie at Clausthal as mining engineer and metallurgist. Returning to this country in 1874, he obtained a position as assayer and later as chemist and assistant superintendent of the Delaware Lead Works, a refining and desilverizing plant in Philadelphia.



CHARLES KIRCHHOFF

At the time of the Centennial Exposition in Philadelphia in 1876, he secured a position as technical correspondent for several English and German journals, and his letters attracted much attention. This experience seems to have determined him to make technical journalism his future career, and after the close of the exposition he became connected with the staff of the *Metallurgical Review*. A year or so later he joined the staff of the *Iron Age*, but left it in 1880 to become managing editor of the *Engineering and Mining Journal*. In 1884 he returned to the *Iron Age* as associate editor and in 1888 was made editor-in-chief, a position which he held for 21 years. He was also for a large part of that time vice-president of the David Williams Publishing Co., publisher of the paper.

Under his able management the *Iron Age* prospered exceedingly and came to be recognized as the leading organ of the iron and steel trades. He secured the services of many able contributors both at home and abroad and placed the paper on a high plane. He became intimately acquainted with the leading men of the iron and steel trades and was generally recognized as a keen and accurate observer and a wise counsellor on both technical and commercial points. A year or two before the organization of the Steel Corporation, Andrew Carnegie, whose intimate friend he was, urged him to join in the activities of the Carnegie Steel Co., which was then fast becoming the leader and chief factor in the steel industry; but Mr. Kirchhoff declined, preferring to continue the editorial work in which he had been so successful and in which he was completely absorbed.

While always the guiding head and director of his paper, Mr. Kirchhoff did not seek to absorb the entire credit of the work. He raised up around him a body of assistants who ably seconded his work, and when he made up his mind finally to retire, in 1909, they were able to take up and continue the management on the same high plane to which he had adjusted it. After retiring he traveled in Europe for a time and later found employment in travel, in writing occasionally for his paper—in which he retained a financial interest—and in the affairs of the various societies with which he was connected and in whose proceedings he was much interested. It should be mentioned that at an earlier date, in addition to the work on *Iron Age* he had for several years acted as agent for the United States Geological Survey in collecting statistics of metal production.

Mr. Kirchhoff was a member of the American Institute of Mining Engineers for many years and took active part in its proceedings. He was chosen president of the Institute in 1898-99 and again served as president in 1911-12. He was a member of the Iron and Steel Institute and of the American Society of Mechanical Engineers, also of the Iron and Steel Institute of Great Britain and the Verein Deutscher Eisenhüttenleute. He was a member of the Century and the Engineers' clubs.

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United States Steel Corporation reports for the quarter ended June 30 as below, the net earnings being the surplus over all working expenses and ordinary repairs and renewals:

	1915	1916
April	$7,286.409	$25,423,676
May	9,320,576	27,554,899
June	11,343,070	28,147,473
Net earnings for quarter	$27,950,055	$81,126,048
Depreciation and sinking funds		$9,745.826
Interest, etc., on U. S. Steel bonds		5,673,962
Total charges		$15,419,788
Surplus for the quarter		$65,706,260
Dividends declared		17,741,725
Undivided surplus		$47,964,535

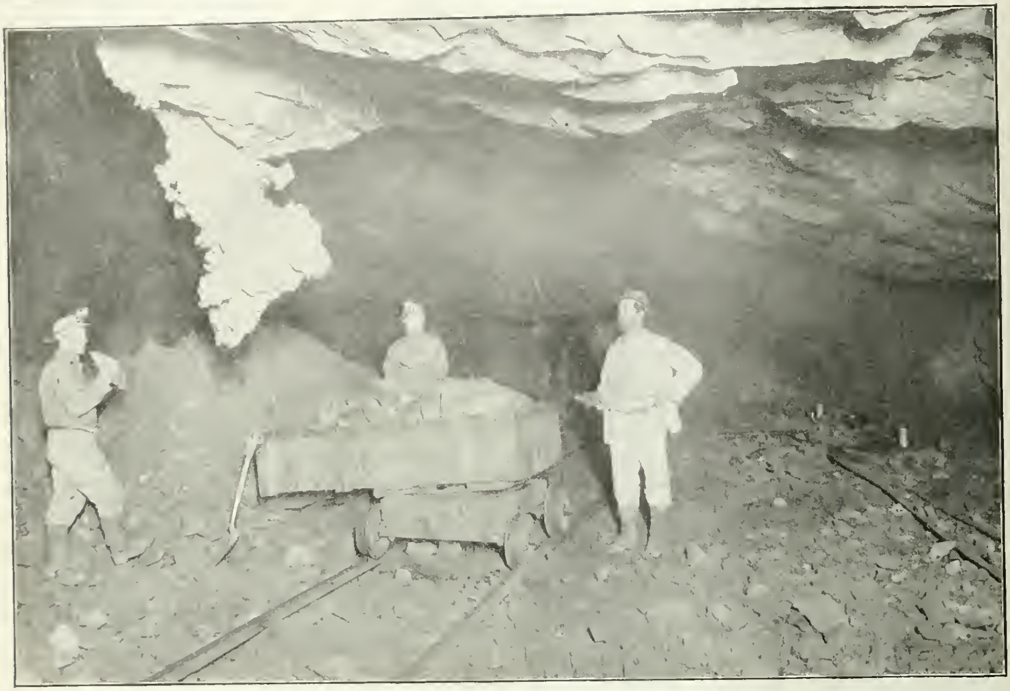
The dividends declared were the regular 1¾% on the preferred stock and 2¼%—being 1¼% quarterly and 1% extra—on the common stock. No statement is made of any special appropriations from surplus. The net earnings for the half-year ended June 30, 1916, were $141,839,672, being $101,431,808 more than in the first half of 1915.

President Farrell issues the following statement: "During the past quarter the plants and properties of the Steel Corporation were operated at their maximum capacity. Both production and earnings exceeded those for any previous quarter.

"The several subsidiary companies have many extensions and improvements under way, calling for the expenditure of a very large sum of money. These improvements are mainly for the purpose of diversifying products and increasing the economic efficiency of the properties.

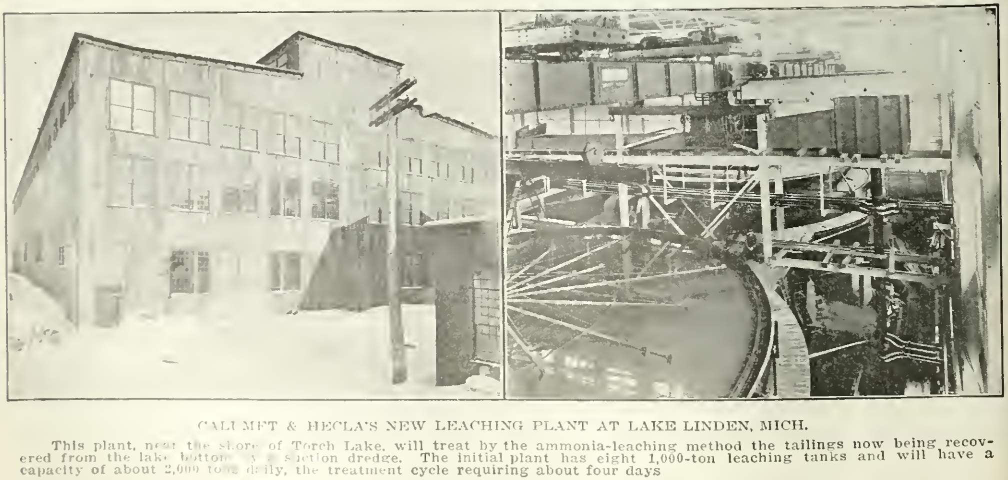
"Unfilled orders on hand at June 30, 1916, amounted to 9,640,458 tons, which will occupy the mills for several months. New business is coming in at a satisfactory rate, many contracts being entered for delivery of materials throughout 1917."

Photographs from the Field



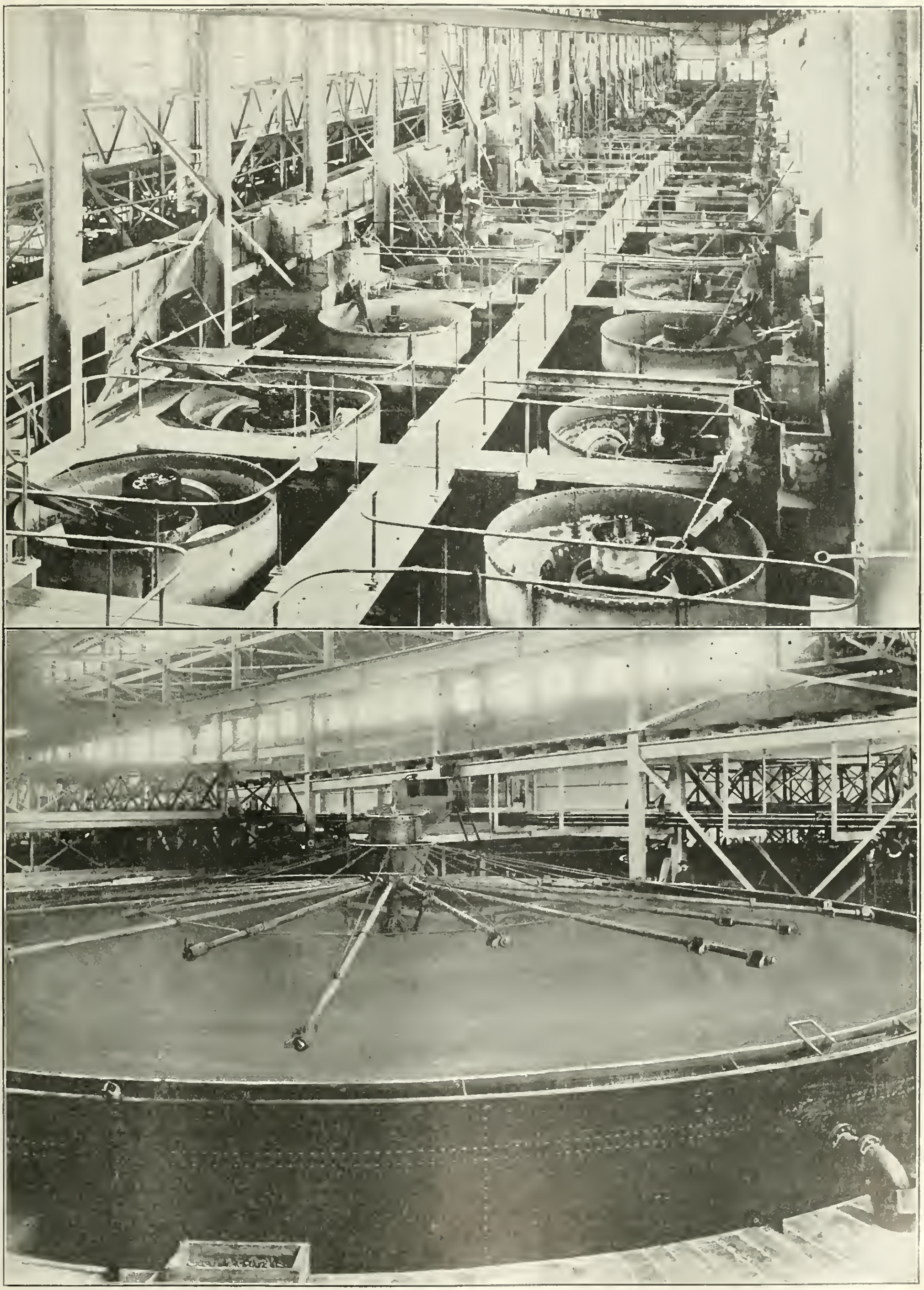
MASS COPPER IN THE CHAMPION MINE, PAINESDALE, MICH.

Occurrences of masses of native copper in the Lake Superior district are sometives of great size. This particular mass extended over 100 ft. above the portion shown in this view. In another of the Copper Range Consolidated properties, the Trimountain mine, there was an occurrence of mass copper extending from the third to the 22nd level



CALUMET & HECLA'S NEW LEACHING PLANT AT LAKE LINDEN, MICH.

This plant, near the shore of Torch Lake, will treat by the ammonia-leaching method the tailings now being recovered from the lake bottom by a suction dredge. The initial plant has eight 1,000-ton leaching tanks and will have a capacity of about 2,000 tons daily, the treatment cycle requiring about four days



TWO INTERIOR VIEWS IN THE NEW CALUMET & HECLA LEACHING PLANT

Correspondence and Discussion

Bolivian Mining Data

In the *South Pacific Mail* of Apr. 27, 1916, appears an article on Bolivia copied from the *Bulletin* of the Pan-American Union. Within the last two years a number of articles on Bolivia and the west-coast republics have been published (some of them in the *Journal*), the majority of which have undoubtedly been written by men with but a scant acquaintance with their subject. Their bad work may be forgiven, as perhaps they did their best.

But from such a publication as the *Bulletin* one expects correct data. In the article mentioned, the Antiquera (Antequera) mine is referred to as a rich tin mine. This must be over-cocktail information from Antofagasta. The Antequera mine is perhaps the most dismal failure in Bolivia, as many a Chilian investor can testify.

Berenguela, in the province of Cochabamba, is said to have an exceptionally high grade of ore. As a matter of fact it is well known to have an exceptionally low grade of ore. Moreover, Berenguela is a mountain, on which are located four to six tin-mining companies, all of little importance. I doubt if the total production amounts to 40 tons of *barilla*. The Berenguela company, the biggest concern, is the most consistent producer.

We have yet to learn in these parts, that the Monte Blanco mines are a great success. As the Santa Fé lode is said, in the *Bulletin*, to have an average width of 6 to 9 ft. (1,000 ft. of outcrop) and 12% pure cassiterite, it ought to have been made a success. Such values are not to be found, and the statement has probably been copied from some authority still more unreliable than the *Bulletin*.

Again, it is stated that "in the country of the Aymara no such objects (bronze) are ever found, yet it is here that the known tin deposits of the present time are located." I read this to mean that there are no known (or few) tin deposits in the country of the Quechua race. An exactly opposite statement would be nearer the truth. Chorolque, Tasna and Chocaya Mountains, embracing some of the best tin mines, are in the country of the Quechua. Chorolque (a mountain) is described as one of the four mining districts of Bolivia. The mountain is the center of the mining activity of the Aramayo Co., operating also on Chocaya and Tasna. From Chocaya the output is now probably greater than from Chorolque, the chief producers being the Oploca Co., Aramayo (Chocaya section), and smaller concerns. The whole district can more correctly be described as the Southern Potosi. At present the mines of Bolivia can best be divided into three groups: First in importance, those of Oruro (with the town of Oruro as center) and including the Berenguela mines; second, those of the department of Potosi; and last, and not yet of much importance, the mines near the City of La Paz. There are other errors in this article, but enough have been noted, as may be seen from the corrections noted here, to show that the *Bulletin* is not a reliable authority on Bolivia. J. H. IVEY.

Antofagasta, Chile, June 16, 1916.

Gas Explosion in Metal Mines

An accident occurred recently at the Peters mine of the Puruni Development Co., Ltd., Demerara, British Guiana, which may be of interest and may also serve to call attention to an unusual form of danger, against which it will be wise to take precautions in opening up old mines.

The property had been closed down for six years when we began to dewater the shaft about Mar. 1, 1916. After the workings were pumped to the 300-ft. level, another engineer and I waded in through about 4 ft. of water to make an examination. About 350 ft. from the shaft a stope 140 ft. long had been opened and timbered with square sets on the level. Above the timber the stope was filled with waste to within 15 ft. of the back, with the exception of four cribbed chutes and manways. A connection to the level above was at the time sealed by mud and water, making the open part of the stope an excellent trap for gas.

There was no evidence of gas or foul air on the level, but an attempt to climb one of the manways was almost immediately followed by a violent explosion, accompanied by blue flames that continued to burn for some time. The water on the level was fortunately deep enough to afford a temporary refuge and was probably the means of preventing a fatal accident, as the heat was intense and all parts, even those momentarily exposed, were severely burned. The gas must have been generated by the decomposition of the mine timbers, as neither the quartz-vein matter nor the hornblende-schist country rock could well have been responsible for it. Local hardwoods, greenheart and mora, were used in timbering. The volume of the gas that ignited was about 40,000 cu.ft. This experience suggests the advisability of using a safety lamp or something of the kind under similar conditions.

E. V. NEELANDS.

Demerara, British Guiana, June 15, 1916.

Drill Steel Consumption

Having had occasion to investigate the consumption of drill steel at our company's mine and found it surprisingly high, I have been trying to secure data from other mines for comparison. Much to my surprise I found, on looking through a stack of company reports, that only an insignificant number of companies apparently paid any attention to the cost of drill steel. Beyond the bare fact that it cost from $0.002 to $0.004 per ton stoped at some of the largest mines where the stoping tonnage per drill-shift was as high as 35, and from $0.011 to $0.021 per ton where the tonnage was considerably less, the investigation netted nothing. Apparently this cost item is one commonly relegated to the catchall caption such as "miscellaneous costs," "general expense," or "sundries," or if mentioned at all, most aggravatingly lumped under cost of "drill steel and sharpening," a most unfortunate condition.

The most valuable information so far accumulated was furnished by the Colonial Steel Co. of Pittsburgh as follows:

"One of the large zinc-mining companies states that the loss of steel due to wear, breakage and resharpening is 0.02 lb. per ton of ore broken, or $\frac{2}{3}$ lb. per ton of concentrates. Loss for each resharpening operation is 0.07 lb. steel. This data refers entirely to $1\frac{1}{4}$-in. round hollow steel."

In the hope that this will attract the attention of others interested in the subject, I am forwarding the item to you for publication.

I am bound to admit that the steel consumption at our mine is very much greater than at the rate of 40 to 50 tons stoped per lb. of steel. And if other managers of comparatively small mines will look into the facts, I believe they will discover a similar condition at their own properties. It is probably a common failing with most of us to take it for granted that the blacksmith knows all about steel and its sharpening and that is one item the manager need not worry his head about. As a matter of fact, I believe investigation will show that most blacksmiths waste more steel than is necessary. Others through a mistaken zeal for quantity of work to please the boss, burn a lot of steel on the one hand, and do such a poor job of tempering, on the other hand, that the drill footage per shift is materially reduced.

I know one or two mine managers who never set foot in their shops more than once or twice a month and then only to promote good feeling by handing out the smokes. This good-feeling promotion is commendable, but it would be more so if, when once established, the manager would take the time to learn a few facts about steel consumption in the shop and then figure a way to help the blacksmith save the company considerable money by reducing consumption and increasing footage. DRILL STEEL.

New York, July 20, 1916.

Propeller Slimes Agitator

I have been deeply interested in the descriptions of the propeller slimes agitator as published in the *Journal* of May 6, and July 15, 1916. My attention has been attracted to this device because I have been operating slimes agitators since the institution of slimes treatment by agitation, beginning with the original system of putting an air pipe into a slimes tank and moving it around by manual labor. I have seen the development of the mechanical agitator from its simplest forms to the air agitator and the patented forms, such as the Trent, Patterson, Pachuca, Parral, Hendryx, Dorr, and a lot of others. The tendency from the beginning has been to secure as efficient agitation as is possible with least possible expense. The system as installed at the plant of the Hedley Gold Mining Co. appears to me to partake of the qualities of the Hendryx agitator. While nobody denies that the Hendryx is a good machine, and this new agitator may be as good, both of them giving efficient agitation and good results so far as extraction is concerned, it still seems to me that they must consume more power than most operators care to put into slimes agitation at the present time. Most of the modern agitators will give good results in the same way, but the object to be attained is to secure the agitation with the least possible expense. It appears that some of the new forms of tanks, such as the Pachuca or the Dorr agitators, must be able to deliver good results, so far as agitation and extraction are concerned, together with lower costs than can be expected with a propeller device. It has generally been considered that the propeller system entails higher costs due to its greater power consumption. I should be deeply interested in knowing more about the results obtained at the Hedley mill with the Devereux propeller, since if a device of this kind can be operated at a cost as low as some other types of slimes-agitating machines, it would be of value for me to know of it.

New York, July 20, 1916. HENRY A. MARVIN.

Drilling and Analysis of Copper Ores

I have read with interest A. J. Sale's able article on "Drilling and Analysis of Copper Ores," in the *Journal* of July 8, 1916. Mr. Sale's attitude as to the reliability of assayers reminds me of the time-worn story of the blind man at the circus who, having laid hold of the tail of the elephant, declared the animal to be shaped like a rope.

His statement in the article that "any manager who trusts his copper assaying to any one man, without any kind of a check, is courting commercial suicide" appears to me to be a rather far-reaching assertion. I believe most engineers will agree with me that the chance of receiving the grossly inaccurate returns cited in his article are remote—so remote in fact as not to be worthy of taking into account as a probable source of error in drillhole or any other samples. I also believe that most men who have had any considerable experience with sampling and laboratory work will agree that the chances of error, after the sample has been delivered to the assayer, are slight.

The errors mentioned in Mr. Sale's contribution—"one drill hole where over a hundred feet of nearly 2% ore was reported as 0.5%, and in another hole where the same grade of material was reported as 0.1%"—appears to me to be due, possibly, to the employment of the "ocular" or "backdoor" method of assaying rather than to the extreme insolubility of the "refractory" chalcopyrite and other complex sulphides contained in the sample.

Grants Pass., Ore., July 13, 1916. E. R. CROUCH.

Engineering Students Number Over Thirty Thousand

The appended tabulated figures on students in the engineering schools of the United States were presented at the recent annual meeting of the Society for the Promotion of Engineering Education, through the coöperation of the United States Bureau of Education and the society's Committee on Statistics. A variety of interesting comparisons are possible, such as the great increase in chemical engineers, the decrease in civil and mining, and the slump and recovery in number of mechanical engineers.

STUDENTS IN THE UNITED STATES

Engineering Branch	1906	1911	1915
General	2,501	5,591	6,059
Chemical	1,234	1,452	2,383
Civil	7,962	8,934	7,182
Electrical	5,696	6,128	6,637
Mechanical	7,426	7,052	7,751
Mining	2,826	2,337	1,922
Other	82	....	958
Total	27,727	31,499	32,843

United Eastern Mine, Oatman, Ariz.

By J. A. Burgess*

SYNOPSIS—Brief account of the development of the United Eastern mine, the discovery of which resulted in the present activity at Oatman.

The discovery and the opening of a large body of high-grade gold ore on the property of the United Eastern Mining Co. at Oatman, Ariz., was accomplished with a directness and speed that has seldom been equalled. The company was incorporated in November, 1913. In March, 1914, shaft sinking was started by means of a hand windlass. After sinking to a depth of 40 ft., work was stopped temporarily, until July of the same year. At this time a headframe was erected and in September a gasoline hoist was set up. In October, 1914, the shaft intersected the vein near the 200-ft. level. The vein was small and weak, but offered encouragement to the prospectors. Samples averaged from nothing up to $8.78. About a month later the 300-ft. level was reached and a crosscut encountered the vein 10 ft. from the shaft. At this point the vein was also small, but a width of 1 ft. assayed from $14 to $27, a selected sample assaying $193. By March, 1915, a crosscut was driven through the vein on the 465-ft. level, where a width of 25 ft. of ore averaging $22.93 was exposed. Since that time the vein has been opened by drifts and crosscuts on the 565- and 667-ft. levels, with the result that about 200,000 tons of ore, assaying higher than $20 per ton in gold and having a gross value of approximately five million dollars, has been opened sufficiently for sampling and estimating. In places the ore has a width of 40 ft. No work has been done below the 667-ft. level, but the orebody maintains its strength and grade at that depth. The vein consists of calcite irregularly banded with quartz, the valuable metal content being practically all in gold. The country rock is andesite.

UNITED EASTERN SHAFT, THE STRIKE IN WHICH STARTED THE OATMAN EXCITEMENT

An all-sliming cyanide mill of 200 tons daily capacity is now being built on the property and a new working shaft is being sunk. The crushing department of the mill will have a capacity of 400 tons and the cyanide department will have a capacity of 200 tons. This arrangement will permit of doubling the capacity of the mill readily, whenever it may be required. It is expected that the mill will be completed the latter part of this year.

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*General superintendent, United Eastern Mining Co., Oatman, Ariz.

The discovery of the United Eastern mine reads like a romance. In March, 1913, J. L. McIver, a miner and a man of keen observation, came into the Gold Road-Tom Reed district looking for a "poor man's opening" in mining. He found two of these that suited him; one was a lease on the old Moss mine, and the other was an option on the group of claims now included in the United Eastern property. The principal merit of the latter was its proximity to the oreshoots of the Tom Reed mine. After securing these options, McIver sent to Bisbee for his partner, George W. Long, and these two proceeded to work on their lease, and at the same time tried to raise funds for developing the United Eastern property. With absolute faith in the enterprise they did what work they could by themselves, and even went to work for wages in the adjacent Tom Reed mine to raise additional funds. Their observation in this mine confirmed their faith in their optioned property, and they approached several captalists for financial assistance.

On June 27, 1914, W. K. Ridenour, of Oatman, secured a small block of United Eastern stock at 25c., and had sufficient confidence in the property to recommend and sell United Eastern shares to his friends at 25c. From these sales, together with those of Long & McIver, there was raised, up to December, 1914, approximately $13,000, which was applied to the development of the property. All of these people to whom the stock was sold have reaped great profit on their investment. In December, 1914, they were successful in interesting Messrs. Frank A. Keith, Seeley W. Mudd and Philip Wiseman, of Los Angeles, and through them secured the funds that enabled them to carry their enterprise to its present state of success.

Italy, A Field for American Mine Supplies

By Charles Will Wright*

As a mining country Italy has not attracted much attention in America. Its metal production is comparatively small and comes mostly from the lead and zinc mines in Sardinia, although the mercury and pyrite mines in Tuscany and the iron mines on the island of Elba add largely to the annual metal output. Although these Italian mines are among the most ancient, it is only during recent years that developments on a sufficient scale to make them important producers have been initiated, and the large tonnages of ore at present available and the extensive fields for further exploration, particularly in Sardinia, make the outlook promising.

The total amount of supplies consumed at the mines in Sardinia alone equals $2,500,000 annually. Previous to 1915 a large percentage of the mine supplies were imported from Germany and names such as Koppel on the mine trucks, Krupp on the ball mills and Flottman on the rock drills are the most noticeable. Without these importations from Germany and because of the present high freights from England and America, the prices of many of the mine supplies in Italy have risen 100%, and more in certain instances. The supplies that are largely imported consist of drill steel, piping, rails, rock drills and compressors for underground work; steel cars, car wheels, hoists, wire rope, aërial ropeways and ore sacks for transport; and belting, shafting, clutches, screens, steel balls, crusher plates, roll shells, etc., for the concentrating mills. As to the steam-engine plants, Diesel and gas engines and electrical equipments, most of the mines use those of Italian manufacture. Milling machinery, such as jigs, screens, and table, is constructed at the mines or by the local foundries.

There are a number of steel plants in Italy, and a few of them manufacture such mine supplies as cars, rails, piping, steel balls and roll shells, but since their output does not meet the demand and that for drill steel, wire rope, belting, screening, etc., the mines are practically dependent upon imports. For this reason many of the necessary supplies are now becoming scarce and high prices are being paid for those of inferior quality. A few examples of present prices are as follows: Drill steel solid and hollow, 2 lire and 3 lire per kg. (18 and 25c. per lb.); construction steel, rails, etc., 0.60 to 1 lire per kg. (5 to 9c. per lb.). For dynamite, oil and coal the prices have more than doubled. It is probable that as the difficulty of obtaining these supplies increases still higher prices will be paid and certain of the necessary articles may not be obtainable. Such is the present condition of the market.

The Italian field, though now small, is a growing one and worth the attention of the American manufacturer who desires to export his products, and the present year is the time to consider how to introduce them into Italy before the German manufacturers corral the business, as they certainly will do after the war, wherever they find an opening.

The writer's experience has been confined to the importation of small shipments of mine and mill machinery from the United States to Sardinia, and because of the difficulties encountered he finds that certain changes are necessary before American exporters can hope to have any success in selling their products in Italy or in other Latin countries. This problem of promoting trade relations with the Latin countries presents many difficulties—serious difficulties, although they may not at first seem so—which the American manufactnrer must recognize in order successfully to compete in the future with German manufacturers, who have mastered the situation.

They must first realize that foreign purchasers cannot be bothered with our system of selling supplies by the foot, pound and gallon, which denominations often mean little to him, while quotations given in the metric system, which he knows thoroughly, are more acceptable. A prominent mine manager recently showed me a quotation per foot and per pound for drill steel from an English firm, given in English currency against cash payment by some London bank on presentation of shipping documents. He shrugged his shoulders and said *"Come si fa?"* (What can one do?). It would take him some time to figure out the quantity and cost per kilogram or meter in his own currency, and as to the amount to add for transport and duty he knew nothing. The result is that he sends his order to some agent in Italy, who gives him quotations in the metric system and in Italian currency, including transport and duty to Italy and often to the railway station nearest his mine and against payment on or soon after receipt of goods. This agent naturally adds from 20 to 60% to the price as his commission.

Giving quotations in the metric system and currency of the country from which the request comes is not enough. The American exporter must obtain the freight rate and quote for deliveries at one of the principal ports in the country to which the shipment is to be made, and, still better, he should indicate the amount of duty to be paid at the port of entry in that country. A table of duty rates can be obtained from any Italian consulate or from Ulrico Hoelpi, publisher, Milan, Italy.

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*Mining engineer, Ingurtosu, Sardinia.

The Italian mine manager, and it would probably be the same in Spain or any other Latin country, usually has an exaggerated idea of freight rates and duty on imports, and this fear often prevents him from sending orders to foreign firms.

To get this trade it would be well for the American manufacturer to have his catalogs or descriptions of the articles he has to offer translated in Italian, French or Spanish as the case may require. A list of the mining companies that would probably become purchasers should also be obtained, catalogs sent them and a local agency established if possible. The turning over the sale agency for a district to a foreign agent is often risky, as he may hinder rather than promote business, especially if he is not situated in the mining district. The foreign agent does not always realize the importance of advertising or the necessity of following up inquiries in order to find business, and it is therefore advisable for the American manufacturer to do his own advertising by correspondence. By using caution in selecting local agents in the foreign mining districts and by providing such agents with prices and samples of articles or descriptive matter properly translated, it will be possible gradually to build up a substantial foreign trade.

The usual method of payment for supplies from the Italian and German firms is one-third of the amount with the order, one-third at the time of the delivery of the goods and the balance three months after delivery. Payments are usually made through some bank such as the Credito Italiano, which is represented in New York by the Guarantee Trust Co., and the standing of the mining companies may be ascertained through them.

The Italian mining companies are generally of high standing, both financially and morally, and they must be so considered. If they are to trust the American manufacturer to ship the quantity and quality of goods ordered, they must in turn be trusted to pay for them, as they are accustomed to do with Italian and German firms. To demand full payment for goods against presentation of shipping documents to some New York bank discourages foreign business.

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Tin Mining in the Federated Malay States

Tin production in the Federated Malay States in 1915 showed a small decrease, according to the mine warden's report. The total output for two years past was, in gross tons:

	1914	1915	Changes
Perak	28,557	27,776	D. 781
Selangor	15,103	13,938	D. 1,165
Negri-Sembilan	1,697	1,244	D. 453
Pahang	3,685	3,808	I. 123
Total	49,012	46,766	D. 2,276

At the close of the year there were 164,457 men employed in the mines, of whom 205 were Europeans, 2,372 Malays, 5,313 Indians and 156,414 Chinese. The conditions of employment show that 85,589 miners worked under lease or tribute, 45,070 under contract, 32,131 were paid wages and 1,667 were independent miners or prospectors, holding individual licenses.

There was an increase in 1915 in machinery used in the mines, the chief instances being the completion of the hydraulic plant of the Gopeng Consolidated Mining Co. and the rebuilding of the Perak electric plant. Ten dredges were at work at the close of 1915, seven of them having been installed during the year. Another one is under construction for use at the Bentong Mine in Pahang.

Chinese not only form the great majority of the workers, but predominate in the management, 72% of the output being from mines controlled by Chinese.

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Sicilian Sulphur Production

The sulphur situation in Sicily remains strong. Export demand for England, France, Australia, Russia and Sweden has been very active; on the other hand, production has decreased, owing to the fact that the mines are suffering from increased cost of coal, wood, oil and explosives, and to a certain extent from dearth of labor as well, the younger men having been called to arms. The export figures, according to Ferd. Baller & Co., from Jan. 1, 1915, to Dec. 31, 1915, are as follows:

EXPORTS OF SICILIAN SULPHUR

	Metric Tons		Metric Tons
Sicily	7,685	Sweden-Norway	24,781
Italy	108,916	Turkey (Europe)	
Austria	70	United States and Canada	2,054
Belgium	....	Central and South America	5,517
Denmark	51	Egypt	825
France	96,156	Algiers	6,540
Germany	391	Turkey (Asia)	..
Greece	19,857	India (English)	5,010
England-Malta	36,156	Australia	330
Holland	1,163	Other countries	11,035
Portugal	12,784	South Africa	9,474
Russia	2,791		
Spain	8,220		359,806
Stocks on hand Dec. 31, 1915			323,391

The production as published for the fiscal year of the Consorzio stands as follows: From Aug. 1, 1914, to July 31, 1915, 335,000 tons (of 1,000 kg.). During the same period 1915 to 1916, it is estimated that the production will show a decrease of about 10%, say 300,000 tons altogether, and that from Aug. 1, 1916, to July 31, 1917, it will not exceed 275,000 tons. In consequence the prices have advanced considerably, and for a short time the Consorzio offered small parcels only, then withdrew altogether from the selling side. Now they have decided to sell one month about the quantity produced in the preceding month and not to sell for future delivery. They intend also to give the preference to Italian consumers and to those of the allied countries. The Consorzio will expire July 31, 1918, and it is expected that up to that date the stock available will be greatly reduced.

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A Mine Lessor's Liability Concerning Materials

By A. L. H. Street*

On foreclosure of a lien against mining property for materials and labor furnished a lessee of the property in its development, personal judgment may be rendered against the lessee, but not against the lessor, according to the holding of the Oregon Supreme Court in the case of Haines Commercial Co. vs. Grabill, 152 Pacific Reporter, 877.

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*Attorney at law, 829 Security Building, Minneapolis, Minn.

Editorials

The Zinc Situation Abroad

The report of the Zinc Corporation for its last year and the address of Mr. Govett, the managing director, at the stockholders' meeting in June throw some light on the zinc situation abroad. It should be borne in mind that the tension in spelter arose from the isolation of Germany and Belgium—where the bulk of the accumulated stock at the middle of 1914 was held—and the sudden closing of the outlet for the mines of Broken Hill, Australia. There was plenty of ore, the supply being adequate as it was previous to the war, but there was no place to smelt it. This put a premium upon smelting capacity, the price for spelter rose to figures unheard of previously, and this was an invitation to enterprising persons to build new smelteries as fast as they could—which was done, especially in the United States.

We can see now that the British authorities failed completely to grasp the basic facts of the situation, although the zinc companies did. The companies were hampered, however, by the government's onerous—nay, impossible conditions—with respect to new plant and the long course through the courts that the companies had to pursue before they could obtain legal release from their ore contracts with the German concerns. Mr. Govett reviewed all this and made numerous statements respecting which the muddle-headed would do well to reflect. Among others were the following:

"To recapitulate—the original contracts were necessarily with Germany, as there were no English buyers. After the outbreak of the war we could not sell—first, because there were no immediate buyers anywhere, and secondly, because we could make no new long contract, on account of the risk of being left short of material in the event of the German contract reviving at the end of the war."

The first of these statements is identical with what the *Journal* has been telling the world from the beginning. Out of all the wild talk about a German conspiracy—which was made largely for political effect—the simple fact is that the Australian ore went to German houses for the reason that there were no other buyers. In obtaining release from its contract with Aron Hirsch & Sohn, the Zinc Corporation did not get through the maze of the British courts until the Board of Trade declared void contracts contrary to the national interest, so after all it was not the courts that settled the matter. The release of the Zinc Corporation was not an unalloyed blessing, for Aron Hirsch & Sohn was owing it £84,000 for concentrates delivered before the war and the Zinc Corporation has not yet been successful in attaching any realizable assets of the firm.

In attempting to dispose of its production during the war, however, the Zinc Corporation was not idle. Theodore Hoover visited the United States in October, 1914, and upon his return to England made recommendations, which were not adopted for one reason or another—partly Governmental obtuseness—although of course Mr. Govett does not say so or imply it. Among other things the sale of some of the companies' ore to American smelters was contemplated. Later, when negotiations were renewed, it was found that Australian concentrates were being offered on much cheaper terms by other Broken Hill companies. "That was the trouble," said Mr. Govett, "the ruinous competition of the other companies."

In the meanwhile progress has been made in several directions. A large tonnage of Australian ore has come to the United States. A good deal has gone to Japan, where the smelters have greatly increased their capacity. British smelters have also been increasing their capacity—belated but nevertheless increasing—and now comes the important statement by the Zinc Corporation that it has made a contract for a sale of 100,000 to 150,000 tons of concentrates to supply the requirements of British smelters. The electric zinc smelters of Scandinavia have also been increasing their production. In short, the production of zinc has been expanding in all parts of the world, although nowhere else in so spectacular a manner as in the United States.

But the Australian producers are looking further ahead. In their lead business they allied themselves some time ago as the Broken Hill Associated Smelters, taking over the plant of the Broken Hill Proprietary at Port Pirie, which company has now become the largest single producer of lead of the world. About the same companies lately formed the Zinc Producers Association, which is going to handle the combined zinc output. The Zinc Corporation has gone into this, with reservations that may permit it to unite with the Burma Corporation in certain contingencies. The plans of the association, which has been developed to a large extent through the visit to Great Britain by Mr. Hughes, the Australian Premier, assisted by W. S. Robinson, the managing director of the Broken Hill Associated Smelters, include the ideas of erecting smelteries in England and Australia, steps to insure the exclusion of German spelter after the war and preferential treatment of the Empire's products, allowing a fair share of the raw materials to France and Belgium. Careful consideration of trade relations with France and Belgium, especially the latter, where zinc smelting has for centuries been an important industry, was necessary.

What of lead and spelter after the war? "Will there be an enormous demand for lead and zinc to replace waste and in rebuilding," asks Mr. Govett, "or will the world be in ruins financially as well as actually? I do not see my way, but this is clear; since the high prices there has been an enormous increase in capacity for output of spelter in America. The war is likely to end with large stocks on hand, and it may be that the price of spelter will be very low indeed, and there may be no profit from this source until the price rises, unless we can sell our concentrates to English smelters, as far as they can take them, under a tariff or a bounty, which is the fence that the government has got to jump. If I may hazard a guess. it is that after the war the price of lead is likely to continue high, while if the government will jump the fence the price of spelter will be above the living wage for the Australian producers." It is owing to such views that the Australian producers are asking the Imperial Government to grant a bounty which will maintain for them a spelter price of £23 per ton, or 5c. per lb., which in their opinion is the point of "living wage."

The Steel Corporation

The statement of the United States Steel Corporation for the June quarter was expected to show a large gain over the preceding quarter and over last year, but it has proved to be even better than was anticipated. Not only are the net earnings larger than those reported in any preceding quarter, but the surplus over all charges and dividends on the preferred stock was equal to 11½% on the common stock. Only a fraction of this was divided, the common stock receiving an extra dividend of 1%, making its total 2¼% for the quarter. The undivided surplus was $47,964,535, of which a large part will doubtless be used in the extensive improvements now being made at Duluth, Gary, Ojibway and elsewhere, though no formal appropriations for those purposes are announced. Possibly some of it may go into the reserve fund to equalize dividends, of which Chairman Gary has talked at different times. but this is not at all certain.

The net earnings for the quarter, reaching a total of $81,126,048, or about three times those of the corresponding quarter in 1915, reflect the joint influences of extremely active business, and of increasing prices. Both domestic and foreign orders were heavy and the gradual advance of prices begun early in the year was continued. Apparently it has very nearly reached its limit, however, since the recent effect has been to limit domestic sales and to check consumption. The familiar danger signals are thus displayed and doubtless will be effective so far as any further price raising is concerned. The foreign trade remains strong and does not seem to be affected.

The Steel Corporation has not directly entered into the manufacture of war munitions. It has taken large contracts for rails and other materials for export. It has, however, supplied much steel to manufacturers of munitions. and to that extent has profited largely by the war demand. The amount of this business cannot be determined without further information, but it must have been very large. An important point in the statement is that existing orders and contracts are not only sufficient to provide for active employment of the mills through the balance of the current year. but also that many of the contracts provide for business running well into 1917. This seems some security against any abrupt collapse of business, especially as successful efforts have been made through the past two years to systematize and improve the rather loose system of contracting for steel and iron which formerly prevailed.

The Steel Corporation for several years has furnished about 45 to 50% of the finished steel output of this country. Its quarterly reports, therefore, are looked upon as fair indications of the general course of the steel trade. In the present case the indications are good. The large volume of business done and the profit realized, point to a year of real prosperity in the trade. It is possible that there may be some recession in prices, but it is not at all likely that such a recession will go below a point where fair profits may be realized by the steel maker; and it would be more than compensated by increased business.

Cargo of the "Deutschland"

There has been a good deal of conjecture respecting the cargo that the submarine "Deutschland" is to take back to Germany. Ideas finally focused on a cargo of nickel and rubber, which was embarrassing to the United States. Great Britain lifted her embargo on nickel, rubber and other commodities required by us upon our assurance that they would not be permitted to leak out to Germany. The nickel question, in particular, has been raised repeatedly by Canadian politicians seeking political capital against the Government. If the "Deutschland" should carry out nickel, fate would have unexpectedly played into their hands and they may be relied upon to make most of it. The International Nickel Co. has been very careful in supervising the destination of its nickel and does not believe that any of its product can be on the "Deutschland." It is pointed out that there is a considerable production of nickel in the United States from domestic byproducts.

If the New York *Telegram* is to be relied upon, however, there is not going to be any controversy, for the packages marked "nickel" that are stowed in the hold of the "Deutschland" are now rumored to contain not nickel, but $4,000,000 in gold. But "whether this is true or not," remarks the *Telegram,* "it is known that 3,000 bottles of beer are a part of the cargo, designed for alleviating German thirst." This looks much like carrying coals to Newcastle.

The Proposed Tax on Copper

At a hearing before a subcommittee of the Senate last week, on the matter of the proposed tax on copper, a new point against it was offered; namely, that such a tax as is contemplated would be unconstitutional, being distinctly class legislation. That objection might be met by extending the tax to all metals, but then what a howl there would be from the zinc- and lead-producing districts! That alone would be sufficient to defeat the whole project.

Another objection, which was not brought out in Washington, so far as we know, but which is a good one, is that the tax falling on refiners would have to be paid by them on copper derived from foreign raw material as well as domestic.

American copper refiners have during the last 10 years built up an immense import business, drawing copper to their works from all parts of the world—South America, Australia, Japan, Africa and Europe—in competition with the refiners situated elsewhere. The diversion of crude copper from Great Britain and Germany to New York has been one of the recent romances of business. The taxation of their production will be a handicap to them in their competition with the rest of the world.

BY THE WAY

No one appreciates the possibilities of engineering less than the engineering papers. Look at the following advertisement from a nontechnical contemporary:

> Solution producing unlimited power from power without cost, and motor combining both principles, requires manufacturing facilities. N-25, Times.

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"Two Constant Readers" who write from McGill, Nev., but do not give their names, inquire "what is the lowest price reached by English sovereigns during the last two years, in New York, and could they be bought in the open market at the price quoted? By 'sovereign' is meant the gold coin minted by Great Britain." The principal firm of coin and bullion brokers in New York informs us that it has bought English sovereigns on several occasions at $4.85 per sovereign during the last two years, and considers that to be about as low a price as they have reached during that period.

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Perhaps one of the neatest compliments ever paid any type of drilling machine is contained in the remark of a certain Finnish miner in one of the mines of the Crystal Falls, Mich., iron-mining district. A few years ago, just after the light, rotating, hammer drills had been introduced in this district, this miner, who had been given one to use, happened to go to the warehouse on some errand or other. After his wants were supplied, the warehouse clerk asked him, "John, how do you like your new drill machine?" To which he replied, in characteristic dialect, "O, dat's ma-seen no good. He is go 'Br-r-r-r-r' five minutes—I s'ovel all day."

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Messrs. Samuel Montagu & Co. write from London under date of June 29: "The attitude of neutral countries toward gold imports is curious and interesting. It is reported that Holland wished to purchase lumber from Sweden, and as Sweden would not take any gold, such purchase was found to be impracticable, as the two countries possessed more gold than they needed or cared to have. After prolonged negotiations, Sweden agreed to take a certain amount of gold, as a matter of grace, at a price 3% lower than the ruling rate. The transaction was then completed and Holland received its lumber. Thus the extraordinary circumstance occurred of gold being accepted by a state institution only at a heavy discount compared with the currency of that country."

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Mining south of the Mason and Dixon line makes many gray hairs for the engineer, but occasionally gives a laugh. The store at one mine carried two brands of tobacco—smoking and chawin'—about the only difference being that one came as a plug and the other in a paper package. One day an old mountaineer came into camp and purchased some tobacco. A few days later he was back again and tried the other brand. He loaded his pipe carefully, took a few whiffs and spat violently. He took another draw and a look of unutterable disgust crept over his face. He was game, however, and kept on puffing for a few minutes. Then he rose to his feet, knocked out his pipe, heaved the package halfway across a nearby river and remarked: "I'd just as soon hol' ma maouth wide open and let the sun shine into hit as smoke them thar tobacco."

*

The proclivity of the Latin races (particularly Mexican) toward the use of firearms for the settlement of all disputes is shown by the following story related in a recent issue of the New York *Times:*

> Refugees recently arrived in Havana from Mexico City tell the story of the killing of Gen. Benjamin Hill, military commander of the Federal district, in a fight with Jean Tardan, a Frenchman, proprietor of a famous hat store in the Mexican capital. They say Hill entered the store with his staff to buy a fancy sombrero as a present to Carranza. The proprietor himself waited on him. Hill selected a hat and inquired the price. Tardan answered: "Seven dollars and a half American, 15 pesos Mexican silver, 750 pesos uncounterfeitable bills, and 3,000 pesos Mexican counterfeitable bills." Hill became incensed at the last price, as he has always maintained that Carranza money was as good as American. He drew his revolver and began shooting. Tardan shot also, mortally wounding Hill. The staff then drew revolvers, shot Tardan until lifeless and then killed every clerk in the establishment. The staff then sacked the store.

This would make it appear that shopping at present in Mexico has a certain amount of spice to it.

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"Some time ago it was my not pleasant duty to sit on a coroner's jury over an unfortunate who had fallen some two hundred feet in a chute," wrote a young mining engineer from a Western mining district. "The verdict we rendered was not satisfactory to some of the mine officials; they claimed it was irrelevant and unfair. I give below the sole reason for the objectionable phrase. We were assembled in a small room in which was stored a quantity of candles; the floor was littered with paper and other rubbish. But paper and candles were not the only combustibles in the place; there were explosives as well. An open fuse box full of capped primers, ready for use, was lying on a full box of blasting caps. The superintendent came in and seated himself on the candle boxes, just above the fuse box full of primers. He was smoking a cigar, and he seemed not to see the naked caps. I moved as far as I could get away from the cigar and watched it. Some time during the taking of the testimony, it dawned on me that a live ash about an inch long was due to part company with the cigar at any minute. There were the shining caps directly beneath it. Now I was not familiar with the company's safety-first methods and practices, and besides, I am a timid man. Then, too, it stood to reason that an attempt to call attention to the situation at that moment would have been quite as dangerous as any other procedure and much more embarrassing. I said nothing and sat still. As per schedule, the ash fell. I closed my eyes. A minute or an hour later, however, I was sufficiently calmed to realize there was a spirited argument being indulged in by the state mine inspector and the head of the company's safety-first department as to whether the gathering was a coroner's jury or a safety-first meeting. The inspector claimed it might appropriately be both. When the question was finally decided, the spectators filed out and the jury was instructed to give a verdict. I got hold of the paper and wrote (and I could not have agreed to anything less lenient): 'It is the opinion of the jury that the company should have taken more precaution to safeguard the life of the employee.' Perhaps it was unfair; I never heard the testimony."

PERSONALS

E. C. Petro, late at Hayden, Ariz., is now in Denver.

F. H. Jenks has gone from Oatman, Ariz., to Albuquerque, N. M.

C. H. Coberly has gone from Rowena, Colo., to National, Nevada.

W. A. Gilles is now at San Pedro, N. M. He was recently at Ophir, Utah.

Frank W. Reeves has gone from San Bernardino, Calif., to Bartlesville, Okla.

J. A. McDonald, recently at Berkeley, Calif., has gone to Montana and is now at Anaconda.

N. L. Warford, recently at Phillipsburg, N. J., has gone to Montana and is now at Anaconda.

G. Miller has gone from Cobalt, Ont., to the Reward Mine at Manzanar, Inyo County, California.

Lloyd T. Buell, recently at Benson Mines, N. Y., is now with the Ore Trading Co., Ltd., Santiago, Chile.

Joseph H. Hill has gone from Rapid City, S. D., to Ray, Ariz., where he is with the Ray Consolidated mine.

Glenn L. Allen is now metallurgist for the Shattuck-Arizona Copper Co. and may be addressed at Bisbee, Ariz.

Dr. J. A. Dresser of the Canadian Geological Survey will make an examination of the Rice Lake district of Manitoba.

G. A. Morrison, recently in Chicago, is now with the American Star Antimony Co., at Gillham, Sevier County, Ark.

Dr. August Foerste, geologist, of the University of Ohio, is in Ottawa conducting researches at the Canadian Geological Survey and examining rock formations in the neighborhood.

A. M. Bilsky and a party of Montreal capitalists have returned from an inspection of the Atlas gold prospect in the West Shining Tree district of Ontario with spectacular samples of ore.

Charles A. Moffitt, for some time past manager of the plant of the Gulf States Steel Co. at Gadsden, Ala., has been chosen vice-president and general manager of all the plants of the company.

G. G. S. Lindsey, of Toronto, formerly president of the Canadian Mining Institute, who has been in China for a year and a half, during part of which time he was engaged in drafting a mining code for that country, has returned to Canada.

Arthur W. Stevens has just returned to Piedmont, Calif., from a three-months' examination trip, during which time he visited Ouray and other camps in Colorado, the Bullion Coalition mine in Utah, Hamilton and other places in Nevada, all in the interests of New York and Philadelphia parties.

R. L. Daugherty has been appointed professor of hydraulic engineering at Rensselaer Polytechnic Institute, Troy, N. Y. He has for the past six years been assistant professor of hydraulics in Sibley College, Cornell University. Professor Daugherty is the author of "Hydraulic Turbines," "Centrifugal Pumps" and "Hydraulics."

OBITUARY

Sir William Ramsay died at his residence in England July 24, aged 64 years. He was eminent as a chemist and writer. Born in Glasgow, Scotland, he was professor of chemistry in the University of London for 26 years. He was an honorary member of many foreign societies and a winner of the Nobel prize. His discovery of argon, a hitherto unknown element in the air, and his experiments in the transmutation of elements were his most noted achievements.

Thomas Macdonald Patterson died at Denver, Colo., July 23, aged 77 years. Born in Ireland he came to this country when a boy, living first in Indiana and then in Colorado. He was prominent for many years in politics and as owner and editor of the "Rocky Mountain News" and the "Denver Times." He was twice United States Senator from Colorado. His chief connection with mining was at the time of the Leadville boom, when he, with C. S. Thomas, acquired valuable mining property in that district.

Philip Diedesheimer died in San Francisco, July 21, aged 84 years. He was for many years prominent as a mining engineer, and was the designer of the square set system of mine timbering first used on the Comstock and since adopted in many well-known mines. He was engaged in mining on the Comstock and in California for many years and was widely known in California. He was alternately successful and unsuccessful and died a poor man, although he owned claims which he hoped would make him rich.

Fred. T. Williams died at Salt Lake City, Utah, July 14, aged 40 years. He was born in Cleveland, Ohio, and graduated from the Colorado School of Mines. After working for five years at Victor, Colo., he went to Utah in 1906 and was for some time engineer for the Daly West Mining Co. In 1911 he formed the Federal Leasing Co., of which he was president and general manager. This concern leased mining claims from the Daly West and other companies and was most successful. He leaves a widow and two children.

W. R. Patterson died at Chicago, July 19, aged 62 years. He was distinguished as an electrician, and was connected with the Western Electric Co. for 32 years, retiring to become a consulting engineer. He was the inventor of many electrical devices. Mr. Patterson was born at Effingham, N. H., where he received his early education. In 1876 he was graduated from Dartmouth College. He was for 39 years a resident of Chicago, where he was a member of the University Congregational Church, the Union League Club, the American Society of Civil Engineers, and the Western Society of Electrical Engineers. He leaves his widow, two daughters and a son.

William Teague, a widely-known British Columbia pioneer, who had lived in that province about 58 years, died at Seattle, Wash., recently. He was a native of St. Day, Cornwall, England, and was 81 years of age at the time of his death. He went to British Columbia in the "Oregon," the first steamer to make the call at Victoria from San Francisco. Proceeding thence to Hope, on Fraser River, he worked at placer-gold mining on Cornish bar. In 1873 he was appointed Provincial Government Agent at Yale, where he remained twelve years. After leaving the government service, he resumed mining, but later retired from active work.

John Francis Campion died at Denver, Colo., July 17, aged 67 years. Born in Prince Edward Island he went to California with his parents when a boy. In 1868 he engaged in mining in California, and spent 10 years at White Pine in that state and at Pioche and Eureka in Nevada. In 1879 he went to Leadville and from that time on was prominent in the history of the famous camp. He was interested in several of the large mines of the Leadville basin and made a careful study of the district which lead him to invest on Breece Hill. With several others he formed the Ibex Mining Co., the management of which he retained until his death. From his Leadville properties he accumulated a fortune. He moved to Denver a number of years ago, and was largely interested there in banking and other enterprises. He leaves a widow and four children.

SOCIETIES

American Institute of Mining Engineers—In connection with the Arizona meeting at Douglas, Bisbee and Globe, Sept. 19-22, arrangements have been made for an excursion in which Eastern members may join. It will leave New York, Sept. 14, going by way of Chicago, will visit various mines and plants in Arizona, the Grand Cañon, the Apache Trail and other points of interest and will reach New York Sept. 28 on the return trip. The arrangements for the train are in charge of W. V. Lifsey, 1216 Broadway, New York.

INDUSTRIAL NEWS

The Sullivan Machinery Co., of 122 So. Michigan Ave., Chicago, and Salisbury House, London, England, has established an agency in Holland with Messrs. Petrie & Co. Heerengracht, 141-145, Amsterdam, as its special representatives. Messrs. Petrie & Co. will sell the Sullivan air compressors, rock drills, hammer drills, diamond core drills, quarrying and coal-mining machinery in the Netherlands. This new arrangement replaces the Sullivan Machinery Co. agency previously at the Hague.

Hirsch Electric Mine Lamp Co., of Philadelphia, has recently manufactured a new "Hirsch" portable electric lamp outfit of high candlepower, suitable for shaft digging and mine work. The lamps are made in two sizes, 6 volts with three cells 20 to 25 cp., weighing 10 lb. complete and 10 volts with 5 large cells 35 to 40 cp. and weighs 26 lb.

Editorial Correspondence

SAN FRANCISCO—July 19

Bullion Receipts at the San Francisco Mint for the month of June, according to the report of Superintendent Shanahan, were: Gold, 201,019.319 fine oz., valued at $4,155,438.26; silver, 63,856.98 oz., valued at $40,339.

Proposed Option of the Lincoln Consolidated at Sutter Creek was the interesting feature of the week's news from Amador County. A purchase option has been taken provisionally by James Hoatson, of Calumet, Mich., for $205,000, this price to be payable in four semiannual payments of $41,000 each, in addition to a payment of $41,000 upon execution of the option. The purchaser is not obligated to operate the property, but in case of operation all the yield over $3 per ton is to be applied on the purchase price. Meeting of stockholders to be held Aug. 7 to ratify the option and consider the question of disposition of funds of the company. There are 606,555 shares outstanding. The indebtedness of the company, which is $2,000, will be paid at once.

Production of Oil in California in June increased about 6,000 bbl. a day as compared with May, the average daily yield being 255,451 bbl., or a total of 7,663,510 bbl. for the month. The total crude stock on hand at June 30 was 51,199,918 bbl., a decrease during the last six months of 5,947,133 bbl. The total production of all fields for the first half of 1916 amounted to 43,709,756 bbl. For that period the several fields produced as follows: Midway-Sunset, 18,962,650 bbl.; Whittier-Fullerton, 6,861,701; Coalinga, 6,321,449; Kern River, 4,244,275; Lost Hills-Belridge, 2,217,947; Lompoc and Santa Maria, 2,068,720; McKittrick, 1,516,127; Los Angeles and Salt Lake, 888,264; Ventura and Newhall, 586,748; Summerland, 28,225; Watsonville, 13,650 bbl.

The Explosion of an Oxygen Tank at Keswick, in the oxy-acetylene department of the Mountain Copper Co. machine shops on July 16, which finally resulted in four deaths, was the third within four days in California, these three explosions causing a total of 7 deaths and 4 serious injuries. The explosions were in three different counties; the first was at the Hercules Powder Co. plant in Contra Costa, and the second one at San Francisco. The Metal Weld Co., of San Francisco, which furnished the oxygen tank used at Keswick, sent a telegram of warning to postpone the use of it as a similar tank had exploded on July 14 in the works of the California Artistic Metal and Iron Co. in San Francisco, when two men were killed. The telegram, however, arrived too late. Karl L. Brackett, manager of the Metal Weld Co., is investigating the cause and an investigation is also being made by the state mine inspector.

DENVER—July 18

The Ward District in Boulder County is experiencing a decided improvement in its mining activities. Formerly there were numerous profitably operated mines near this town, but for a number of years little ore has been mined. It was known years ago that there were good showings of tungsten in the lodes, but the ferberite always accompanied sulphides and there was no market for tungsten ores that carried sulphur. The same veins also carried gold and silver and these were the metals sought in working the mines. Since the more recent demand for tungsten, no objection has been raised against small amounts of sulphur in an ore and a number of the old mines have been reopened while prospectors have discovered many new tungsten-bearing veins. Among the older mines that are being given new attention are the Star, managed by George P. Sale; the Newmarket, owned by Burnhart & Sharks; the Queen, owned by a Mr. Walter, of Denver; the Nelson; the B. & M., owned by T. B. Burbridge and superintended by S. A. Stafford; the Knight; and the Porto Rico. The Humboldt mill, erected a year ago, is being run on gold-tungsten ores, from which it makes good concentrates of the separate metals. The mill embodies stamp crushing, amalgamation and concentration on tables.

The Lake Mine, at the top of the divide between Clear Creek and Gilpin Counties, is one of the original 50x3,000-ft. claims of the State. Right now, it possesses special interest from the fact that ore is being mined in large amounts at a depth of 2,400 ft. from the surface, operations being conducted through the Big Five tunnel, whose portal is at Idaho Springs. The vein is a strong one, traceable for six miles, and is opened up in the Frontenac and Aduddell mines in which—as at the Lake—the surface workings produced ore high in lead and zinc, whereas at a medium depth, these metals are replaced by high-grade gold ore carrying grey copper. The Big Five tunnel cuts the Lake vein at a distance of about 8,300 ft. from its portal. Here a strong shoot pitching to the west from the Frontenac is drifted on at a depth of about 2,300 ft.; this shoot is already proved for 600 ft. along the level and has been stoped to an average height of about 125 ft., the production during the past 20 months amounting to about $300 000. Two winzes below the level are in the same good ore. Silver occurs in the ratio of about 10 to 1 of gold, by weight, but appears to be increasing with depth. There is much virgin ground above the tunnel level. At present, the trains of the tunnel are loaded directly from the Lake chutes and the ore is hauled, without transfer, to the mills in Idaho Springs.

BUTTE—July 20

Timber Butte Zinc Mill is to be enlarged according to an interview with ex-Senator W. A. Clark. With the opening of the war and the shutting off of the Belgium and German markets, the Australian output of zinc concentrates threatened to deluge the American market. "The Timber Butte company, however, was fortunate in having smelting contracts that protect it," said Senator Clark. "We have a contract that has three years to run yet with a company that has its headquarters in Germany but has an American branch and smelts the ores at its plants in Kansas and Oklahoma."

The Growing Activity of the East Butte District is clearly indicated by the fact that the Northern Pacific Railway Co. has ordered surveys to be made immediately for a spur to run from its main line to the Bullwhacker, Colusa-Leonard, Tropic, Butte & London and other mines. The plan is to branch off from present main line south of the Pittsmont property, and come around close to the Bullwhacker, then north to the Tropic and connecting with the Colusa-Leonard and the Butte Main Range shafts. The plan also calls for an extension to the Greenleaf and the Butte & London mines as soon as development work at these properties is completed. The building of the spur will mean much to the entire district in that it will afford shipping facilities to a number of working mines which are now dependent on hauling by team to the nearest railroad track.

SALT LAKE CITY—July 17

The First Unit of Sulphuric-Acid Plant, which the Garfield Chemical and Manufacturing Co. is building at Garfield, will be placed in commission in October. The steel work is almost entirely finished; and the chamber building has been so far completed that two of the chambers are ready for the lead burners; and two more will be ready shortly. Excavation for a second unit has begun. The plant is to have a capacity of 200 tons of sulphuric acid daily. If acid in excess of what is required by the Utah Copper is available other low-grade ores in the state may be treated.

Utah Mines Paid Dividends amounting to $10,915,000 during the first half of 1916. Fifteen mining companies contributed this wealth; six are in Tintic, three in Bingham, three in Park City, one in Big Cottonwood, one in Beaver County and one at Promontory in Box Elder County. The distribution during the six months amounted to $170,000 more than the total dividends in 1915. The properties are the Cardiff, Centennial-Eureka, Chief Consolidated, Daly-Judge, Horn Silver, Iron Blossom, Gemini, Lake View, Mammoth, May Day, Silver King Coalition, Silver King Consolidated, Utah Consolidated, Utah Copper and Utah Apex. These Utah mines have paid up to date dividends of $87,494,000.

LUNING, NEV.—July 20

The Southeastern Part of Mineral County, Nevada, has not attracted the attention warranted by its present activities. Recent tungsten discoveries southwest of Sodaville have been only one feature of the activity in the Pilot Mountains, tributary to Mina and Luning. About 500 miners are employed in the region and considerable amounts of copper ore and quicksilver are being shipped from these stations. Regular shipment of copper ore is made from mines east of Luning. Northeast of Mina copper mining is principally in the prospecting and development stage. Quicksilver production in this vicinity is mainly confined to the operations of Fullerton

& Drew and Pepper & Kehoe. The former company shipped 58 flasks of quicksilver in June; the other company less than that but made a good showing. At Sodaville a new 100-ton tungsten mill was given a tryout on July 1. The operating company, representing Atkins, Kroll & Co., of San Francisco, has valuable scheelite deposits 12 mi. southeast of Sodaville in the Excelsior Mountains. The company has bought up the townsite of Sodaville; installed an electric-light plant and otherwise begun the establishment of a permanent camp. It is probably a safe estimate that there are 600 miners, prospectors and teamsters employed in what may be termed the Luning and Sodaville districts, covering a region about 30 mi. long and 30 mi. wide.

DULUTH, MINN.—July 22

Conditions on the Mesabi Range are gradually righting themselves. At Aurora the Mohawk mine (underground) has resumed, and at Virginia the Victoria, Franklin and Union mines are again working. A large searchlight is employed nightly at the Franklin mine. At Biwabik on the night of July 19 a number of rifle shots were exchanged between the strikers and two deputies going from the Holland to the Ruddy mine; nobody hurt. George Parsons West, of the Federal Industrial Relations Department, has been on the range for some days, leaving for Washington on July 21, after having secured material for a government report on strike conditions. Statisticians figure the economic loss of this strike at $2,000,000. Nearly 2,000 men are now doing police duty on the range.

JEROME, ARIZ.—July 19

United Verde Copper Co. is now producing about 6,000,000 lb. of copper per month, and, according to an interview with ex-Sen. W. A. Clark, this will be increased to 10 000,000 lb. as soon as improvements now under way are completed. The plant is being steadily enlarged and additional crushing facilities are being installed. The reverberatories have been increased from three to five, and the fifth blast furnace is being added. The Wedge furnaces are being increased from six to twelve. The town of Clarkdale, situated about 4 mi. from Jerome and about 2,000 ft. lower in altitude, is being made a model town for United Verde employees. Three separate styles of houses are being built for different classes of employees. For the Mexican miners houses are built along lines preferred by them, of low construction and built of brick and made fireproof. The Mexican miners are segregated on the lowest ground. On a bench just above them a different style of house is built for white workmen, these houses being of two to six rooms each, with every modern convenience. The third series of houses are on another bench about a quarter of a mile still higher, these being intended for salaried employees who can afford to pay a better rental. All rentals are based on a low rate of interest return on the actual cost to the company for the construction. The company retains ownership, polices the town, and furnishes all accommodations. An uptodate schoolhouse has been built at a cost of $65,000, and another is under construction. A high school is also planned. The town of Clarkdale already has a population of 2,000 and is growing rapidly.

DOUGLAS, ARIZ.—July 21

Phelps, Dodge & Co.'s Arizona Headquarters will be moved from Bisbee to Douglas. With this change comes the announcement of several promotions in Phelps, Dodge & Co. Walter Douglas, who has been general manager, becomes vice-president with headquarters in New York. S. W. French, formerly general manager of the Copper Queen Consolidated Mining Co., will succeed Walter Douglas as general manager of Phelps, Dodge & Co. A. V. Dye, who has been assistant to Walter Douglas, will be assistant general manager of Phelps, Dodge & Co., with headquarters in Douglas. G. H. Dowell will be promoted from assistant general manager to manager of the Copper Queen company. Mr. Dowell was first connected with the Copper Queen as ore purchaser; later he was superintendent of the Old Dominion at Globe, leaving there about five years ago to become assistant general manager of the Copper Queen. Doctor Dye, the youngest member of the Phelps-Dodge organization in Douglas, gave up his position as American consul at Nogales four years ago to become assistant to Walter Douglas.

Ventilation at Bisbee Mines of the Copper Queen company has been made a subject of special investigation for some time and deep satisfaction is felt both by managers and miners in the manner in which the ventilation problems have been solved. Formerly the atmosphere in miles of the underground workings at Bisbee was anything but comfortable, and the efficiency of the workmen much reduced. Now, an engineer of special qualifications is kept on this work, his duty being to visit all places where poor air or gas might be found or where there might be conditions of excessive heat or humidity. As a result, working conditions have been improved vastly. Temperature generally is kept at 77° F., relative humidity under 85%, the air current in working places at 100 ft. per min. and the quantity of air at not less than 250 cu.ft. per min. for each workman. In the Lowell fire district the temperature has been lowered 4° and miners are relatively comfortable, for the air current is kept at 400 ft. per min., and the humidity has dropped from 98 to 80. Not only has ventilation been improved by means of shaft connections and doors, but blowers of large capacity are in general use. Several of these have been placed at emergency points, to control gas or smoke in case the fire should accelerate in any unexpected section of the workings.

JOPLIN—July 22

Radical Reduction in Price of Ore during the past two months has created a situation in the district in some measure unique, but not at all comfortable to the ore producers. The general arrangement with the miners regarding the sliding scale of wages based on the price of ore, naturally takes care of the proportionate labor cost at all market levels, but no such arrangement automatically reduces the price of the powder and mine and mill supplies. The point has therefore been reached where the price received for concentrates in many of the sheet-ground properties is but the cost of production, and in some cases below the cost of production, though the prices paid for ores is, relatively speaking, still high. Where powder formerly cost $4.50 per box, it is now $10.50. Where dynamite caps formerly cost 60c., they now cost $1.90. Steel, cable, belting, hard iron and many other items of supply have increased largely and the operator is feeling the pinch at present. As a result many of the sheet-ground operators shut down two weeks ago. Practically all mills in the sheet-ground district were recently closed for about 10 days by the breaking down of the chief unit of the Empire District Electric Co.'s power plant. This forced curtailment of ore production came at a time when it was most needed. The surplus stocks had reached a total of 28,000 tons, one of the largest surplus stocks ever accumulated in the Joplin district. Moreover, the increased output from the Miami field which can turn out concentrates at a cost of from $20 to $40 per ton profitably is rapidly increasing, and will automatically take the place of some of the sheet-ground mills. The situation therefore is not the brightest, especially as regards any radical reduction over a long period. The curtailment at present is temporary, but will probably prevent any rapid growth in the surplus stocks, which represented about three weeks' production.

TORONTO—July 22

The Nickel Controversy is increasing in intensity and occupies a large share of public attention. The situation is confused by a mass of conflicting reports, statements and denials from official and other sources, but two important features are sufficiently clear: (1) That the Canadian government has no present intention of yielding to the clamor of the agitators by placing any further restrictions on the exportation of nickel ore or matte; and secondly, that the Liberal party is determined to make all possible political capital out of the movement and make it a leading issue in the next election campaign. Hon. Arthur Meighen, Canadian Solicitor General, speaking at Hamilton, Ont., on July 20, warmly defended the position of the government on patriotic grounds, stating that had the export of nickel ore been interfered with many Canadians would have been thrown out of employment, and that before refining in Canada could be effected a dangerous delay would have resulted and the Allies would have been deprived of a rush delivery of munitions. He read the following cablegram from the British Secretary for the Colonies: "His Majesty's Government is fully aware of the arrangements made for assuring the destiny of the nickel refined from Canadian ore in the United States, and is satisfied with the precautions that have been taken to prevent such nickel getting to the enemy." Hitherto although many individual politicians and journals connected with the Liberal party have condemned the government's nickel policy, it has not been regarded as a party issue. The National Liberal advisory committee, which met in Ottawa this week to draw up a platform for the next election campaign, devoted much attention to the question, the concensus of opinion favoring the adoption of a plank demanding more effective safeguards against Canadian nickel reaching the enemy than those provided by the government. Formal action was deferred for a closer study of the whole question, and a general policy to meet the situation will be announced later by Sir Wilfred Laurier. A statement that the International Nickel Co. had secured a site for the contemplated branch plant in Nova Scotia is denied by representatives of the company, who are now making a tour of Ontario looking over a number of locations. The partly consists of R. C. Stanley, general superintendent of works; Clifford Branigan, chief engineer; Frank Ludlam, purchasing agent and W. L. Wetherspoon, consulting engineer.

The Mining News

ALASKA

KENSINGTON (Juneau)—New mill to be erected. Reserves estimated to average $3 per ton. S. Peabody Rogers, superintendent; Bartlett L. Thane, manager.

ALABAMA

TENNESSEE COAL, IRON AND RAILROAD CO. (Ensley)—Will install electric furnace for preheating ferromanganese; Bessemer blowing capacity to be enlarged.

ARIZONA

Cochise County

OUTPUT OF DOUGLAS SMELTERIES for June approximated 21,000,000 lb. copper; Copper Queen, 13,500,000, and Calumet & Arizona, 7,500,000 lb.

DR. GEORGE H. FRENCH will soon begin shipping silver-lead ore from four claims near Niggerhead Mountain, 9 mi. east of Douglas.

Greenlee County

ARIZONA COPPER (Clifton)—June copper production about 4,800,000 lb.

Mohave County

GOLD ROAD (Goldroad)—Press reports state mine shut down account miners' strike for more pay.

PAYROLL (Chloride)—Hoisting from 400-ft. level resumed after recent inflow of water; crosscutting to main vein.

JOHNNY BULL (Chloride)—Started sinking 300-ft. shaft on south extension of Tennessee vein.

SCHENECTADY (Chloride)—Telluride and Chloride L. M. and M. Co., now working this property, has incline shaft down over 120 ft.

BOUNDARY CONE (Oatman)—Driving on 750 level both in east and west drifts; south crosscut from west drift has just entered the orebody.

OATMAN CRESCENT (Oatman)—Adit in 330 ft. and is expected to reach its objective about Aug. 15. Vein on surface 10 to 20 ft. wide; sampled for 800 ft. with fair results.

Maricopa County

PHOENIX CUSTOM SMELTER CO. (Cavecreek)—New organization, capitalized at $3,000,000, to erect custom smeltery in Cavecreek district. J. G. Harden, president of the Slocum Copper Co., Cavecreek, president.

Pinal County

AJAX (Superior)—Main shaft, down 195 ft., will be sunk to 600-ft. point.

WOODBURY COPPER (Superior)—Sold to Colorado and Washington men for $200,000; will begin work Aug. 1.

PACIFIC (Superior)—Several carloads 30% copper ore shipped; more on dump; Eastern men negotiating for purchase.

ARIZONA BONANZA COPPER (Superior)—Will be explored by drilling as soon as road is completed to property 6 mi. from Superior.

A. L. GARFORD ASBESTOS MFG. CO. (Superior)—This company, of Elyria, Ohio, is negotiating for purchase of asbestos claims of H. B. Riggs, S. E. Douglas, and Phil Connelly.

GILA DEVELOPMENT CO. (Kelvin)—Organized by Charles H. Barney, of Boston, to develop the Cane Springs gold claims, 1½ mi. south of Troy. Roy G. Mead, managing director.

MINERAL DEVELOPMENT CO. (Redrock)—This company, composed of L. S. Cates and others of Ray Consolidated staff, is developing Aguirre mine and shipping some copper-carbonate ore to Sasco smeltery. Ray Consolidated company not interested, as reported in daily papers.

Yavapai County

BLACK ROCK, LTD. (Wickenburg)—Free-milling gold ore struck on 425-ft. level.

HOMESTEAD (Walker)—A 3-ft. body of milling-grade gold ore encountered at 75 ft. depth.

GOLD BLOSSOM MINING (Prescott)—High-grade lead-silver ore opened at 185 ft.; will sink to 200 ft. before drifting.

JEROME-VICTOR (Jerome)—Unwatered to 550-ft. level; lowering water about 100 ft. per week; retimbering shaft; George W. Salisbury, superintendent.

THREE MEDALS (Jerome)—Carload machinery, including hoist and compressor, expected in few days; shaft down 175 ft.; Ramon Martinez in charge.

Yuma County

BLACK REEF COPPER (Wenden)—Gasoline hoist ordered; shaft now down 120 ft. The 2-ft. copper-gold vein at surface is 6 ft. wide at 100-ft. depth.

PLOMOSA PLACER (Vicksburg)—Williams-Quenner mill and Stebbins dry concentrator to be in operation by August. A. Maltman, superintendent.

FLYING DUTCHMAN AND BLUE STATE (Quartzite)—Owned by Fenchler, Murray and Fenchler, of El Paso; main shaft 175 ft. on way to 300-ft. point; free-milling gold ore.

WENDEN COPPER (Wenden)—New organization to develop 12 all-copper claims of Sydney P. Osborn and James Burson in Cunningham Pass district. Machinery will be installed soon.

CALIFORNIA

Amador County

PLYMOUTH CONSOLIDATED (Plymouth)—Report of Superintendent James F. Parks for June: Crushed 11,400 tons of ore, valued at $56,685. Working expenses, $28,000; development, $7,321. Surplus, $21,364. Other capital expended, $15,525.

Butte County

BUTTERFLY (Oroville)—Gold-bearing gravel 4 ft. deep reported struck while driving 500-ft. tunnel from Morris ravine; width of gravel bed being determined by crosscut. Operated by C. F. Belding and associates.

Eldorado County

HORSESHOE BAR (Georgetown)—Machinery being hauled from railroad through Georgetown by motor trucks to middle fork of the American river. Mine being prospected with a view of installing a dredge. Part of ground hydraulicked in early days.

EUREKA SLATE QUARRY (Slatington)—Again reported that property will be operated, this time by the Sierra Slate Corporation of New York. This slate was used extensively several years ago, having been adopted as acceptable in Federal work. Reported that company will market 1,000 to 3,000 squares per month.

MONTEZUMA (Nashville)—Shaft on June 15 had reached 980 ft., 150 ft. having been made in first half of month. Developing on the 300, 500 and 800 levels. The large vein will be drifted on north and south and by crosscuts on 1,000-ft. level. Assays ranging from $5 to $30 obtained on the 500 and 800 levels. Property is being developed by William J. Loring and George Wingfield. The adjoining property, Havilla, is also under bond; development will depend largely upon results in the Montezuma.

Inyo County

CERRO GORDO (Keeler)—The large body of zinc ore, recently disclosed on the 200 level, proved to further depth by 50-ft. winze, showing orebody same in size and character.

MONTEZUMA (Big Pine)—Mine, situated 7 mi. southeast, recently reopened by John Mitchell, of Los Angeles. Producing high-grade silver-lead ore from orebody 70 ft. long; hauled by motor trucks to Zurich.

CHIPMUNK (Bishop)—This tungsten claim and the Two Warriors, situated in Little's Cañon, southwest of Bishop, have been taken on bond and lease by J. J. Gunn, representative of San Francisco men; owned by L. W. Munzinger, W. H. Gibson and William Nourse.

Kern County

SUNSHINE (Randsburg)—Shaft on Illingworth & Jewett lease down 50 ft. and drift being run north and south on a small vein of low-grade scheelite ore; producing about 200 lb. of tungsten concentrates per day. Hoist will be installed.

PAGE (Randsburg)—The I. C. L. lease, operated by Robert Lanka, C. G. Illingworth and Thomas Colburn, in the Stringer district, reported to have developed rich strike of tungsten. Five tons of 15% ore have been taken out; 200 lb. of high-grade per day being mined from a narrow vein.

Nevada County

TEXAS (Nevada City)—Mine in Willow Valley being reopened by W. H. Tuttle, of Nevada; 25 men employed cleaning up the old works and installing a 600-ft. pipe line. Unwatering.

SULTANA (Grass Valley)—Development in lower levels to be undertaken with view of finding extension of the Empire vein system. Mine equipped.

Placer County

ALGO (Lincoln)—This copper mine to be reopened. B. C. Musher, cashier of the Bank of Lincoln and H. P. Sartain, of Hotel Burdge, are principal owners. Hoisting machinery has arrived.

ADVENTURE (Colfax)—Reopening this property in Shirt Tail Cañon, Iowa Hill district, by tunnels. Installation of 5-stamp mill and concentrator.

Plumas County

SENECA CONSOLIDATED (Seneca)—Orebodies in the Del Monte and White Lily being developed by tunnel and shaft. Mill not yet in operation.

ENGELS COPPER (Keddie)—Preparations to increase mill to 1,500 tons per day; extensive exploration beyond main orebodies; 4,000-ft. tunnel being driven to tap main orebodies at 750-ft. greater depth.

Shasta County

MAMMOTH COPPER (Kennett)—Labor demands settled by increase of 50c. per day, when copper is over 15c. Fire on July 25 nearly destroyed mine surface equipment.

BALAKLALA (Coram)—In year ended June 30, shipped 76,000 tons of ore yielding net profits of $175,000. About $25,000, or 33⅓c. per ton, was spent in development work. Will increase development allotment to 50c. per ton; chiefly in diamond-drill exploration from lower workings. Shipping 300 tons daily to Kennett smeltery on 10-year contract. Initial dividend of 25c. will be paid by holding company, First National Copper Co., which has 600,000 shares outstanding.

Tuolumne County

HARVARD (Jamestown)—John Hernandez, 25 years old, killed by falling rock in north stope on 1,850 level. Hernandez and partner were barring down loose rock preparatory to drilling.

COLORADO

Lake County

BERTHA (Leadville)—Lease taken on this Breece Hill property.

HUGH LEASE (Leadville)—Production of 50 tons gold ore per week being made; new equipment being added. Property near head of South Evans gulch.

ONYX (Leadville)—New camp buildings being erected and more men put at work on the crosscut adit being driven by contract from Half Moon Gulch into French Mountain.

Mesa County

NATIONAL RADIUM PRODUCTS CO. (Grand Junction)—Enlarging its experimental plant to 200-mg. basis per month. Will develop its carnotite holdings in Utah. George Kunkle, president.

Montrose County

HART (Montrose)—Carload of carnotite ore recently sold to National Radium Institute.

San Miguel County

CONCENTRATE SHIPMENTS from Telluride in June were: Tomboy, 51 cars; Smuggler-Union and Black Bear, 29 cars to Durango and 18 cars to Blende; Liberty Bell, 12 cars; Alta Mines Co., 4; Sheridan, 3; total, 117 cars.

DUFFY (Ophir)—B. W. Purdy and associates developing on lease.

TOMBOY (Telluride)—Two 6½-ton electric locomotives recently installed at mine.

PRIMOS CHEMICAL (Vanadium)—This company purchasing iron-sulphide ore from the Lizzie G. at Sawpit.

SILVER GLANCE EXTENSION (Telluride)—Low-grade silver-lead ore opened in this property on Boomerang Hill.

MATTERHORN MINING AND MILLING (Ophir)—Properties being developed under direction of Frank Ensign.

SANTA CRUZ (Ophir)—Under lease to Wichmann & Fantone, who recently shipped two cars of sorted high-grade ore from development.

WELLER MINING AND MILLING (Telluride)—This company's Ballard mine being operated by Anderson & Lacey, lessees, who have started 10-stamp mill.

BUTTERFLY (Ophir)—This old property now being operated by the Jurich Leasing Co.; mill running at full capacity under superintendence of Stephen Lacey.

LITTLE MARY MINES CO. (Ophir)—Has taken over properties of Lake Superior-Ophir Mining Co. Crosscut is being advanced on the lower level under contract. Machine drills installed. S. E. Smith is manager.

SILVER BELL (Ophir)—Main raise, being driven by Samuel Richards under contract, rapidly nearing completion. Frank Trumble, manager. Tungsten lease, developed by Hill, Krise & Baer, sold to Foyle & Acaley for $4,000.

San Juan County

NEW TUNGSTEN STRIKE made near mouth of Minnesota Gulch in Silverton district.

HERMES (Animas Forks)—Development will be resumed under Joseph Warner.

O'MALLEY (Silverton)—Stringers of hübnerite opened in this Minnesota Gulch property.

BELCHER (Silverton)—This old silver-lead-zinc mine on Sultan Mountain recently bonded.

TRY AND TRUST (Silverton)—Development work on this tungsten prospect under way.

SILVER LEDGE (Chattanooga)—Mill being overhauled by lessees; good supply of ore in bins and broken in mine.

NORTH STAR (Silverton)—Development resumed at this Sultan Mountain property under management of Mr. Slattery; hübnerite streak opened.

CONGRESS (Chattanooga)—Being developed under lease by James Pearson and associates. Trial shipment of copper ore made. Dumps being hand sorted for copper ore.

BEN BUTLER (Animas Forks)—Development will be resumed under management of Frank Jackson, of Ouray. Compressor plant and machine drills being installed and power house remodeled.

LINWOOD (Silverton)—Heavy sulphide ore, 5 ft. wide, opened recently in new tunnel at 20-ft. point. Shoot carries chiefly galena, sphalerite, pyrite and chalcopyrite, with increasing amount of gray copper.

SILVER CROWN MINING AND DEVELOPMENT CO. (Silverton)—Developing Lee mine near mouth of Burns Gulch, under superintendence of D. P. Hill. Main adit advanced 150 ft.; vein 8 to 12 ft. wide, contains from 2 to 3 ft. of payable ore.

Summit County

ELDORADO (Breckenridge)—Driving crosscut tunnel into east spur of North Star Mountain to cut shoot of good-grade gold ore opened higher up hill.

PHILADELPHIA MINES CO. (Montezuma)—Now operating Toledo, Jumbo and Philadelphia mines; treating ore in Toledo mill, operated by electric power from Colorado Power Co. New compressor installed in mill recently to supply air for drills at mines.

ORO EXTENSION LEASING CO. (Breckenridge)—Operating old Oro ground in French Gulch. Building new 30-ft. headframe and installing new hoist, compressor and sinking pump. Will sink to 300-ft. level and explore lead-silver vein discovered in dredging work in French Gulch.

MONTEZUMA MINES AND MILLS CO. (Montezuma)—Now operating Silver Wave, Chatauqua and Princess mines. Ore milled at Silver King mill. Planned to build mill near junction of Deer Creek and Snake River where ore from all three mines can be transported by aërial tramways.

IDAHO

Shoshone County

CONSOLIDATED INTERSTATE-CALLAHAN (Wallace)—Purchase of Nipsic group of seven claims on the north for $111,200 approved at shareholders' meeting.

REX CONSOLIDATED (Wallace)—Eastern bankers have arranged capital necessary for development and reconstruction of tram and mill; 65,000 tons blocked out; production to begin in autumn.

SILVERADO MINING CO. (Old National Bank Building, Spokane, Wash.)—Company owning 21 claims near Osborn is building 75-ton flotation mill to treat the silver-lead ore opened by its 4,000-ft. tunnel; orebody exposed for 200 ft. W. H. Farrar, superintendent.

MINNESOTA

Mesabi Range

WANLESS (Virginia)—A 50-kw. 250-volt direct-current generator installed to furnish current for underground and surface tramming. Generator is driven by a Unaflow engine. Duplicate installation made at the Shiras mine.

Vermilion Range

PIONEER (Ely)—New concrete boiler house being built at "A" shaft. Repair shop, 40x165 ft., and wareroom, 28x36 ft., also being erected.

SIBLEY (Ely)—The Oliver company sinking new shaft, 11 ft. by 20 ft. 9 in; five compartments, one for cage, two for skips, one pipe-and-ladder way and one for counterbalance. Shaft being sunk at inclination of 68° 30′, with an inclined depth of 1,201 ft. Steel shafthouse from the Savoy mine will be moved to new shaft.

MONTANA

Madison County

ALDER CONSOLIDATED (Virginia City)—Brayson & Moore, of Virginia City, operating this Alder Gulch placer under lease, are preparing for first cleanup of season.

Silver Bow County

GOLD HILL (Butte)—This gold property, in the Highlands, 25 mi. south of Butte, is being reopened and 10 men are at work.

EAST BUTTE EXTENSION (Butte)—Shipment of 70 tons of 4% ore from the 200 level was made from this property to Pittsmont smeltery.

BUTTE & LONDON (Butte)—North crosscut on the 1,600-ft. level intersected barren stringer, 100 ft. from shaft, at first thought to be the vein cut in the shaft 200 ft. above. Crosscut will be continued.

BUTTE & GREAT FALLS (Butte)—Crosscut on 500 level cut the Dewey vein on July 14; third vein cut in this crosscut, the others being the V. G. and the Genevieve. Drifting on these veins will be started immediately. Mine in extreme northrn section of camp.

ANACONDA (Butte)—Contract let for sinking three-compartment shaft at the Nettie from 500 ft. to 1,500 ft. First deep shaft in the western part of Butte district, except Butte & Zenith City shaft, which is being sunk to the 1,000-ft. level 2 mi. west of the Nettie. Company has exercised its option on 100,000 additional shares of the Butte Copper & Zinc Co.; now holds 188,000 of 500,000 shares; under terms of contract property must be opened to 1,600 level; sinking will be started soon.

NEVADA

Lincoln County

UVADA COPPER (Pioche)—Shipped 29 cars in June, or about 40 to 50 tons daily of copper-silver and lead-silver ore. M. M. Johnson, Salt Lake City, Utah, manager.

Mineral County

WEDGE COPPER MINING (Reno)—Driving tunnel on middle vein which is averaging 6%. Mine is 6 mi. from Luning, equipped with 60-hp. compressor and company intends developing for one year to determine if property warrants reduction plant. Mark Walser, president.

Nye County

TONOPAH ORE PRODUCTION for week ended July 15 was 10,360 tons, valued at $212,560, compared with 8,038 tons for week previous. Producers were: Tonopah Belmont, 2,824 tons; Tonopah Mining, 2,800; Tonopah Extension, 2,200; Jim Butler, 1,250; West End, 841; Rescue-Eula, 223; Halifax, 157; miscellaneous, 65 tons.

JIM BUTLER (Tonopah)—June profit $22,829 from 3,098 tons, treated under contract at the Millers' plant of the Belmont company.

TONOPAH BELMONT (Tonopah)—June profit $116,847 from 12,074 dry tons. Bullion yield was 2,399.95 oz. gold and 230,651 oz. silver.

WEST TONOPAH (Tonopah)—Sinking shaft on three shifts. Station will probably be cut at 1,050-ft. level and work done on vein encountered at 870-ft. point.

TONOPAH BONANZA (Tonopah)—Shaft down 1,560 ft. and occasional quartz stringers being cut. Plan to sink to 1,650 ft., where station is to be cut.

Storey County

SIERRA NEVADA (Virginia)—Old east crosscut 2,400 level repaired to 112-ft. point; north drift 2,500 level reopened to 116-ft. point.

CON. VIRGINIA (Virginia)—South drift just west crosscut 2,700 level advanced to 213-ft. point, face in vein porphyry carrying stringers of quartz.

MEXICAN (Virginia)—Continued advancement of west crosscut No. 2, face mixture of porphyry and quartz of low assay at 40-ft. point. Mexican mill received 449 tons custom ore, average assay $26.30.

UNION CON. (Virginia)—Extracted 386 tons from 2,400 and 2,500 levels, gross value about $12,000. Repaired southeast drift from 2,500 station to 170-ft. point. Sierra-Union 2,500-

2,900 winze reopened to 25-ft. point. Union shaft repaired to 169 ft. below 2,500 level.

CROWN POINT-BELCHER (Gold Hill)—Saved 40 cars of ore from 300 level in prospecting and cleaning; repairs made on 1,400 level (shaft and electrical equipment). Jacket mill received 729 tons dump rock, 40 cars of ore.

NEW MEXICO

Grant County

SANTA RITA DEVELOPMENT (Santa Rita)—New organization to develop property adjoining the Chino, capitalization $100,000; incorporators are Elmer S. Morton, of San Francisco; W. W. Lawson, B. A. Richardson and E. C. Bradford, of Douglas; H. W. Loomis, of Silver City is statutory agent.

85 MINING (Lordsburg)—The 450-hp. Diesel engine exploded, leaving mine without power until duplicate engine, ordered recently, arrives.

Guadalupe County

PINTADO CONSOLIDATED COPPER CO. (Santa Rosa)—This new company is building a 100-ton leaching plant, after plans of J. L. Matt, to operate on a sandstone copper deposit in Pintado Cañon. Barren layer of sandstone, 6 ft. thick, overlying deposit, will be removed and ore quarried; copper-bearing layer 12 ft. thick exposed in tributary cañon. Several cars shipped to El Paso averaged better than 3% copper. Townsite being laid out. C. H. Taggert, president.

Socorro County

GOLD EAGLE (Mogollon)—This group, owned by Louis Gramas, has begun shipping.

EBERLE (Mogollon)—Oaks Co. has begun drifting north and south on Queen vein; shaft now unwatered and ore being shipped to custom mill.

SOCORRO MINING AND MILLING (Mogollon)—Pacific mine shaft retimbered and electric power brought to property. Shipments to mill will begin as soon as aërial tramway is completed.

ALBERTA MINING AND DEVELOPMENT (Mogollon)—Manager A. H. G. Palmer is in camp, arranging for reopening. The workings comprise 300-ft. adit and drifts east and west. Some good ore developed.

PENNSYLVANIA

BETHLEHEM STEEL (South Bethlehem)—Orders placed with Maryland shipbuilding plant for five steel ore vessels to serve the company's properties in Chile and Cuba. The new boats—some of 17,000 tons and some of 11,300 tons carrying capacity—will be operated by the Ore Steamship Corporation, a Bethlehem Steel subsidiary.

SOUTH DAKOTA

Custer County

OLD MIKE MICA (Custer)—Dispute over ownership settled and property shipping mica regularly.

CUYAHOGA (Custer)—One car of copper-sulphide ore shipped to the East. New hoist will be installed.

Lawrence County

ORO HONDO (Deadwood)—Exploratory work continues on 2,000-ft. level; diamond drills extensively used.

MOGUL (Terry)—Mill running steadily on good-grade ore, mainly from Ofer and Two Johns mines. At the latter, the 4,000-ft. tramway to the railroad completed.

HOMESTAKE (Lead)—New tungsten concentrator working two 8-hr. shifts per day. W. H. Butler recently took contract to haul 30 tons of ore daily from mine to mill.

TROJAN (Trojan)—Mine and mill operating nearly at capacity, 350 tons daily. Installation of revolving drum filters is planned; stationary leaf filter now being used.

WASP NO. 2 (Flatiron)—Tungsten concentrator is treating 25 to 30 tons daily averaging 1.25% tungstic acid. Jigging is followed by table concentration, final recovery being made on canvas tables. Cyanide mill continues to operate on ore from underground workings in westerly part of property.

Pennington County

HILL CITY TUNGSTEN DISTRICT is scene of great activity. Black Hills Tungsten Co. is operating concentrator. Hill City Tungsten Production Co. completing installation of machinery in old Harney Peak tin mill at Hill City; will treat some custom ore and stimulate mining, affording a market for many small mines.

NEW GOLDEN WEST (Rochford)—Crosscut tunnel advanced over 400 ft., has entered orebody. Compressor plant started.

U. S. GYPSUM (Rapid City)—Mill destroyed by fire will not be rebuilt. Company acquired property near Piedmont and will erect fireproof plant there immediately; deposits large and of good grade.

UTAH

Juab County

TINTIC SHIPMENTS for the week ended July 14 amounted to 191 cars.

VICTORIA (Eureka)—Property, acquired by Eagle & Blue Bell, being opened by drifts from the 1,000- and 1,300-ft. levels of the Eagle & Blue Bell.

IRON BLOSSOM (Silver City)—Utah and Juab counties are again in controversy over taxes paid by this company, which owns ground in both counties.

EAGLE & BLUE BELL (Eureka)—Installation of $35,000 electric hoist made and new development undertaken; shaft down 65 ft. below 1,700-ft. level. Shipments averaging 65 cars monthly. Earnings for second quarter about $55,000.

Salt Lake County

YAMPA (Bingham)—This property is being worked to the 1,600 level; shipping 200 tons daily of 3 to 4% ore.

UTAH METAL AND TUNNEL (Bingham)—In six months ended June 1, earned $600,000 net or nearly $1 a share. Development expenses unusually heavy. Production from Bingham-New Haven workings, first 10 days of June, amounted to 1,255 tons of milling ore, 105 tons of lead and 332 tons of copper ore, which was shipped. The Utah Metal workings produced 746 tons of milling ore and 218 tons of copper shipping ore. Seven sets of lessees operating in old upper workings.

BINGHAM MINES (Bingham)—Earnings for second quarter, including profits from Eagle & Blue Bell at Tintic (of whose stock Bingham Mines owns 75%) were $82,000. The Bingham properties earned a little over $40,000 for the period, May, with $15,426, showing largest monthly earnings. Outstanding bonds have been reduced to $250,000.

Tooele County

INTERNATIONAL SMELTING (Tooele)—Cottrell system, being installed at sintering plant, is approaching completion Two units expected to be ready July 22 and remaining two in about a month.

Utah County

ALPINE EMPIRE (American Fork)—Control taken by Jesse Knight.

BAY STATE (American Fork)—Tunnel is in 225 ft.; face in brown limestone. Three shifts working.

EARL EAGLE (American Fork)—New road completed to property. Machinery being installed for more active development.

PACIFIC (American Fork)—Fifteen men are working. New orebody opening satisfactorily. Machinery for mill being loaded at American Fork.

CANADA

British Columbia

CONSOLIDATED MINING AND SMELTING (Trail)—New sulphuric-acid plant completed. Initial capacity, 10 tons daily. Hydrofluosilicic acid is also made. Recently shipped 250 tons electrolytic zinc to Great Britain; capacity of zinc plant expected to reach 30 tons daily in August. Electrolytic copper refinery producing about 35 tons daily.

ROCHER DE BOULE COPPER CO. (Tramville)—Shipping 1,500 tons monthly to Tacoma smeltery but expect to increase to 3,000 tons when 500-ft. level is more extensively opened. Crosscut adit being driven to open workings 1,000 ft. below 300-ft. or old-tunnel level. Former leasing company, Montana Continental Development Co., of Butte, erected aërial tramway, narrow-gage railroad, 225-hp. hydro-electric plant, modern camp buildings, ore bins at Prince Rupert, B. C., and shipped 23,000 tons, averaging 7.25% Cu and carrying some silver and gold. D. J. Williams, manager.

Ontario

ORE SHIPMENTS FROM COBALT in June over Temiskaming & Northern Ontario Ry. were: Aladdin, 26.77 tons; Beaver, 47.87; Cobalt Comet, 82.38; Coniagas, 68.29; Crown Reserve, 121.91; Kerr Lake, 155.48; La Rose, 130.75; McKinley-Darragh, 195.54; Mining Corporation of Canada, Cobalt Lake, 129.35, and Townsite City, 169.07; O'Brien, 31; Penn Canadian, 85.76; Peterson Lake, 79.11; Temiskaming, 42.04; Casey Cobalt (New Liskeard), 63.30; Wettlaufer (South Lorrain), 12.26; total, 1,440.88 tons. Alexo nickel ore (Pourquois Jctn.), 848.35 tons.

DOMINION REDUCTION (Cobalt)—Installing flotation to replace cyanide treatment.

MILLER INDEPENDENCE (Boston Creek)—Purchased Leach Veteran claim adjoining the Miller.

HUDSON BAY (Cobalt)—Recently reopened; discovered lens of high-grade ore above 300-ft. level.

KING EDWARD (Cobalt)—Installing flotation and will dredge old tailings from lake and treat them.

WEST DOME CONSOLIDATED (Porcupine)—Will sink new four-compartment shaft near center of property.

NORTH THOMPSON (Porcupine)—Shaft down 460 ft. and four levels opened with satisfactory results. Ore above average grade found on 400-ft. level. Another level will be run at 500 ft.

VIPOND—Report for quarter ended June 30 shows loss in operation. Tonnage milled was 10,185 and bullion produced $37,000; average value of $3.69 per ton; operating costs, $4.45 per ton. Expect to treat better grade ore from 400-ft. level.

McINTYRE (Porcupine)—In quarter ended June 30, milled 34,173 tons, averaging $8.29, and recovered $241,650. Operating cost per ton was $4.23; total operating profits, $122,064; treated 3,721 tons of customs ore. Extra settling tanks ordered to bring mill capacity up to 500 tons.

CUBA

CONSTANCIA (San Ignacio 54, Habana)—Maximilian Paetzold, Austrian consul at Habana, has made preliminary shipments of 15% copper ore from this old mine in Pinar del Rio; new lens has been opened.

MATAHAMBRE (Apartado 1795, Habana)—Manuel L. Diaz, principal owner of this copper mine in Pinar del Rio Province, has arrived in New York to purchase concentrating equipment for the second-class ore. C. L. Constant & Co., 44 New St., New York, engineers.

WEST INDIES MINES DEVELOPMENT CO. (25 Broad St., New York, U. S. A.)—Organized by L. E. Whicher and associates of New York to explore and operate on royalty basis certain copper prospects in Province of Pinar del Rio, Cuba, and also in the Republic of Hawaii. Hermann A. Keller, of New York, is consulting engineer, and will be in Cuba for the next few months. His address is care of Dr. A. F. Guiteras, Milanes 57, Matanzas.

CHILE

BRADEN (Rancagua)—May copper production, 1,941 short tons; June, 1,129 tons; mill closed about two weeks account repairs to tailings dam. Copper production, first half of 1916, 11,555 tons. Equipment ordered for extension of reduction works, which are to have capacity for treating 10,000 tons of ore daily by March, 1917; present daily capacity, 4,500 tons.

ASIA

Chosen

ORIENTAL CONSOLIDATED (Unsan)—Final return for May: 200 stamps ran 29.7 days crushing 27,173 tons. Gross receipts, $133,908; operating costs, $76.404; operating profit, $57,503; development and betterment, $3,704; net profit, $53,799.

The Market Report

Metal Markets

NEW YORK—July 26

During the last week copper apparently touched bottom, a sharp rally following and the advance being held firmly. The rally in spelter went further, but ultimately culminated, the price receding again toward the close. The lead market was considerably confused but manifestly was weaker.

The N. Y., N. H. & H. Ry. put a new embargo on eastbound freight into effect at midnight July 26-27.

Copper, Tin, Lead and Zinc

Copper—On July 20 some rather large sales were made at 23c., r.t., and on the following day further business was done at the same price, but other producers entering the market at that time were able to get 24c., r.t. About all of this business was domestic and was to a large extent covering by manufacturers who had previously sold their finished products without contracting for the raw material. On July 22 a round lot was sold for export at 23c., net cash, but by the end of the day 24c., or 24¼c., r.t., was realized on domestic business in quantity. On July 24 business was done at 24½c., r.t., and on July 25, at 25c., r.t., but there were still sellers at 24½c., r.t. The same conditions continued to prevail on July 26. The business that was done was chiefly for September, October and September-November deliveries. For delivery in the last quarter there continued to be sellers at concessions, 23½c., r.t., being offered at the close.

Business was done during the week from day to day and the aggregate of what we had reports was of respectable proportions. The major part of it was for domestic account, although there were some export sales. The resiliency exhibited by the copper market during the week was quite satisfactory and the opinion was expressed in the trade that a definite turn had come about. The hope was expressed, however, that the large producers would reënter the market at a reduced level and exercise a restraining influence against a further advance.

Copper Sheets are nominally unchanged at 37½c. per lb. for hot rolled and 38½c. for cold rolled. Copper wire is 29@30c. per lb. for carload lots at mill.

Tin—Practically nothing was done in this metal; the price advanced slightly, following the London market.

Bolivian Tin Ore Shipments for the six months ended June 30, 1916, were equivalent to 9,700 tons tin, 7,168 tons going to Great Britain and 2,455 tons to the United States. For the corresponding half of 1915 shipments were equivalent to 11,467 tons tin, 11,381 tons to Great Britain and only 86 tons to the United States.

Lead—The situation in this metal, especially as to price, was more confused than ever. In the St. Louis market there was no doubt about there being a softer tone, sales of Missouri lead being made at gradual concessions, business being reported done as low as 6c. on July 26. In the New York market the principal producer reported sales of desilverized lead at 6.50c., but other producers of desilverized reported the offering of tonnages at 6.20@6.25c. and inability to effect sales. There was similarly a discrepancy among reports as to volume of business. One large producer reported more done than in the previous week, but sales of others were less. The confusion of views and ideas was well reflected by the offers for the delivery of 225 tons of lead to Frankford Arsenal, which takes the Philadelphia freight rate, these bids being opened on July 25. The Pennsylvania Smelting Co. offered at 5.98c., the United States, at 6.15c., Caswell & Starke, at 6.24c., the American Metal Co., at 6.30c., and another brokerage house, at 6.60c.

The labor and political situation in Spain continued unsettled. It is reported no worse, but it remains a factor of potential importance in the market.

Spelter—The market continued to advance under the impetus received in the previous week. The chief feature was the sale of a large block for export, delivery running far ahead. This business was done at a price much below the current market, and probably constituted a back-log for the latter. The business for near-by delivery was well divided among the producers and in the aggregate attained fair proportions without anyone doing a specially large amount. This business was chiefly for domestic account, including some with galvanizers. Subsequent to July 24, however, the demand petered out and the market promptly receded. The facts that numerous consumers are known to be overbought and that some of them are offering round lots for resale, while others are endeavoring to arrange postponement of deliveries, do not tend to give the market any great stability. On the other hand, a potential demand from Europe at a lower level is considered to be an insurance against a severe decline.

DAILY PRICES OF METALS IN NEW YORK

July	Sterling Exchange	Silver, Cts. per Oz.	Copper	Tin	Lead		Zinc
			Electrolytic, Cts. per Lb.	Spot, Cts. per Lb.	New York, Cts. per Lb.	St. Louis, Cts. per Lb.	St. Louis, Cts. per Lb.
20	4.7575	62¾	22½ @23	37½	6.20 @6.25	6.10 @6.20	8.75 @9.25
21	4.7581	63¾	22¾ @23¼	37¾	6.20 @6.25	6.05 @6.15	8.75 @9.25
22	4.7581	63⅜	23 @24	37¾	6.20 @6.25	6.00 @6.10	9.00 @10.00
24	4.7581	63¼	24 @24½	38	6.20 @6.25	6.00 @6.10	9.50 @10.00
25	4.7581	62⅞	24¼ @24¾	38¼	6.20 @6.25	6.00 @6.10	9.25 @9.75
26	4.7581	63⅛	24¼ @24¾	38¼	6.20 @6.25	6.00 @6.05	9.00 @9.50

The quotations herein are our appraisal of the average markets for copper, lead, spelter and tin based on wholesale contracts for the ordinary deliveries of the trade as made by producers and agencies; and represent, to the best of our judgment, the prevailing values of the metals, reduced to basis of New York, cash, except where St. Louis is given as the basing point. St. Louis and New York are normally quoted 0.17c. apart.

The quotations for electrolytic copper are for cakes, ingots and wirebars. Electrolytic copper is commonly sold at prices including delivery to the consumers and is subject to discounts, etc. The price quoted for copper on "regular terms" (r.t.) is the gross price including freight to the buyer's works and is subject to a discount for cash. The difference between the price delivered and the New York cash equivalent is at present about 0.25c. on domestic business. The price of electrolytic cathodes is 0.05 to 0.10c. below that of electrolytic. Quotations for lead represent wholesale transactions in the open market for good ordinary brands. Quotations for spelter are for ordinary Prime Western brands. Only the St. Louis price is herein quoted, St. Louis being the basing market. We quote the New York price at 17c. per 100 lb. above the St. Louis price.

Silver quotations are as reported by Handy & Harman and are in cents per troy ounce of silver bars 999 fine.

Some current freight rates on metals per 100 lb. are: St. Louis-New York 17c.; St. Louis-Chicago, 6.3c.; St. Louis-Pittsburgh, 13.1c.

LONDON

July	Silver	Copper				Tin		Lead		Zinc	
		Standard		Electrolytic							
		Spot	3 Mos.	£ per Ton	Cts. per Lb.	Spot	3 Mos.	£ per Ton	Cts. per Lb.	£ per Ton	Cts. per Lb.
20	29⅞	90½	88	121	25.76	166½	167	28½	6.06	51	10.86
21	30 3/16	91	89	122	25.98	168¼	168¼	28⅝	6.09	54	11.50
22	30 3/16	.....	.....	.....	.....	.	...	...	......	...	.
24	30⅛	94	91	122	25.98	166¼	167	27¾	5.91	56	11.92
25	29 15/16	98	95	122	25.98	166	166½	28¼	6.01	60	12.77
26	30⅛	100	98	122	25.98	165½	166¼	28	5.96	59	12.56

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2,240 lb., except silver which is in pence per troy ounce of sterling silver, 0.925 fine. Copper quotations are for standard copper, spot and three months, and for electrolytic, price for the latter being subject to 3 per cent. discount. For convenience in comparison of London prices, in pounds sterling per 2,240 lb., with American prices in cents per pound the following approximate ratios are given, reckoning exchange at 4.80. £15 = 3.21c.; £20 = 4.29c.; £30 = 6.43c.; £40 = 8.57c.; £60 = 12.85c. Variations, £1 = 0.21⅜c.

Zinc Sheets are in good demand, both for domestic deliveries and for export. The quotations are unchanged at $15 per 100 lb. f.o.b. Peru, Ill., less 8% discount.

Other Metals

Aluminum—There is no change in the market. Demand continues fair and deliveries seem to be sufficient. Quotations continue at 59@61c. per lb. for No. 1 ingots, New York.

Imports of aluminum in May are reported at 1,391,575 lb., against 418,708 lb. in May of last year.

Antimony—The market was dull, but some new inquiries were reported. We quote spot at 13½c.; the principal interests were unwilling to quote futures.

Quicksilver—The market is quiet but steady. We quote $80, New York. San Francisco reports by telegraph $79, market dull.

Minor Metals—Current quotations for **Bismuth** are $3.15@3.30 per lb., New York.—**Cadmium** is quoted at $1.30@1.50 per lb.—**Cerium,** electrolytic, is sold at $8@9 per lb.—**Cobalt Metal** is quoted at $1.25 per lb.—**Magnesium** is lower, with sales at $3.50@3.75 per lb. for 99% pure.—**Selenium** is from $3 up to $5 per lb., according to size of order.

Gold, Silver and Platinum

NEW YORK—JULY 26

Gold continues to arrive in New York. This week a consignment of $20,000,000 from London by way of Halifax was received.

Gold in the United States July 1 is estimated by the Treasury Department as follows: Held in Treasury against gold certificates outstanding, $1,565,879,989; in Treasury current balances, $234,888,296; in banks and circulation, $639,153,647; total, $2,439,921,932, an increase of $446,372,917 over July 1 of last year.

Platinum—This market was dull and unchanged from the close last week. We quote $60, and at the close not very strong at that.

Our Russian correspondent writes from Petrograd that the market is rather dull and inactive. The demand has sensibly decreased, especially from abroad. From Ekaterinburg it is reported that the production of platinum has further increased, therefore a decline in prices may be expected. The producers and dealers affirm, however, that the dullness is temporary only and that the market will return to the former position. Prices remain generally unchanged. For crude metal, 83% platinum, the quotations are: In Petrograd, 64,000@65,000 rubles per pood; at Ekaterinburg, 17 rubles per zolotnik. These are equivalent to $63.21 and $63.92 per oz. respectively.

Silver—The market continues without special feature. China exchanges remain below London parity, so that there is not much prospect of an inquiry for silver from that quarter to compete for the business offering.

Mexican dollars were quoted in New York, July 20, at 48⅛@52⅛c.; July 21, at 47@51c.; July 22 at 44⅞@48⅞c.; July 24 at 48¾@52¾c.; July 25 at 48½@52½c., July 26 at 48¼@52¼c. There was a quick recovery from the fall on July 22.

Zinc and Lead Ore Markets

Joplin, Mo., July 22—Quotations are as follows: Base price per 2,000 lb., ore assaying 60% zinc, $75 for premium ore; $70@60 for medium; down to $55 for low grade. Average price realized for week's sales, $68.41; highest price, $76.90. Calamine base price per 2,000 lb., ore assaying 40% zinc, $55@45; average realized for week's sales, $47.50 per ton.

Lead, base price per 2,000 lb. ore assaying 80% lead, $72.50@70; average realized for week's sales, $69.51; high price, $72.10 per ton.

Shipments for week ended July 22 were 4,751 tons blende, 227 tons calamine and 764 tons lead ore. For year to date, 195,978 tons blende, 15,288 tons calamine and 33,641 tons lead ore. Total value, $388,890 for the week; $23,788,850 for the year to date.

A low stage of water in the streams from which electricity is generated by water power for the mines has created a shortage of power, and lack of power is preventing a number of mines operating steadily, and the production of ores is lessened by this cause, and further by some mines closing down on account of the 90% advance in dynamite and other high costs that deplete the profit side of the mining business. From a production of 10,000 tons per week in April it has dropped to under 7,000 tons. Further reduction is indicated.

Butte, Mont., July 20—The Butte & Superior Co. reports that in June 48,475 tons of ore were treated, with a recovery of 10,830 tons of zinc concentrates; a decrease of 828 tons from May.

OTHER ORES

Antimony Ore—Small business was reported for local stocks, prices ranging from $1.25@1.50 per unit.

Tungsten Ore—Buyers and sellers were still unable to get together. The market is quoted nominally at $27@30 per unit, for which most of the largest producers are holding. European inquiries are reported in the market. The recession in tungsten prices is believed to have brought about a considerable curtailment of production.

Charles Hardy, of 50 Church St., New York, has been appointed New York broker for the Atolia Mining Co.

Iron Trade Review

NEW YORK—July 26

The feature of the week is the Steel Corporation statement for the June quarter, which is fully up to expectations and shows net earnings unparalleled in the past.

There is no considerable change in the actual condition of the iron and steel market. Domestic orders continue to be rather limited, but export business is pressing and large contracts have been placed or are under negotiation. No price changes are reported. The discussion over steel-bar contracts is not yet closed, the agricultural implement makers holding back for some further reduction in price. Structural steel is slow, owing to questions of price and delivery which have brought about some delay in building projects. The most pressing business just now is in plates, for which the demand is strong. Railroad and car material buying is chiefly for export.

In the pig-iron market the principal feature is the demand for Bessemer and low-phosphorus pig for export. Hot weather is affecting the output of the blast furnaces about as usual at this season.

PITTSBURGH—July 25

Steel-mill outputs continued to be curtailed by the hot weather and on the whole the output this month will represent a larger curtailment than usual for July, though the actual output will be much larger than in any previous July.

The domestic market continues extremely quiet, new buying being very light. The continued dullness emphasizes the inherent strength of the situation, as the steel mills have shown no signs of wavering in the matter of prices. There is a disposition to deny recently published reports that steel bars were sold to agricultural-implement makers for the first half of 1917 at 2.35c., although for the implement makers to pay as high as 2.35c. would represent a strong market, when early in the year they paid 1.90c. for second-half deliveries only under protest. It is evident that the mills purpose maintaining 2.50c. on bars in the general market.

IRON ORE

Exports and imports of iron ore in the United States five months ended May 31 were in long tons:

	1915	1916	Changes
Imports....	432,996	501,873	I. 68,877
Exports....	22,900	151,593	I. 128,693
Excess, imports	410,096	350,280	I. 59,816

Exports are chiefly of Lake Superior ore to Canadian furnaces.

A record cargo of iron ore passed through the Sault Ste. Marie Canal last week. It was 15,008 tons of ore carried by the "W. P. Snyder, Jr." on 20 ft. 6 in. draft. It was bound from Duluth to Cleveland.

Announcement is made by the Lake Carriers' Association that the recommended loading depth for boats from Lake Superior to Lakes Michigan and Erie be increased from 19 ft. 11 in. to 20 ft. 10 in. The greater depth means, on the average, 800 tons of iron ore more per cargo. The increase in depth is due to dredging recently completed in Lake St. Clair. From now till the season's close this increase in tonnage will amount to about 5,000,000 tons.

COKE

Coke production in the Connellsville region for the past week is reported by the "Courier" at 418,016 net tons; shipments, 417,027 tons. Shipments of Greensburg and Upper Connellsville districts, 36,012 tons. Hot oppressive weather continues to keep down the production.

From Birmingham, Ala., it is reported that the orders for coke there are pressing, especially for foundry coke. The plants making coke for sale are overrun and prices for foundry coke are quoted as high as $4.25 per ton at ovens.

Assessments

Company	Delinq	Sale	Amt.
Algomah, Mich	May 18	....	$1.00
Blue Bell, Ida	July 8	Aug. 5	0.002
Cedar Creek, Ida	July 5	Aug. 5	0.01
Clear Grit, Ida	Aug. 7	Aug. 25	0 002
Columbus Ext., Utah	July 13	Aug. 8	0 02
Cons. Imperial, Nev	July 18	Aug. 10	0.01
Cons. Virginia, Nev	July 27	Aug. 17	0.05
Crackerjack, Nev	July 3	Aug. 1	0.01
Emerald, Utah	July 15	Aug. 11	0.00¼
Four Timbers, Ida	July 26	Aug. 26	0.002
Friend, Ida	June 30	July 20	0.002
Gold Mt. Champion, Utah	July 20	Aug. 10	0 0025
Gould & Curry, Nev	July 14	Aug. 3	0.03
Great Western, Nev	July 24	Aug. 15	0 005
Hope, Calif	July 17	Aug. 14	0.01
Hugo, Ida	July 29	Aug. 30	0 002
Independence, Ida	July 8	July 29	0.001
Iron Spar, Ida	July 17	Aug. 15	0.003
Jacket-C. Point-Belcher, Nev	Aug. 14	Sept. 7	0.05
Jack Waite, Ida	July 27	Aug. 28	0.01
Kewanas Reor., Nev	Aug. 2	Sept. 6	0 01
Lehi Tintic, Utah	Aug. 5	Aug. 25	0.0025
Lucky Calumet, Ida	July 20	Aug. 21	0 005
Morgan Argentine, Utah	July 15	Aug. 5	0.01
Nevada-Douglas, Nev	July 15	Aug. 16	0.10
Nevada Zinc, Nev	Aug. 14	Sept. 2	0 01
North Lake, Mich	June 14	..	1 00
Old Veteran, Ida	July 8	Aug. 5	0.002
Sierra Nevada, Nev	July 11	Aug. 3	0 10
Silver Moon, Ida	July 8	Aug. 3	0 005
Silver Pick, Nev	July 5	Aug. 14	0 01
Southern Swansea, Utah	July 17	Aug. 5	0.001
Spearhead Reor., Nev	July 3	Aug. 3	0 01
Sunrise, Ida	July 27	Aug. 28	0.002
Swansea Ext., Utah	July 10	Aug. 1	0.0025
Tar Baby, Utah	Aug. 3	Sept. 4	0 01
Tarbox, Mont	July 25	Aug. 12	0 005
Tiberius, Ida	July 8	Aug. 1	0.001
Tintic Central, Utah	July 12	Aug. 8	0 005
Ton. Gypsy Queen, Nev	July 11	Aug. 15	0.01
Uvada, Nev	June 24	July 27	0 02
Victoria, Utah	July 8	Aug. 2	0 005
Wolf Mt. Copper, Utah	Aug. 2	Sept. 6	0.005

Stock Quotations

SAN FRANCISCO July 25	
Name of Comp.	Bid
Alta	.04
Andes	.10
Best & Belcher	.06
Bullion	.01
Caledonia	‡ 44
Challenge Con	.03
Confidence	.18
Cons. Imperial	.01
Con. Virginia	.12
Gould & Curry	.03
Hale & Norcross	.05
Jacket-Cr. Pt	.03
Mexican	.16
Occidental	.70
Ophir	.21
Overman	‡ 05
Savage	.04
Seg Belcher	.02
Sierra Nevada	.31
Union Con	.66
Utah Con	01
Belmont	4 05
Jim Butler	86
MacNamara	04
Midway	‡ 19
Mont.-Tonopah	25
North Star	.14
Rescue Eula	23
West End Con	81
Atlanta	.10
Blue Bell	.01
Booth	.13
C.O.D. Con	.03
Comb. Frac	.06
D'field B.B.	.02
D'field Daisy	.02
Jumbo Extension	.78
Pitts.-Silver Peak	.12
Round Mountain	46
Sandstorm Kendall	04
Silver Pick	.11
Central Eureka	10
Argo	08
Ariz. Central	13
Big Jim	90
Lazy Boy	12
Oatman No. Star	15
Tom Reed	1 63
United Eastern	3 62
United Western	09

LONDON	July 10
Alaska Tre'dwell	£5 17s 6d
Burma Corp	3 6 3
Cam & Motor	0 14 3
Camp Bird	0 9 6
El Oro	0 9 6
Esperanza	0 11 0
Mexico Mines	4 0 0
Nechi, pfd	0 16 0
Oroville	0 18 6
Santa Gert'dis	0 14 0
Tomboy	1 3 6

SALT LAKE July 24	
Name of Comp.	Bid.
Alta Con	24
Black Jack	05
Colorado Mining	.15½
Crown Point	.03½
Daly-Judge	7 75
Emma Cop	47
Gold Chain	22
Grand Central	68
Iron Blossom	1.47½
Lower Mammoth	.03
May Day	.11
Opohongo	.01½
Prince Con	1.35
Seven Troughs	.03
Silver King Coal'n	3 00
Silver King Con	3 25
Sioux Con	08¼
Uncle Sam	.06
Yankee	.17½

COLO. SPRINGS	July 25
Acacia	.03¼
Doctor Jack Pot	.09
Elkton Con	.14½
El Paso	.72
Findlay	.03½
Gold Sovereign	.03½
Golden Cycle	2.05
Granite	.67½
Isabella	.17½
Jack Pot	.05
Jerry Johnson	.04
Mary McKinney	.32
Portland	1 62½
Vindicator	2 00

TORONTO	July 24
Adanac	1.62½
Bailey	06
Chambers Ferland	19
Coniagas	4.25
La Rose	.56
Peterson Lake	.22
Right of Way	03
Seneca Superior	43
T. & Hudson Bay	55 00
Temiskaming	53
Trethewey	‡ 21
Wettlaufer-Lor	10
Dome Exten	34
Dome Lake	32
Foley O'Brien	48
Hollinger	28 00
Jupiter	28
McIntyre	1 43½
Newray	.40
Porc. Crown	68¼
Preston E. D.	‡ 03
Vipond	40
West Dome	.35¾

N. Y. EXCH. July 25	
Name of Comp.	Clg.
Alaska Gold M	18¼
Alaska Juneau	8¼
Am.Sm.&Ref.,com	93½
Am. Sm. & Ref., pf.	110½
Am. Sm. Sec., pf. A	93
Am. Sm. Sec., pf. B.	84½
Am. Zinc	33¾
Am. Zinc, pf	65½
Anaconda	79
Batopilas Min	1⅛
Bethlehem Steel	435
Bethlehem Steel, pf.	125
Butte & Superior	67½
Chile Cop	20½
Chino	47½
Colo. Fuel & Iron	44¼
Crucible Steel	68¾
Dome Mines	25½
Federal M. & S.	12½
Federal M. & S., pf.	37½
Great Nor., ore ctf.	35¾
Greene Cananea	45
Homestake	130
Inspiration Con.	48
International Nickel	44½
Kennecott	45¼
Lackawanna Steel	69½
Miami Copper	34¼
Nat'l Lead, com	63
National Lead, pf	113
Nev. Consol	16½
Ontario Min	6
Quicksilver	2¾
Quicksilver, pf	4½
Ray Con	22½
Republic I&S, com	46¼
Republic I&S, pf	108½
Sloss-Sheffield	44
Sloss-Sheffield, pf.	94
Tennessee Copper	23½
Utah Copper	76
U. S. Steel, com	86
U. S. Steel, pf	118
Va. Iron C. & C.	43½

N. Y. CURB	July 25
Beaver Con	.36
Buffalo Mines	.87½
Butte & N. Y.	1½
Butte C. & Z.	4½
Caledonia	.71
Can. Cop. Corpn	1¾
Cashboy	.05
Cerro de Pasco	34½
Con. Ariz. Sm.	1⅜
Con. Coppermines	2¼
Con. Nev.-Utah	$\frac{5}{16}$
Crystal Cop	1
First Nat. Cop.	4
Florence	.43
Goldfield Con	.86
Goldfield Merger	.08½
Granite	.28
Hecla Min	$6\frac{3}{16}$
Howe Sound	4¾
Jerome Verde	1½
Joplin Ore & Spel.	2¾
Kerr Lake	4¼
Magma	13
Majestic	¾
McKinley-Dar-Sa.	.56
Mother Lode	.31½
Nevada Hills	.16
N. Y. & Hond	15¾
Nipissing Mines	6¾
Oro	.04
Ray Hercules	3⅜
Rochester Mines	.58
St. Joseph Lead	15
Standard S. L.	1½
Stewart	.25
Success	.59
Tonopah	6¼
Tonopah Ex	5¼
Tribullion	¾
United Zinc	6
White Knob, pf.	1¼
Yukon Gold	2

BOSTON EXCH July 25	
Name of Comp.	Bid
Adventure	2½
Ahmeek	93
Algomah	1¾
Allouez	59
Ariz. Com., ctfs.	8½
Bonanza	.25
Butte-Ballaklava	1⅛
Calumet & Ariz	68¾
Calumet & Hecla	515
Centennial	14
Copper Range	57½
Daly West	2¼
East Butte	11½
Franklin	6¼
Granby	81
Hancock	11
Helvetia	.20
Indiana	2
Island Cr'k, com	44
Island Cr'k, pfd	88½
Isle Royale	25
Keweenaw	3½
Lake	11
La Salle	‡1
Mason Valley	1¾
Mass	11¾
Mayflower	2
Michigan	2½
Mohawk	81
New Arcadian	5
New Idria	11
North Butte	20
North Lake	1½
Ojibway	1
Old Colony	1½
Old Dominion	62
Osceola	81
Quincy	82
St. Mary's M. L.	71½
Santa Fe	1⅜
Shannon	7½
Shattuck-Ariz	26
So. Lake	4½
So. Utah	.19
Superior	12¾
Superior & Bost	4
Tamarack	37
Trinity	4¾
Tuolumne	.35
U. S. Smelting	67¼
U. S. Smelt'g, pf	50
Utah Apex	3¾
Utah Con	12¾
Utah Metal	6¾
Victoria	3
Winona	4¼
Wolverine	48
Wyandot	1¼

BOSTON CURB	July 25
Bingham Mines	9¾
Boston Ely	1
Boston & Mont	.91
Butte & Lon'n Dev.	.67
Calaveras	4¾
Calumet-Corbin	.02½
Chief Con	1¼
Cortez	.35
Crown Reserve	.45
Davis-Daly	1¾
Eagle & Blue Bell	1¼
Houghton Copper	1¼
Iron Cap Cop., pf	6
Mexican Metals	.31
Mines of America	2½
Mojave Tungsten	4
Nat. Zinc & Lead	$1\frac{3}{16}$
Nevada-Douglas	1
New Baltic	1½
New Cornelia	12¾
Ohio Copper	.10
Oneco	.80
Raven Copper	.06
Rex Cons	.26
Rilla	.21
United Verde Ext.	27½

‡Last Quotations.

Monthly Average Prices of Metals

SILVER

Month	New York			London		
	1914	1915	1916	1914	1915	1916
January	56.572	48.855	56.775	26.553	22.731	26 960
February	57.506	48.477	56.755	26.573	22 753	26 975
March	58 067	50.241	57 935	26.788	23 708	27 597
April	58 519	50.250	64.415	26.958	23 709	30 662
May	58.175	49.915	74.269	26.704	23 570	35.477
June	56.471	49.034	65.024	25 948	23.267	31 060
July	54 678	47.519	......	25 219	22.597	......
August	54.344	47.163	......	25.979	22 780	......
September	53 290	48.680	......	24.260	23.591	......
October	50 654	49.385	......	23 199	23 925	......
November	49.082	51 714	......	22 703	25 094	......
December	49 375	54 971	......	22.900	26 373	......
Year	54 811	49 684	......	25.314	23.675	......

New York quotations cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

COPPER

Month	New York		London			
	Electrolytic		Standard		Electrolytic	
	1915	1916	1915	1916	1915	1916
Jan.	13.641	24 008	60.756	88.083	65 719	116.167
Feb.	14 394	26 440	63.494	102 667	*	133.167
Mar.	14.787	26.310	66.152	107.714	*	136.000
April	16.811	27.895	75.096	124 319	*	137 389
May	18 506	28.625	77.600	135.457	*	152.522
June	19.477	26 601	82.574	112 432	95.333	137 455
July	18.796	......	76.011	......	91.409	......
Aug.	16.941	......	68 673	......	82.333	......
Sept.	17.502	......	68 915	......	85.250	......
Oct.	17.686	......	72.601	......	88 000	......
Nov.	18.627	......	77.744	......	93.273	......
Dec.	20.133	......	80 773	......	100.43	......
Year.	17.275	......	72.532	......	......	......

TIN

Month	New York		London	
	1915	1916	1915	1916
January	34.260	41 825	156.550	175.548
February	37.415	42.717	176.925	181.107
March	48.426	50.741	180.141	193.609
April	47.884	51.230	166.225	199.736
May	38.790	49 125	162.675	196.511
June	40.288	42 231	167.636	179 466
July	37.423	......	167.080	......
August	34.389	......	151.440	......
September	33.125	......	152.625	......
October	33.080	......	151.554	......
November	39.224	......	167 670	......
December	38.779	......	167.000	......
Av. year	38 590	......	163.960	......

LEAD

Month	New York		St. Louis		London	
	1915	1916	1915	1916	1915	1916
January	3.729	5.921	3.548	5.826	18.606	31.167
February	3.827	6.246	3.718	6.164	19.122	31 988
March	4.053	7.136	3.997	7.375	21.883	34.440
April	4.221	7.630	4.142	7.655	21.094	34 368
May	4.274	7 463	4.182	7.332	20.347	32.967
June	5.932	6.936	5.836	6 749	25.170	31.011
July	5.659	......	5.531	......	24.611	......
August	4.656	......	4.520	......	21.946	......
September	4 610	......	4.490	......	23.151	......
October	4 600	......	4.499	......	23.994	......
November	5.155	......	5.078	......	26.278	......
December	5.355	......	5.266	......	28.807	......
Year	4.673	......	4.567	......	22.917	......

SPELTER

Month	New York		St. Louis		London	
	1915	1916	1915	1916	1915	1916
Jan.	6 386	16.915	6.211	16.745	30.844	89.810
Feb.	8 436	18.420	8.255	18.260	39.819	97 762
Mar.	8 541	16.846	8.360	16.676	44.141	95.048
April	10 012	16.695	9.837	16.525	49.888	99.056
May	14 781	14.276	14.610	14.106	68.100	94 217
June	21.208	11.752	21.038	11 582	100.614	68 591
July	19 026	......	18.856	......	97.250	......
Aug.	12.781	......	12.611	......	67.786	......
Sept.	13.440	......	13.270	......	67.841	......
Oct.	12.800	......	12.596	......	66.536	......
Nov.	15.962	......	15.792	......	88.409	......
Dec.	15.391	......	15.221	......	89.400	......
Year	13.230	......	13.054	......	67.553	......

New York and St. Louis quotations, cents per pound. London, pounds sterling per long ton. * Not reported.

PIG IRON IN PITTSBURGH

Month	Bessemer‡		Basic‡		No. 2 Foundry	
	1915	1916	1915	1916	1915	1916
January	$14.59	$21.60	$13.45	$18.78	$13.90	$19.70
February	14.55	21.16	13.45	18.93	13.90	19.51
March	14.55	21.81	13.45	19.20	13.95	19.45
April	14 55	21.65	13.45	18.95	13.95	19.45
May	14.61	21.78	13 60	19 11	13.83	19 58
June	14.70	21.95	13.67	18.95	13.77	19.34
July	14 94	......	13.91	......	13.68	......
August	16.01	......	15.31	......	14.75	......
September	16.86	......	15.95	......	15.70	......
October	16.95	......	15.96	......	15.80	......
November	17 57	......	16.47	......	17.20	......
December	19 97	......	18.44	......	18 95	......
Year	$15.82	......	$14.76	......	$14 95	......

‡As reported by W. P. Snyder & Co

Engineering and Mining Journal

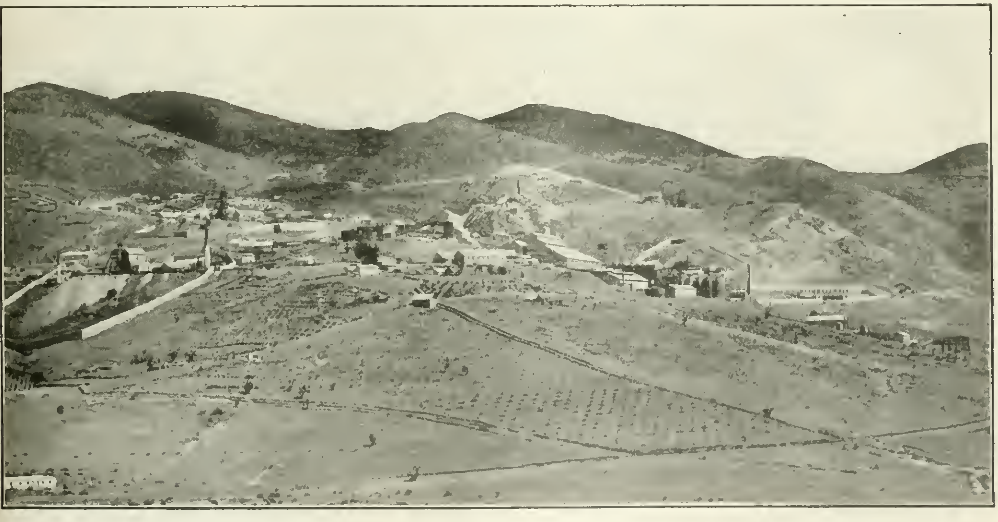
VOLUME 102 AUGUST 5, 1916 NUMBER 6

Santa Gertrudis Mill, Pachuca*

SYNOPSIS—A description of the Santa Gertrudis mill, one of the best of cyanide plants of the modern all-sliming type. The plant will handle 1,100 tons per day, and cost $792 per ton of daily capacity.

The milling operations of Santa Gertrudis at Pachuca, Mexico, are carried on by a separate organization, known as Cia. Beneficiadora de Pachuca, S. A. The plant capacity is 1,100 tons per day. The accompanying flow sheet shows the arrangement of the machinery. The crushing-plant bins—of 600 tons capacity—feed two No. 6K gyratory crushers, discharging to a double screen 14 ft. long; the oversize from the 4-in. round-hole screen passing by conveyor to the tube-mill storage bin, the undersize joining the oversize of the 2-in. round-hole screen for crushing in two No. 4K gyratory crushers; the undersize from the 2-in. screen, together with the discharge from the secondary crushers, is delivered to a 22-in. troughed belt conveyor equipped with Merrick Weightometer. The 22-in. conveyor discharges over the first one of three Vezin samplers, a 5% cut being taken and stored in a sample bin of 15 tons capacity; the reject flows to a 30-in., shuttle-type, flat-belt conveyor for distribution into battery bins of 2,000 tons capacity. The first sample cut is fed from the 15-ton bin through a set of 26x15-in. rolls reducing to ¾ in. and finer and discharging to a second Vezin sampler cutting out 10%, which is delivered by a revolving Challenge feeder to the third Vezin, taking a 20% cut. The sample thus obtained is one ton for each 1,000 tons milled and is crushed to ¼ in. in a size F gyratory crusher, thereafter being cut down by Jones riffles and reduced in the usual manner. Rejects from the second and third Vezin samplers and from the quartering floor are returned to the battery bins by an 8-in. elevator.

The ore passes from the battery bins through Hoscur feeders to sixty 1,550-lb. stamps arranged in units of 10 stamps each, 20 stamps being driven by a 65-hp. motor belted to a jackshaft; the stamps make 102 7½-in. drops per minute; 3-mesh and 4-mesh screens are used, the pulp from the batteries flowing through split distributing launders to six primary duplex Dorr classifiers, the sand passing to six 5x16-ft. tube mills, the discharges from which are delivered to the launder, going to the secondary classifiers by elevator or by reserve 10x54-in. Frenier pumps, one pump to each mill. The slimes overflow from the primary classifiers is laundered to 8 secondary duplex classifiers, feeding sand to four 5x20-ft. and two 5x22-ft. tube mills, the discharges from which are returned by elevator or Frenier pumps to the classifiers. The slimes overflow from the secondary classifiers passes to 6 primary



GENERAL VIEW OF THE SURFACE PLANT OF THE SANTA GERTRUDIS AT PACHUCA, MEXICO

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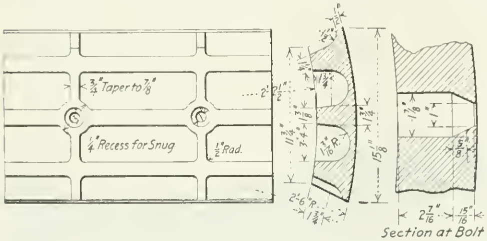
*Excerpt from an article by Hugh Rose, in the "Bulletin" of the American Institute of Mining Engineers, August, 1916

Dorr thickening tanks, 35 ft. diameter by 15 ft. deep, wherein the pulp is thickened from 10 to 1 to 1.5 to 1. The thickened pulp is delivered to a set of 14 primary Pachuca tanks, 15x45 ft., operating in series; the discharge from the last tank in the series is by means of an air lift submerged in the tank itself and delivering to a launder, where a wash of four parts of mill solution is applied, the pulp flowing to four secondary Dorr thickening tanks, 35x15 ft., wherein it is again thickened to about 1.75 to 1 and delivered to a set of 14 secondary Pachuca tanks, 15x45 ft., also operating in series, the discharge from the last tank of the series flowing to two 35x12-ft. storage tanks equipped with mechanical agitators.

These storage tanks feed by gravity at 35 lb. pressure four 90-frame Merrill filter presses, size of leaf, 4x6 ft., width of frame 3 in. The tailings sluiced from these presses flow to four 35x15-ft. Dorr thickening tanks for recovery of water before passing to the tailings-storage dams. The pregnant solution is clarified by passing through four sand-filter tanks, 40 ft. diameter by 10 ft. deep. Precipitation is effected by the Merrill zinc-dust process in two circuits, partial and barren, in order to economize in zinc dust; two presses are in use on the barren circuit and three on the partial. The precipitate is melted in a battery of 8 oil-fired, No. 400 crucible furnaces arranged on the arc of a circle and served by a radial jib crane fitted with an air cylinder for raising and lowering the pots.



SANTA GERTRUDIS TUBE-MILL LINING

All pumping of solution and water is concentrated in two pumphouses, one below the filter plant and the other below the precipitation plant. The pumps are of vertical triplex-plunger types, gear-driven by motors, and are installed so that one pump is in reserve for two circuits. An electrically operated inclined tramway runs from the top to the bottom of the mill, delivering material to any floor.

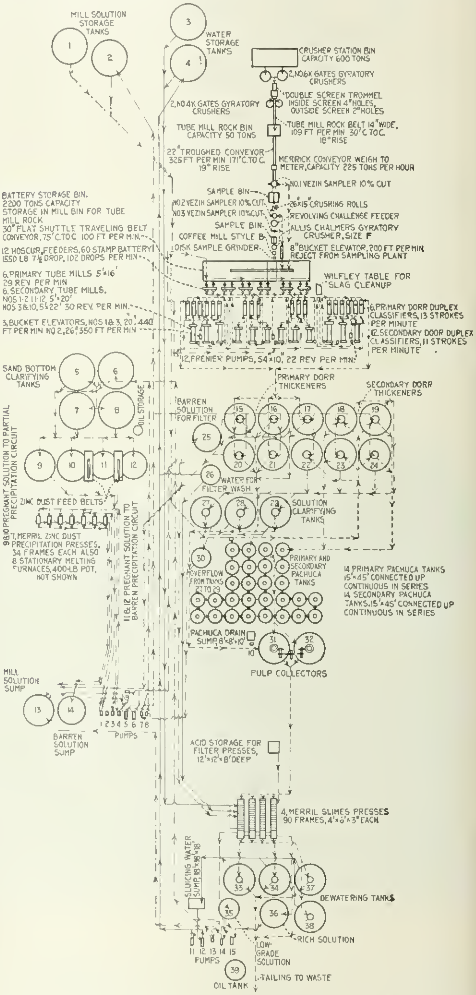
Details of Construction and Operation

Compactness of design was sacrificed to secure a gravity flow. Such design was permissible owing to an unusually ample mill site of 17° slope, coupled with a mild climate requiring no housing of tanks. Supervision is made easy because the size of the plants warrants the division in two departments, mill and cyanide, and the tramway is used by the bosses in getting round. The mill is electrically driven throughout, 50-cycle alternating current being distributed at 140 volts.

The crushing-plant design exhibits no points of special interest. The elimination of elevator returns and the favorable character of the ore make the operation unusually easy and simple. Consumption of steel liners, etc., is almost negligible. The 6K gyratory crushers, driven by 30-hp. motors, take only 15 hp. each. This is again due to the character of the ore and the large percentage of fines, which, if the ore had greater abrasive quality, it might pay to screen out beforehand.

An ample supply of mine rock over 4 in. in size, for use in the tube mills in place of pebbles, is obtained cheaply from the revolving-screen oversize.

Particular attention is paid to securing an accurate sample of the ore delivered to the mill. Ordinarily two classes of ore are sampled separately each day. The rejects from these two are thoroughly mixed and quartered down, to make the mixture sample for the day. The calculated average assay of the two class samples checks very closely the assay results of the mixture. The usual samples are taken for moisture, which averages about 5%.


MILL SOLUTION STORAGE TANKS
1
2
3
4
WATER STORAGE TANKS
CRUSHER STATION BIN CAPACITY 600 TONS
2, NO 6K GATES GYRATORY CRUSHERS
DOUBLE SCREEN TROMMEL INSIDE SCREEN 4" HOLES, OUTSIDE SCREEN 2" HOLES
2, NO 4K GATES GYRATORY CRUSHERS
TUBE MILL ROCK BIN CAPACITY 50 TONS
TUBE MILL ROCK BELT 14" WIDE, 109 FT PER MIN 30' C TO C 18° RISE
22" TROUGHED CONVEYOR 325 FT PER MIN 171' C TO C 19° RISE
MERRICK CONVEYOR WEIGH TO METER, CAPACITY 225 TONS PER HOUR
NO.1 VEZIN SAMPLER 10% CUT
SAMPLE BIN
26×15" CRUSHING ROLLS
NO 2 VEZIN SAMPLER 10% CUT
NO 3 VEZIN SAMPLER 10% CUT
REVOLVING CHALLENGE FEEDER
SAMPLE BIN
ALLIS CHALMERS GYRATORY CRUSHER, SIZE F
COFFEE MILL STYLE B
DISK SAMPLE GRINDER
8" BUCKET ELEVATOR, 200 FT PER MIN REJECT FROM SAMPLING PLANT
BATTERY STORAGE BIN, 2200 TONS CAPACITY STORAGE IN MILL BIN FOR TUBE MILL ROCK
30" FLAT SHUTTLE TRAVELING BELT CONVEYOR, 75' C TO C 100 FT PER MIN
12 HOSCUR FEEDERS, 60 STAMP BATTERY 1550 LB 7½" DROP, 102 DROPS PER MIN
WILFLEY TABLE FOR SLAG CLEANUP
6, PRIMARY TUBE MILLS 5'×16' 29 REV PER MIN
6, SECONDARY TUBE MILLS, NOS 1-2 11-12, 5'×20' NOS 3&10, 5½×22' 30 REV PER MIN.
3, BUCKET ELEVATORS, NOS 1&3, 20", 440 FT PER MIN NO 2, 26", 350 FT PER MIN
6, PRIMARY DORR DUPLEX CLASSIFIERS, 13 STROKES PER MINUTE
12, SECONDARY DOOR DUPLEX CLASSIFIERS, 11 STROKES PER MINUTE
12, FRENIER PUMPS, 54×10", 22 REV PER MIN
SAND BOTTOM CLARIFYING TANKS
5
6
7
8
OIL STORAGE
PRIMARY DORR THICKENERS
SECONDARY DORR THICKENERS
BARREN SOLUTION FOR FILTER
15
16
17
18
19
25
20
21
22
23
24
9&10 PREGNANT SOLUTION TO PARTIAL PRECIPITATION CIRCUIT
9
10
11
12
26
WATER FOR FILTER WASH
27
28
29
SOLUTION CLARIFYING TANKS
ZINC DUST FEED BELTS
11&12 PREGNANT SOLUTION TO BARREN PRECIPITATION CIRCUIT
7, MERRIL ZINC DUST PRECIPITATION PRESSES, 34 FRAMES EACH ALSO 8 STATIONARY MELTING FURNACES, 400-LB POT, NOT SHOWN
30
OVERFLOW FROM TANKS 27 TO 29
PRIMARY AND SECONDARY PACHUCA TANKS
14 PRIMARY PACHUCA TANKS 15'×45' CONNECTED UP CONTINUOUS IN SERIES
14 SECONDARY PACHUCA TANKS, 15'×45' CONNECTED UP CONTINUOUS IN SERIES
PACHUCA DRAIN SUMP, 8'×8'×10'
10
31
32
PULP COLLECTORS
MILL SOLUTION SUMP
13
14
1 2 3 4 5 6 7 8
PUMPS
BARREN SOLUTION SUMP
ACID STORAGE FOR FILTER PRESSES, 12'×12'×8' DEEP
4, MERRIL SLIMES PRESSES 90 FRAMES, 4'×6'×3" EACH
SLUICING WATER SUMP, 18'×18'×18'
33
34
37
DEWATERING TANKS
35
36
38
RICH SOLUTION
11 12 13 14 15
PUMPS
LOW GRADE SOLUTION
39
OIL TANK
TAILING TO WASTE

FLOW SHEET OF SANTA GERTRUDIS MILL

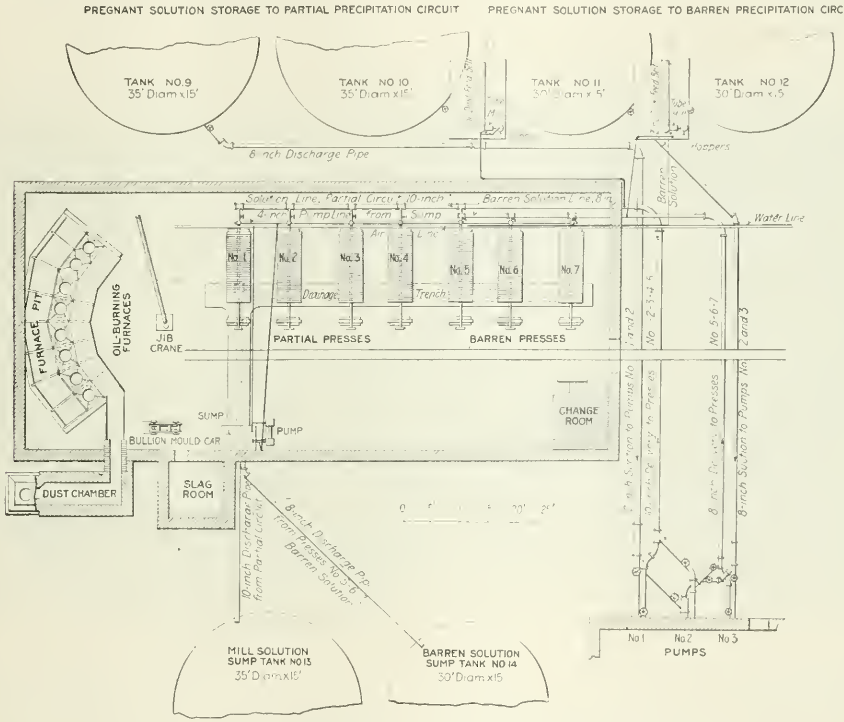
The design of the stamp battery follows standard lines except in a few minor details. The mortar-box foundation bolts are crossed, thereby permitting a broken bolt to be removed easily; none has broken thus far. A traveling crane, as well as a crawl, installed with the building, was found very useful in erecting the battery and in making subsequent current repairs.

The stamp duty averages 21.1 tons through 3-mesh and 4-mesh screens. Crushing is in mill solution, 10 parts of solution to one of ore. Screen wear is of no importance. Steel wear per ton is: Shoes, 0.16 lb.; dies, 0.08 lb.; liners, 0.60 lb. Life of shoes 9¼ in. diameter by 14 in. long averages 90 days; dies, 97 days; liners, 13 days. Shoes and dies are forged steel. Liners are cast iron, made locally; manganese-steel liners have been tried, but the cost per ton crushed was higher. The 65-hp. motors, each driving 20 stamps, are overloaded about 8%.

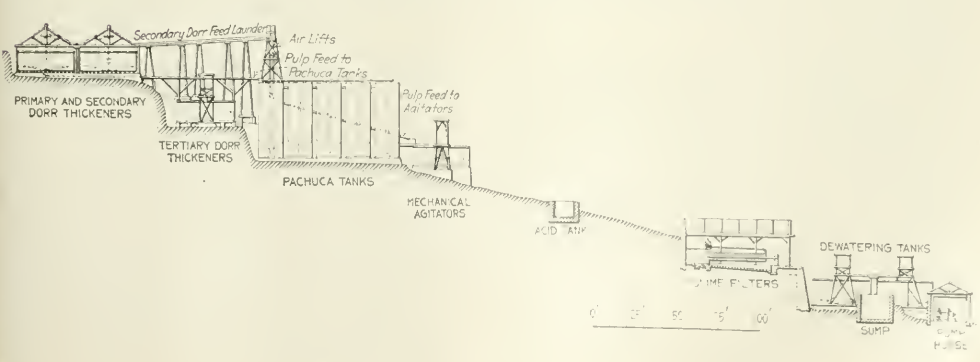
A trial was made of introducing the battery solution through nozzles in the back of the mortar box above the dies, but without success. Stationary screens placed between the feeder and the mortar box to take out fines were also tried and abandoned, the benefit gained being doubtful, while requiring more supervision.

Distribution of the pulp from the battery to the primary classifiers by means of split launders could be improved upon by a mechanical distributer of one of the successful revolving types.

The classifier platforms were built on an incline to save headroom over the tube-mill gears as well as to follow the slant of the classifiers. Returns to the classifiers from the tube mills are by elevators, with individual Frenier


PREGNANT SOLUTION STORAGE TO PARTIAL PRECIPITATION CIRCUIT
PREGNANT SOLUTION STORAGE TO BARREN PRECIPITATION CIRCUIT
TANK NO.9 35' Diam x 15'
TANK NO 10 35' Diam x 15'
TANK NO 11 30' Diam x 5'
TANK NO 12 30' Diam x 5
Hoppers
8-inch Discharge Pipe
Barren Solution
Water Line
Solution Line, Partial Circuit 10-inch
Barren Solution Line, 8-in.
4-inch Pump Line from Sump
Air Line
No. 1
No. 2
No. 3
No. 4
No. 5
No. 6
No. 7
Drainage Trench
PARTIAL PRESSES
BARREN PRESSES
FURNACE PIT
OIL-BURNING FURNACES
JIB CRANE
SUMP
PUMP
BULLION MOULD CAR
DUST CHAMBER
SLAG ROOM
CHANGE ROOM
10-inch Discharge Pipe from Partial Circuit
8-inch Discharge Pipe from Presses No. 5-6 Barren Solution
8-inch Suction to Pumps No 1 and 2
10-inch Delivery to Presses No. 2-3-4-5
8-inch Delivery to Presses No 5-6-7
8-inch Suction to Pumps No 2 and 3
0 5' 10' 15' 20' 25'
No 1
No 2
No 3
PUMPS
MILL SOLUTION SUMP TANK NO 13 35' Diam x 15'
BARREN SOLUTION SUMP TANK NO 14 30' Diam x 15

PLAN OF PRECIPITATING AND REFINING DEPARTMENTS



TREATMENT SECTION OF THE SANTA GERTRUDIS MILL pumps as reserves. A better design would be to effect such returns by means of the classifiers themselves.

Average screen analysis of feed and discharge of the stamp battery, equipped with 3-mesh No. 32 wire screens, is as shown in the table.

AVERAGE ANALYSIS OF FEED AND DISCHARGE

	Feed, %	Discharge, %
On 2-in	0.5	.
On 1-in	18.4	..
On ¾-in	13.8	. .
On ½-in.	8.0	.
On 4-mesh	18.7	1.0
On 8-mesh	11.5	16.3
On 10-mesh	1.8	7.5
On 20-mesh	8.5	14.8
On 30-mesh	3.9	8.1
On 40-mesh	1.4	4.4
On 60-mesh	2.2	6.7
On 80-mesh	2.0	6.2
On 100-mesh	0.5	2.7
On 120-mesh	0.8	3.2
On 150-mesh	0.4	1.7
On 200-mesh	0.2	2.7
Through 200-mesh	6.9	21.2
	99.5	99.5

Tube-mill grinding is done in two stages, using 5-ft. diameter mills throughout. the primary series being 16 ft. long and the secondary series 20 ft. and 22 ft. Comparison of this system with single-stage grinding has failed to show conclusive results in its favor. A slight benefit is apparent, but insufficient to warrant a repetition of this refinement of design unless in conjunction with water concentration not required with this ore. Danish flint pebbles were used for a considerable period, but their increasing cost led to the adoption of mine rock entirely to replace the pebbles. The mine-rock supply is obtained mechanically in the crushing plant and is sent separately over the regular conveyors to a compartment in the battery bin, from which it is transferred by chute to the primary tube-mill floor, where it is distributed by car. Part of the rock is introduced into the mill through the feeder. As the trunnion opening of the mills is not as large as it should be, rocks over 5 in. size as well as occasional large boulders, 12 in. to 15 in., required in the primary mills for efficient grinding, are loaded into the mills through the manholes once a day; 130 lb. of mine rock is required for each ton of ore milled and is credited to the total tonnage treated.

FEED AND DISCHARGE OF PRIMARY AND SECONDARY TUBE MILLS

Mesh	Primary Feed, %	Tube-Mills Discharge, %	Secondary Feed, %	Tube-Mills Discharge, %
On 4	13.9	0.2	0.8	1.6
On 8	22.8	4.5	0.5	0.1
On 10	8.6	2.2	0.4	0.2
On 20	20.6	8.5	1.6	0.2
On 30	11.8	10.9	3.4	0.7
On 40	4.7	4.8	3.3	1.0
On 60	8.0	12.1	17.5	10.8
On 80	1.9	10.2	9.6	5.6
On 100	1.6	5.2	11.4	10.3
On 120	1.5	6.5	17.6	15.5
On 150	0.7	4.0	9.5	11.8
On 200	0.8	5.7	8.4	11.2
Through 200	2.5	25.0	15.6	30.7
	99.4	99.8	99.6	99.7

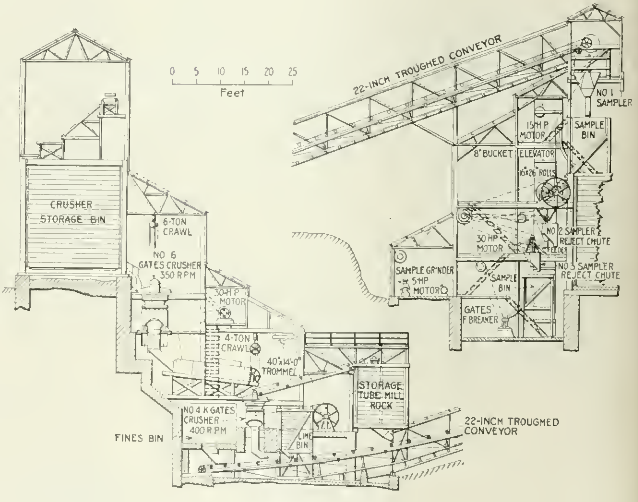
Moisture, 35 to 40%. Operating without return. 175 tons of ore pass through tube mill per 24 hr.

Moisture 35 to 40%. Operating with return, in closed circuit, 200 tons of ore pass through mill per 24 hr.

SECONDARY CLASSIFIER OVERFLOW

(Finished Product of Mill)

Mesh	Per Cent.
On 100	3.8
On 120	5.7
On 150	5.5
On 200	9.5
Through 200	75.1
	99.6



BREAKING AND SAMPLING PLANT OF SANTA GERTRUDIS MILL

Tests are now in hand using cast-iron balls in place of mine rock. Results thus far obtained indicate a capacity increase of 33% with finer grinding. Power load shows an increase of 33%, from 65 to 90 hp. per mill. Forged-steel balls ordinarily used for such grinding were not obtainable, but it is probable that chilled cast-iron or semi-steel balls and liners will prove more economical taking into account the low cost of locally made castings (2.5c. per lb.), as against high first cost plus importation expenses of steel balls. Ball wear is 1.7 lb. per ton milled. Tube-mill liners are of modified El Oro type hard cast iron, the average life being six mouths; cost 2.2c. per ton.

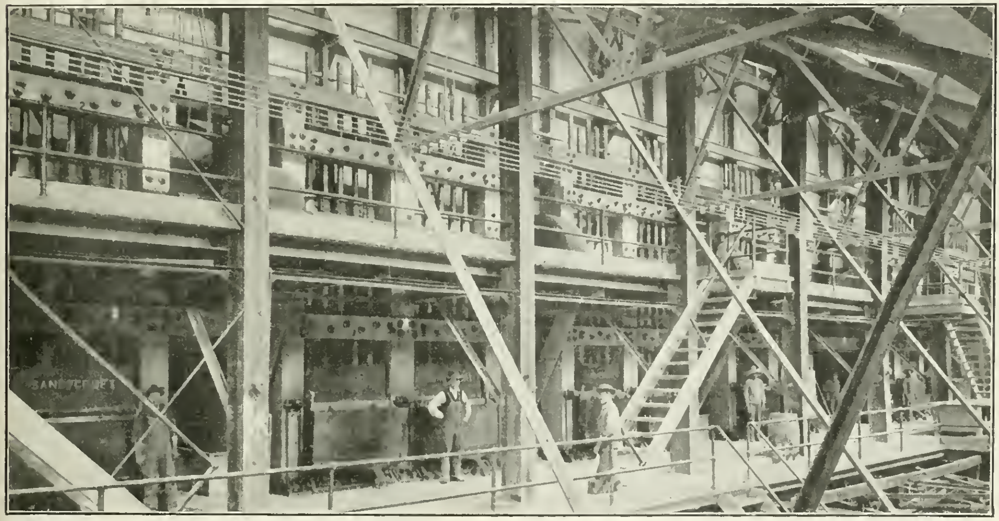
The motor driving each mill through a flexible coupling and one reduction of spur gearing is of high-torque induction type, 65 hp. 230 r.p.m. Allis-Chalmers make, and its ample design easily carries the overload. But the power factor of this motor is low (75%) and an improvement would be to use a higher-speed motor with a single reduction of herringbone gearing.

The economical grinding point is taken at 75% through 200-mesh. The table shows screen tests of feed and discharge of primary and secondary tube mills, using mine rock and at a plant capacity of 1,000 tons daily. These data are worthy of careful consideration.

An extraction of 55.5% of the gold and 18.6% of the silver takes place in the mill before the pulp reaches the Pachuca tanks. Cyanide of sodium, 128 or 120% as obtainable, either in lump or brick form, is added at the first tank of the primary series, at the rate of 4 grams of sodium cyanide for each gram of silver in the ore delivered to the mill. The sodium cyanide consumed is 3.15 lb. per ton, including mechanical loss. The strength of solution at the beginning of agitation is 0.55% KCN; of the mill solution, 0.4%.

Protective alkalinity is maintained about 0.75%; the lime is fed dry into the ore at the crushing plant; it is low-grade, averaging about 65% available, the consumption being 20 lb. per ton. Arrangements are in hand to improve the method of feeding by emulsifying the lime, adding it either to the primary tube mills or to the Pachuca tanks. Crude litharge, between 85 and 90% PbO, adopted in place of lead acetate as both cheaper and more efficient, is ground in a small tube mill, 24 in. diameter by 37 in. long, discharging into the first Pachuca tank at the rate of 0.6 lb. per ton of ore.

The best results are obtained with 72-hr. agitation, although 60 hr. give within 2% as high extraction. The air pressure is 27 lb., 75 cu.ft. per min. being required for each tank. No difficulty has been experienced with the series operation of the Pachuca tanks. Connections between tanks are made by 10-in. horizontal pipes placed 3 ft. from the top, the joint between two abutting pipes being made tight by a wrapping of tarred canvas. This joint takes up the tank vibration. To avoid undue accumulation of slimes on the inside of the tanks, they are emptied and sluiced down once a month. This operation requires about 3 hr. per tank, using a 3-in. Traylor slime pump for the return.



BATTERY FLOOR OF THE SANTA GERTRUDIS MILL

Screen tests of the inflow and outflow of the system are practically identical, showing that there is no segregation or short-circuiting of sand or slime.

The Procedure of Filtering

Filtering is difficult owing to fine-grinding of ore containing a considerable amount of colloidal matter. Also the dissolved values in the pulp to the filters are high—3.5 oz. silver per ton of solution. After extended working-scale tests of several types of vacuum and pressure filters, Merrill presses were adopted, using the center system of filling. A press cycle occupies 75 min., made up of: Charging, 26 min.; barren solution wash, 13 min.; water wash, 13 min.; sluicing, 23 min.; a total of 75 min. Bristol recording pressure gages are attached to the filling pipe of each press, the cycle curves from the chart giving an excellent check upon the care taken by the attendants in operating the presses. The sluice-valve bar and the filling valves are electrically connected so that both cannot be coincidently opened without ringing an alarm bell. The cakes average $1\frac{1}{4}$ in. in thickness, thereby leaving ½-in. space in the center of the 3-in. frame for entrance of washes. The presses handle 11.5 tons dry pulp per cycle. Sluicing water is at 90 lb. pressure, and five parts are required to clean out a press. The bulk of this water is recovered in dewatering tanks. No. 6 cotton duck 72 in. wide is used regularly, after several other weights had been tried. A set of cloths lasts about 2,500 cycles. Acid washing to remove lime is done in the press every 10 days, using 0.75% sulphuric-acid.

Much care is taken with the nozzles of the sluice bar. The bar of each press is taken out and tested every 48 hr., any defective nozzles being replaced. Nozzles are ordinary $1\frac{1}{2}$-in. cast-iron plugs, drilled $\frac{3}{16}$-in. hole: these last as long as special steel nozzles and are much cheaper. The unwashed metals in the press discharge average a trace of gold and 0.08 oz. silver, an efficiency of 97.7%.

All solutions to be precipitated are first passed through ordinary sand filter tanks. The addition of about 40% by volume of sawdust to the sand considerably improves the clarifying efficiency of the filtering medium and at the same time reduces the frequency of slime skimming and sand cleaning. The latter operation is effected by shoveling the sand from the tank to a launder leading to a small trommel, where the sand is washed free of slime with small loss and returned for use again. About 4,500 tons of solution is filtered daily at a cost of 0.28c. per ton solution. Possibly Merrill clarifying presses would be an improvement, although no comparative figures are available. At least the existing equipment does the work efficiently and cheaply, with little supervision.

The Merrill zinc-dust process of precipitation has in every way justified its adoption. The solution from the sand filters averages 0.015 oz. gold and 3 oz. silver. Two circuits are maintained, one precipitating to barren solution sufficient for filter-press washing, and the other circuit to an effluent containing from 0.9 to 1.2 oz. silver per ton. To accomplish this a slight excess of zinc dust is fed to the barren circuit in the proportion of 1.1 oz. zinc dust to 1 oz. fine bullion; to the partial circuit 0.8 to 1. The average zinc consumption of the plant is 1 oz. to 1 fine bullion. Clean-up made at the middle and end of one month and sometimes oftener provides an accurate check on current work.

The only drying given the precipitate is by blowing air through the presses at 25 lb. pressure for one hour, reducing the contained moisture to about 30%. The precipitate is cleaned from the presses into rectangular steel cars, 5 ft. 10 in. by 6 ft. 1 in. by 1 ft. deep, in which it is weighed. Based upon the calculated dry weight of the precipitate, flux consisting of 1½% each of borax and bottle glass is added on top without mixing; the charge is then shoveled from the car into No. 400 crucibles. To permit the introduction of a high column of precipitate, a discarded pot with the bottom out is temporarily fitted into the crucible, being removed after the charge has melted down. This procedure reduces dust losses and accelerates charging and melting.

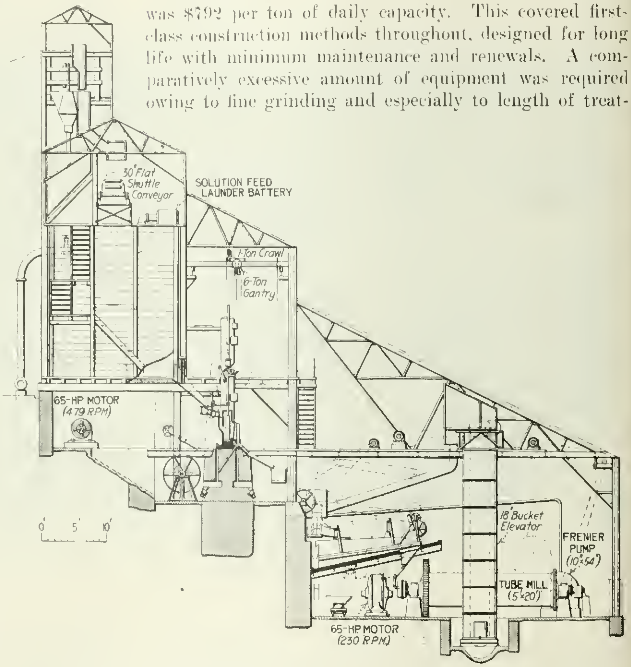
The eight furnaces are oil-fired, built flush with the floor of the melting room on the arc of a circle, with fire pit at rear. This arrangement has proved satisfactory and is to be recommended as convenient and saving labor.

The crucible, upon being lifted from the furnace by tongs attached to ½-in. wire cable, raised or lowered by air cylinder on the post of the jib crane, is swung around to one side to the pouring carriage containing the bullion molds. The slag is first skimmed off, using sand to assist. As the bars are poured, sticks of wood are laid on top and, igniting, prevent too rapid cooling of the center of the bar with the consequent subsidence and holing.

The precipitate averages 85% fine bullion. The doré bars weigh 1,000 oz. and assay 5 gold and 940 silver fine. The No. 400 crucibles contain an average of 7 bars per melt with a maximum of 10 bars. The average life of a crucible is 10 melts, or 70 bars.

With bullion of this fineness no difficulty with matte formation is experienced. The bars are carefully cleaned and all chips and corners removed before sampling and weighing. Drill samples are taken—one on the top of the bar, one-third distance along the diagonal toward the center, and one on the bottom of the bar at one corner. Each hole is drilled halfway through the bar.

The bullion was formerly refined by a French concern in Mexico City, the fine gold being sold to the Mexican government and the fine silver shipped for sale in New York or London. This concern has been closed down since the outbreak of the war in Europe, so that the doré bars are now refined and sold in New York or London.



STAMP MILL AND REGRINDING SECTION OF SANTA GERTRUDIS MILL

As previously described, the tailings sluiced from the Merrill filter presses pass through four Dorr thickening tanks for recovery of water and are then automatically sampled before flowing to the storage basins. These basins, or ponds, four in number, are on the nearest flat land 2 mi. away. The ditch thereto was dug U-shaped, 2½ ft. deep with a 3% grade; 1½% would suffice. The walls of the storage basins are built up as required of tailings, one basin receiving the entire inflow while the others are being prepared. Evaporation and absorption of the solution are high, the decanted effluent representing only 30% of the solution inflow. This solution contains an average of a trace of gold and 0.12 oz. silver, representing filter losses and further dissolving values. A small precipitation plant is being arranged to recover this escaping fraction.

On the basis of 1,100 tons the total cost of the plant was $792 per ton of daily capacity. This covered first-class construction methods throughout, designed for long life with minimum maintenance and renewals. A comparatively excessive amount of equipment was required owing to fine grinding and especially to length of treatment necessary for a silver ore, resulting in unusually large tankage. On the other hand, the all-sliming design without concentration simplified operations and eliminated the installation of concentration equipment.

Power Distribution

The Pachuca district is supplied with electric power generated by several hydro-electric plants owned by three power distributing companies, practically under one control. The main plant, owned by the Mexican Light and Power Co. and situated at Necaxa, Puebla, about 75 mi. by transmission-line to the east, also furnishes energy for Mexico City and El Oro. The 50-cycle alternating current is transmitted at 85,000 volts to the Pachuca substation, where it is stepped down to 20,000 and 6,000 volts for local distribution. The power is sold at the substation of the purchaser on the basis of integrating wattmeter readings, no peak or installation loads being considered. A power factor of at least 80 to 85% is required of the purchaser, and prices vary from $12.50 to $50 per hp.-year, depending on the amount consumed.

Although most of the mines are wet, there are no reserve steam plants in the district with the exception of a relatively few old steam hoists that could be used for baling in an emergency. Nevertheless the several widely separated hydro-electric plants with individual transmission lines provide a very reliable power supply.

The Benevolent Jin

By Mark R. Lamb*

Once upon a time there was a benevolent Jin whose regular beat was from New York to San Francisco, via New Orleans. This trip, which he described to me, he decided to make along the route of the Union Pacific owing to the congestion of military transportation toward Mexico. Now this Jin was eight cubits tall, so that he was right on top of Utah before he noticed it. One reason for this, besides the smelter smoke, was that the people were buried and hidden in a fog of detail. This fog is not confined to Salt Lake. I do not want to give that impression. In other parts of the world this fog is quite as thick as in Utah. As everyone knows, it is 4 ft. 6 in. deep.

The fog made it difficult for the Jin to detect that the city was the abode of ambitious people. It was so dense that some of the women and all the men moved about with heads very low in order not to miss any details. This meant that a man's back was about all that our benevolent Jin could see of him. As backs are developed with use, they covered the landscape disproportionately, and to such an extent that at first, not being a copper miner and being more acquainted with livestock, our Jin mistook the place for a burro farm.

As soon as he discovered his mistake, he was filled with pity. He tried to attract the attention of those whom it seemed likely could straighten their backs. He pointed out the beauties of life—especially in New York—shouted, in fact did everything that his limited intelligence could suggest to get their heads above the fog, but to no avail. He then set about to find a way to distinguish between those who had aspirations and those who were hopeless detailers.

Now you should know that our Jin was among the most powerful in his own line of work, which had been among simple folk, usually consisting of improving crops, fattening burros, eradicating cattle pests and providing hospitals. But as this Utah job was more a mental than a physical task, he decided to get expert advice.

It would naturally be supposed that the men best posted on the conditions and remedies for Utah would be J—— of New York, the high seas, and elsewhere, and as even a Jin would know that, our hero repaired thither hastily. When he had stated his problem, J—— smiled at him sorrowfully.

"My dear colleague," he said, "you are new at this business. Better stick to your own line. I have been trying to help those people for years, and am discouraged." He sighed hopelessly, and after buying a few mines, went on:

"I have hung up beautiful tempting jewels—and jobs—well within the reach of all my people, and have even provided stepladders for getting to them, but those backs you saw have grown stiff, bending over details."

After pensively signing a few checks for two million or more dollars, he continued:

"I confess that I am at sea on this job. Perhaps the prizes have been too large or have been held so that they looked as out-of-reach as the stars. Perhaps those detailers thought others better fitted to win the prizes, or they may be just plain lazy. Quite likely it is a mixture of all these."

He stopped, bought a smeltery, and after a moment, went on:

"If you knew how I would enjoy and appreciate your success in this venture, you would be still more anxious to succeed. All my work would be play if the men at these plants would straighten their backs from time to time, and get their heads out of the fog of details."

J—— stopped and was silent for a long time, staring disconcertingly at the Jin, who waited in respectful silence. The gentle reader of course knows who J—— is and he is known to all Jinn since the time of his birth. He is held up to all of them as the most powerful human Jin. Our benevolent Jin considered this the opportunity of a lifetime and so waited breathlessly for what would follow. After attending to the necessary detailed arrangements for maintaining the earth in balance while steam-shoveling a Western mine, J—— sighed again and went on:

The Greatest Problem

"This is just my one serious problem and I am afraid that it will never be solved. The master Jin himself is powerless where he has not the spark of desire to work upon, and I know my limitations."

He paused long enough to put his feet on his desk—because he believes that all supermen should devote a part of the day to thought—and then continued:

"Others, like the editor of the *Journal*, are constantly holding out tempting prizes well within the reach of any of those men and are ever ready to smooth the path to fame with their powerful publisobiles, but few men can see the prizes and the path, while buried in the fog."

He pressed a button which started a 10,000-ton unit, bought a province in Russia—and then hesitated as to where the cables should be sent for the right men. No other task causes him to hesitate.

"I have decided," he said, finally, "that it will do no harm for you to make a trial."

With him, to decide is to act. The bewildered Jin went hurtling through space toward Utah, faster than ever Jin traveled before. He had not realized how every force of nature had been harnessed to copper.

After arriving, he tried to talk to the busiest, hoping to get a hint that would dispel his perplexity. But everyone was busy on details. True, it was no unusual thing to see women standing upright, seeing things clearly above the fog, yet unable to persuade their men to glance up. Upon such and occasion a husband might say to his wife; "Here, take this five hundred and run down to Salt Lake and don't come back until it is all gone. I cannot go with you. It is vitally important to the company that I stay here and complete this detail, as no one else can do it but me."

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*Allis-Chalmers Co., Santiago, Chile.

And down would go his head into the fog again, and his back would look like all other backs to J—— in New York.

The wife would look at the five hundred and at the back and then sigh and perhaps go off to Salt Lake and spend a hundred or two and keep the other three against the rainy day when the head comes out of the fog for the last time.

The Jin could easily talk to the women. One suggested a cut in wages as a sort of eye-opener and back-straightener. What seemed the most practical woman suggested a little real shining gold say two twenties, tied together so as to chink invitingly and supported by a very light string, tied to a pencil but easily broken. This gold was to be held within easy reach of absolutely every man there. She said it might take a day or two to catch their attention, but that surely within a week every man would make at least one quick grab. Wouldn't it seem likely to you that by almost forcing it into their hands, the detailers could acquire at least a longing sufficient to make them look up and about for more of this easy pencil money?

At least the lady convinced the Jin, and he rushed away to New York to lay the scheme before J—— and get his approval.

The latter laughed and approved, but had no hopes of results.

"You may try it for two months," he said. "As for the money, offer real money not Jin money." He paused.

GOLD BAIT ON A STRING

"I cannot buy the gold for you, as such a purchase could not be slipped past McG——. You see it would be an unauthorized expense, as no good will result. But I will supply the string."

He opened a drawer and withdrew the end of a stout cord.

"This is unbreakable," he said. "Tie your gold with this. In this way I shall know if you get results. Besides that, the man who grasps the gold will have a string on his desk," and he chuckled at the absurdity of hoping for results. He closed the drawer, leaving just enough room for the string to pay out.

The Jin waited for instructions as to where to get the real gold, hoping that the task would not be too heavy for him.

"As for the gold," J—— went on, "it is a good practice to use that of others, so far as possible." He jingled some gold eagles in his own pocket, but instead of offering these, he said:

"See the editor of the *Journal*. Get him interested and he will supply the necessary gold in the hope that the detailer will use the pencil for him in exchange for the coins."

As the editor had been trying for the same results for years, there was no difficulty in talking him into the scheme, but he was no more hopeful than J—— and knew that his money would remain largely untouched.

If every effort made by the Jin were described, this story would be too long. He worked like the slave he is, urged wives to urge husbands to look up, and held the glittering, tinkling gold before the eyes of each man. He even told who supplied the string, but the fog was too dense.

Now this pencil gold is quite different from detail money. The latter comes as a matter of course—and goes that way also. It has strings on it, but they lead nowhere except to the grocer and his tribe.

Pencil money is velvet, is always unexpected and causes the pleasantest sensation imaginable. Merely to think of it is a delight and actually to receive it is incredible.

But the Jin tore his hair in despair as the days passed and no one touched the pencil gold as it swung back and forth in the sun just above the fog, glistening like a lighthouse and chiming like a dividend. He dangled the money right into the hands of the detailers, but they dropped it, preferring other things. One pushed the coins away to take up a test tube. Another preferred a monkey wrench, though others could better use it.

Our Jin resorted to all sorts of tricks. Unexpected bills would be put over onto a likely looking detailer whose back reached nearly to the top of the fog. Or a wife would be persuaded to pretend illness. These tricks would usually bring a head nearly out of a fog, and sometimes the detailer would begin to reach for the pencil gold, but always a nut or a bolt or a drawing would catch his eye, and down the head would go again, never rising far enough to see the cord reaching to New York.

The benevolent Jin gave up the effort. He returned the pencil gold to the editor and cabled briefly to J——, who, reading, seemed to grow older.

"Lad," he said to the office boy, "wind up the cord."

The cable said:

"J——, New York. You knew best. They are hopeless. Have released string. B. Jin."

Gentle reader, for "Utah" read your own job. For "detail money" see your own miserably small pay check. Publishing something you know is not vanity. Reserving it is. Some engineers are so successful that they do not now need to seek publicity (proper professional publicity). It seeks them. But you are not in that class. You know who J—— is in your case. But does he know you, or does he only see your back?

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Computing Income Taxes

By A. L. H. STREET*

In computing income taxes collectible from a lessee of mining property who is developing the property on a royalty basis, although he is entitled to a deduction in the assessment to cover royalties paid the lessor, he is not entitled to a deduction on account of ore depreciation resulting from removal of ore mined. So held the Wisconsin Supreme Court lately in the case of Klar Piquett Mining Co. vs. Town of Platteville, 157 Northwestern Reporter, 763. It was unsuccessfully claimed by a lessee in this case that the last-mentioned deduction was proper on the theory of the lessee's ownership of underlying ore.

The reason for the decision appears in the following extract thereof: "The price paid by the lessee of a mine for ore taken out measures the cost of the raw material to him in the form in which he takes it. To this, of course, must be added the cost of mining and marketing, including depreciation to plant and other proper expense connected with the business, to arrive at the actual cost thereof."

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*Attorney at Law, 829 Security Building, Minneapolis, Minn.

The Chemistry of Minerals

By Joseph E. Pogue*

SYNOPSIS—The chemical composition of a mineral is rarely limited to those elements that give it its characteristics and as which it is usually known. The discussion here bears upon the impurities usually present and their effect upon some minerals.

The idea that all minerals are natural substances with definite chemical and physical properties must be modified, for it is now well known that the chemical composition and physical properties of many minerals—of most minerals indeed—vary within certain limits. These variations for the most part are not to be attributed to chance impurities having fortuitous connection only with the mineral, but rather are inherent in the chemical make-up of the mineral itself and are therefore to be looked upon as characteristic, just as definite properties are regarded as critical and diagnostic.

Chemical composition has long been recognized as a fundamental feature of minerals, conditioning the other properties. Customarily it is expressed by means of exact chemical formulas: $CaCO_3$ for calcite, $KAlSi_3O_8$ (better written $K_2O\ Al_2O_3\ 6SiO_2$) for orthoclase, and so on. A formula is derived from a quantitative analysis and represents the proportions in which the component elements combine. Rarely does an analysis of a mineral yield results that agree absolutely with the theoretical or ideal composition indicated by its formula. In the case of minerals of simple composition, such as quartz, gypsum and fluorite, the difference is slight and lies within the errors of analysis. With minerals of more complicated composition, however, and indeed with many of simple composition, the variation is greater than can be attributed to the analyst, whose errors may now be held within reasonable bounds, and expresses a characteristic of the mineral itself. To focus upon the constancy of minerals and overlook their variability is to miss half their meaning.

In light of our present knowledge, chemical variability among minerals may be attributed to several factors among what are intercrystallized impurities, adsorption of foreign material by colloidal minerals (a form of solid solution), solid solution of isomorphous crystalline substances, solid solution of nonisomorphous crystalline substances and chemical alteration.

Foreign Material Present in Crystals

Minerals form in several ways—they are deposited from solutions either hot or cold; they separate from molten rock material (magma); they are deposited by vapors and gases, etc. The conditions attending their formations are complex, many chemical elements are present, and ideal purity is seldom attained.

If the mineral has time and opportunity to crystallize, it attempts to attract to itself only its own elements and to repel all foreign substances approaching its neighborhood. Some alien material, however, almost invariably becomes entangled and tends to crystallize as minute crystals, contaminating the purity of their host. Few transparent minerals, if thinly sliced and viewed under the high power of a petrographic microscope, fail to show a varying number of such foreign bodies. Even quartz, which ranks among the purest of minerals, often contains tiny bubbles of liquid carbon dioxide or other impurities and thus falls short of absolute integrity. And since the metallographic microscope has been directed to polished surfaces of opaque ore minerals, many of these have displayed an intimate intercrystallization of associated minerals, in some instances visible only under the highest attainable magnifications. The minute graphic intergrowths of bornite and chalcocite noted in ores from Virgilina in Virginia, Mount Lyell in Tasmania, and Butte in Montana attest the tendency of sulphide minerals to intercrystallize.

There is every reason to believe that crystallized impurities range down to submicroscopic size; the limit of microscopic visibility is set by the wave length of light, a breadth requiring thousands of molecules to span and giving ample space for crystallization.[1] Many observations bear out this belief. The titaniferous magnetites, for example, as shown by detailed microscopic studies, made by J. T. Singewald, Jr., for the Bureau of Mines, consist of intergrowths of magnetite and ilmenite, the latter in many cases present as minute lamellæ ranging down to 0.001 mm. and smaller in width; yet some specimens in which no ilmenite was microscopically visible analyzed as high as 6% Ti, a result strongly suggesting the presence of nonmicroscopically visible ilmenite.[2]

Cupriferous pyrite forms a second example; for while the copper value has been shown repeatedly to be due to intergrown chalcopyrite, in some ores, notably those from Mount Lyell in Tasmania, copper was detected in fragments free from microscopically visible chalcopyrite, yet adjoining pieces of ore invariably disclosed chalcopyrite in minute microscopic development. Of course we must draw the line somewhere between physical intergrowth (intercrystallization) and molecular intergrowth (solid solution), but the limit of microscopic visibility is too obviously artificial to select.

When minerals fail to crystallize or crystallize only imperfectly, they possess less power to eject impurities, and such minerals are apt to be more impure than well-crystallized ones.

Adsorption in Mineral Composition

This brings us to a class of minerals in which a process called adsorption plays an important part in conditioning chemical composition. This process is of chief importance among amorphous minerals—those characterized by lack of orderly molecular arrangement. It seems that minerals solidifying with molecular orientation—that is to say, crystallizing—tend to expel foreign material, while minerals solidifying with haphazard molecular assemblage not only lack this self-purifying power, but even in many

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*Associate professor of geology, Northwestern University, Evanston, Ill.

[1] The limit of microscopic visibility varies from 0.0008 to 0.0004 mm.

[2] Singewald, however, concluded that this result appeared to indicate that the magnetite molecule itself carries titanium in isomorphous relation with the iron, forming so-called "titanomagnetite."

cases attract or adsorb impurities. Hence the importance of knowing whether we are dealing with a crystalline mineral or with an amorphous, or as we now say, colloidal one.[3]

All minerals that show an amorphous (noncrystalline) character under the microscope—and this condition is usually expressed outwardly in a wax- or gum-like appearance and rounded surfaces—are to be regarded as solid colloids, or gels.[4]

Now, crystalline minerals have separated from ordinary solutions or from igneous melts or vapors. Gels, or colloidal minerals, on the other hand, have formed from colloidal solutions. It is important, then, to understand clearly what a colloidal solution is and how it differs from a true solution.

A true solution is a suspension in some liquid of simple molecules or of molecules wholly or in part broken up into electrically charged particles known as ions. These molecules and ions show no tendency to settle, but on the contrary they spread out or diffuse until they are evenly distributed through the solvent. They cannot be separated mechanically; they are small enough to pass through the pores of filters, membranes and rocks.

Colloidal Solutions and Their Variations

A colloidal solution is one in which the dissolved substance is finely divided, the particles being larger than the calculated size of molecules, yet smaller than discrete particles visible under the microscope. These particles are not in mere mechanical suspension—they are under other influence than gravity and viscosity. They are electrically charged (most are negative) and in constant motion. Unlike the particles of true solutions, they do not diffuse or diffuse but sluggishly, and they have little effect upon the boiling and freezing points of the solution. They are held in suspension by their surface tensions and electric charges; often, too, by the presence of substances like hydrogen sulphide or certain potassium salts, known as dispersing agents. Upon the escape of these agents or upon the addition of other substances that dissociate into ions bearing charges opposite to those of the colloidal particles (substances known as coagulating agents), or merely upon the evaporation of the liquid, the suspended matter separates. This precipitate may crystallize forthwith or settle slowly as a jelly, occluding some of the solvent and slowly hardening into a solid colloid, or gel. The jelly, while hardening, and even after solidification, acts adsorptively upon material left in solution and supplied by later solutions, drawing in and permanently holding more or less of such. The process seems to be conditioned, in part at least, by the enormous surface exposed by colloidal aggregates and the excessive surface tension set up thereby and is not in the main due to chemical affinity in the ordinary sense.

Now, minerals that have formed from colloidal solutions show strong variations in composition, due to this process of adsorption. Many are adsorption compounds, differing from chemical compounds in the essential fact that the components are not present in definite, but in variable, proportions. Chrysocolla, hydrous copper silicate, is an example of such a compound. It is a typical colloidal mineral, amorphous, variable in composition. It is to be regarded, not as a definite chemical compound, but as a homogeneous mixture of CuO, SiO_2 and H_2O in varying proportions—a solid solution of these components. Here the three components are essential.

There are other colloidal minerals showing varying qualities of adsorbed impurities, but such occluded or dissolved material should be discriminated with care from other components which, though present in minor amount, give important characteristics to the mineral. Psilomelane forms a good example of a mineral in which it is difficult to distinguish between adsorbed components and adsorbed impurities. Chemically, it is chiefly MnO_2 with minor but variable MnO, BaO, K_2O, Cu_2O, H_2O, etc. Its nucleus is MnO_2, and the other compounds were adsorbed during formation or, in part, later. Remove them and the mineral breaks down; it derives certain of its essential qualities from them—its hardness, for example, from the BaO. Obviously, then, certain of these components must be regarded as essential components, even though they do not fit into any definite chemical formula. Indeed, they are not present in chemical combination at all.

There is a certain type of colloidal solution, exemplified in nature by silicic acid and characterized by high viscosity, in which the suspended particles are not rigid but plastic; these solutions represent colloidal emulsions. Like colloidal suspensions[5] they harden, or set, to gels. Their presence even in small quantity in a colloidal suspension greatly increases the stability of the suspension; hence they have been called protective colloids. They undoubtedly have a very important, and as yet little understood, bearing upon mineral formation.

Experimental work on silicic acid and hydrates of iron, aluminum, chromium, etc., has shown that these compounds, hardened from a colloidal emulsion, are not definite hydrates, but show a water content in delicate adjustment with that of the surrounding atmosphere. May we not expect that the water of gelatinization bound up in natural hydrates (limonite, bauxite, etc.) may ultimately tell us many details of the climatic conditions under which such minerals developed? Indeed we already realize that colloidal minerals are mostly formed at or near the surface by the processes of weathering, while crystalline minerals are in general a product of greater depths and higher temperatures. Since weathering is largely dependent upon climatic conditions, we have in colloidal minerals a key to the climates of the past. Felix Cornu pointed out in 1911 that the earth could eventually be divided into typical gel regions of significance in conditioning plant and animal distribution.

Characteristics of Colloidal Conditions

As to the molecular condition of material adsorbed by colloidal minerals we cannot speak as yet without reservation, but from the fact that colloidal jellies present a difficult barrier to colloidal solutions, although they readily permit the diffusion of salts (electrolytes), we may presume that substances absorbed—at least those absorbed—at least those absorbed after the solidification of the mineral—are not necessarily colloidal themselves, but may be crystalline or in an ionized condition. Diffusion processes (of which adsorption in colloids is one effect) are of far-reaching importance in nature, and have been recently emphasized in the researches of Liebgesang, who has discovered and investigated in particular a process of rhythmic precipitation especially potent in colloidal media and bearing, therefore, on mineral formation. The results of this process are best illustrated by the agate, which is no longer to be regarded as deposited in concentric bands, but as developed by the slow diffusion of iron salts through a silica jelly with precipitation of an iron compound at regular intervals through the mass. Periodic or rhythmic precipitation in colloidal substances may be produced in the chemical laboratory, and the principle has been advanced to explain such geological phenomena as weathering rings and certain types of banded ore structures.

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[3] The term crystalline refers to inward structure as opposed to crystallized, which signifies outward shape. Every crystallized mineral is crystalline, but the reverse is not true. The word crystalloid is convenient for designating a mineral that is not amorphous—that is, not a colloid.

[4] A coagulated colloidal solution is called a gel because of its jelly-like nature. The term is also applied to a mineral so originating.

[5] Colloidal solutions in which the suspended particles are rigid—the common type of colloidal solution in nature.

The adsorptive power of noncrystalline compounds is well shown during the course of a quantitative analysis by ferric hydroxide, which is precipitated in colloidal condition and brings down with it phosphoric acid, boric acid, etc. Among mineral substances no better example could be adduced than fuller's earth (a colloidal clay), which possesses to a notable degree the power of removing color from fats, oils and greases. The ability of kaolin to adhere to the tongue illustrates its strong adsorptive power.

ABILITY TO SCATTER AND POLARIZE LIGHT

Substances in colloidal suspension have the ability to scatter and polarize a beam of light. Glass can be given a ruby color by diffusing colloidal gold into it. Many minerals owe their color to traces of material present in colloidal suspension, and this conception is clearing away much of our uncertainty in the long obscure field of mineral coloration, even serving to explain some of the color changes developed upon exposure to radium emanations. Halite, for instance, has been shown to owe its shade in many colored varieties to diffused colloidal sodium. Such halite loses its color upon heating, regaining it when heated in vapors of metallic sodium or exposed to radium rays.

Many minerals resemble colloids, but have internal fibrous or foliated structures. Such may be called metacolloids, as suggested by Wherry. Examples are chalcedony, limonite, malachite, serpentine, etc. These were originally colloidal, but have become more or less crystalline through simple molecular arrangement.[6] Adsorption occurs in metacolloids, so the crystallinity of such compounds does not guarantee their purity.

In some minerals we may have a mixture of crystalline and colloidal components. For example, meerschaum (sepiolite) from the Grecian Peninsula has been shown to consist of a mixture of a fibrous silicate of constant properties with a gel. This gel portion was found to stain intensely, a result of its adsorptive power, while the crystalline portion was unaffected in the presence of the stain. It is supposed that the mineral was originally deposited as a colloid and that the crystalloid formed slowly from the colloid, the change not having proceeded to completeness. Bauxite from Arkansas has lately been described by W. J. Mead as composed principally of a mixture, in variable proportions, of crystalline and amorphous $Al_2O_3 \cdot 3H_2O$, a substance existing independently as the mineral gibbsite. The tendency in the past with this information would be to demote bauxite from the rank of a mineral. Yet we now look upon bauxite as a distinct species, though both chemically and physically unhomogeneous.

PHASES OF SOLID SOLUTIONS

We come now to crystalline minerals that show variations in composition not due to impurities mechanically enclosed nor, as in colloidal minerals, to substances adsorbed, but arising from the fact that such minerals represent varying mixtures of two or more orderly sets of molecules. There are two types of such homogeneous molecular mixtures, or solid solutions[7] as they have been termed: The first where the substances are similar in character and mutually replaceable without greatly modifying the character of the resulting mineral; the second where the substances are dissimilar and not mutually replaceable, the resulting mineral differing greatly according to the relative proportions of the components. The first, which may be called the isomorphous-mixture type of solid solution, has long been known and studied, whereas the importance of the second, which may be termed the mix-crystal type of solid solution, has not been adequately recognized.

Many compounds of allied chemical composition show nearly identical crystal forms and closely related properties. Such compounds are isomorphous—that is, of the same form. For example:

Calcite	$CaCO_3$—Rhombohedral crystallization
Magnesite	$MgCO_3$—Rhomhohedral crystallization
Siderite	$FeCO_3$—Rhomhohedral crystallization

Isomorphous compounds are capable of mixing in varying proportions to form solids that appear perfectly homogeneous under the highest magnifications of the microscope. The resulting substance may be looked upon as a mutual interpenetration of two like molecular structures, a complete merging of components to form a new product. Isomorphous compounds are miscible in the solid state just as alcohol and water in the liquid condition.

Many minerals are isomorphous mixtures of two or more components. Thus the mineral ankerite is an isomorphous mixture of calcium carbonate, magnesium carbonate and iron carbonate: $xCaCO_3 + yMgCO_3 + zFeCO_3$, or, as the formula is usually written, $(Ca,Mg,Fe)CO_3$. This means that the proportions of the carbonates of calcium, magnesium, and iron are variable; or expressing the same thing in another way, that we have calcite ($CaCO_3$) with part of its calcium replaced by an equivalent quantity of magnesium and iron.[8] Only elements capable of forming with the CO_3 radical a compound of the same form as calcite would be able to enter into such relationship. In some ankerites a small percentage of manganese is present. Now, manganese forms a carbonate ($MnCO_3$, the mineral rhodochrosite), which is rhombohedral, hence we regard the manganese carbonate as present in isomorphous relationship.

The isomorphous components of minerals are called isomorphs. In some minerals two or more isomorphs mix in all proportions, giving rise to isomorphous series (as in the case of plagioclase feldspars); in other minerals one isomorph dominates the others (one or more). The second condition is the more common, and a great many minerals owe their chemical variability to the presence of isomorphs in small amounts. For instance, sphalerite (ZnS) generally carries more or less iron—present in the form of an isomorph (FeS) so that the formula of sphalerite is correctly written xZnS + yFeS, in which x always exceeds y.

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[6] It should be remembered that any substance, amorphous or crystalline, may take on the colloidal condition, and conversely that colloidal solutions may give rise to either crystalloids or gels, although the latter are the usual products.

[7] The term "solid solution" was applied to crystalloids long before it was seen to be applicable to colloidal minerals.

[8] Isomorphous replacement, a term often used, refers to the introduction of an isomorphous compound into a substance, and a mineral showing isomorphous replacement is merely an isomorphous mixture.

The plagioclase feldspars form a striking example of a mineral series that represents all mixtures of two isomorphs. We may express their composition thus:

THE PLAGIOCLASE FELDSPAR SERIES

$Na_2O\ Al_2O_3\ 6SiO_2$ = Ab (albite molecule)

Albite	$Ab_1\ An_0 — Ab_6An_1$
Oligoclase	$Ab_6\ An_1 — Ab_3An_1$
Andesine	$Ab_3\ An_1 — Ab_1An_1$
Labradorite	$Ab_1\ An_1 — Ab_1An_3$
Bytownite	$Ab_1\ An_3 — Ab_1An_6$
Anorthite	$Ab_1\ An_6 — Ab_0An_1$

$CaO\ Al_2O_3\ 2SiO_2$ = An (anorthite molecule)

While all the members of this series crystallize in the triclinic system, certain of their properties, such as indices of refraction, vary progressively as more of the anorthite molecule enters in. Indeed, the chemical composition of a plagioclase feldspar may be very accurately and conveniently determined by measurement of its physical properties. A further complication in composition is caused by the fact that a single crystal of a plagioclase feldspar may be zonally developed, the zones differing in composition. This structure is not uncommon, and the innermost zone is apt to be the most calcic, the successive zones outward ranging more and more sodic. But here we have in reality an intergrowth between two or more minerals, even though such minerals be closely allied members of an isomorphous series. This same sort of thing is seen within many isomorphous series.

Isomorphs By Tungstates of Iron and Manganese

Another notable example of isomorphs admixed in all proportions is formed by the tungstates of iron and manganese, well described by W. T. Schaller in Bulletin 583 of the United States Geological Survey. A total of 95 analyses have been made of members of this series, which are found to range all the way from nearly pure $FeWO_4$ through intermediate mixtures of $FeWO_4$ and $MnWO_4$ to almost pure $MnWO_4$. It becomes necessary then either to consider the whole range as embracing a single mineral or to make arbitrary divisions and assign a mineral name to each. As the mineral names ferberite, wolframite and hübnerite were already in use for natural compounds falling within this series, Schaller proposed that these names be maintained but confined to particular combinations, as

$FeWO_4$ = Ferberite (pure to 20% hübnerite molecule)
$(Fe,Mn)WO_4$ = Wolframite (ferberite molecule 80%—20%)
$(Fe,Mn)WO_4$ = Wolframite (hübnerite molecule 20%—80%)
$MnWO_4$ = Hübnerite (20% ferberite molecule to pure)

The point has been raised by E. T. Wherry that such "arbitrarily partitioned-off portions of isomorphous series are not to be regarded as definite minerals," and he proposes that in all such cases it is better to use chemical prefixes to indicate where in the series a mineral substance lies: thus, for example, calling ferberite a ferro-wolframite, hübnerite a mangano-wolframite and so on. But this is merely a question of nomenclature; the fact remains that here we have a range of compositions, and while a given specimen corresponds to a definite point in this range, no two specimens may be expected to be chemically the same, and the mineralogic unit is not a point nor even any arbitrary section, but the entire range itself.

The physical properties of any mineral affected by isomorphism are modified by the isomorph entering in proportion to its character and amount. And the modification is in general a perfectly regular one, capable of being expressed graphically by curves, so that when the relation between composition and properties is worked out in detail for a given mineral, the physical measurements assume a new meaning, conveying chemical information that could not be obtained otherwise than through a laborious analysis.

Another Variation of Solid Solutions

We have just considered a type of solid solution common among crystalline minerals, in which the component substances are closely related chemically and replace one another in the crystal structure. We now come to a second type of solid solution of equal rank with the first named, its importance as yet scarcely recognized, which has been termed the mix-crystal type. This is a solid solution in which the component substances are widely different in character—so different that they are nonisomorphous and not mutually replaceable in the crystal structure, but upon mixing give a new type of crystal structure, a compromise between the two merging ones. Among minerals this kind of solid solution may show itself through small ranges where one component dominates and the other enters in small proportion only, affecting but slightly the physical character of the mineral; or we may find the two components mixing through a wide range or even in all proportions, giving rise to a series of distinct minerals differing markedly in crystallization and other properties.

The composition of a number of minerals has been cleared up by an application of these ideas of solid solution to their study. The mineral nephelite forms a good example. Its composition approximates $NaAlSiO_4$, but many specimens hold 2% too much silica to be consistent with this formula. This fact has long been puzzling, and the formula of nephelite has consequently been in dispute, but recent investigation goes to show that this excess of silica exists in the mineral dissolved in the $NaAlSiO_4$. The molecular condition of this "dissolved" silica is not definitely known, but it has been suggested that it is present in the form of $NaAlSi_3O_8$, a compound existing independently as the mineral albite. If the excess silica is present in this molecular condition, then we have tricline albite dissolved in hexagonal nephelite up to 2% in quantity, that figure apparently representing the "saturation limit" of nephelite to albite.[9]

Pyrrhotite forms a second example, with its sulphur content varying from 36.3% to over 40% without causing marked change in properties. If the excess of sulphur be regarded as present in solid solution, dissolved in the normal pyrrhotite, then the variation in composition found in this mineral becomes readily understandable. Thus pyrrhotite is theoretically FeS (a compound found only in meteorites) but practically FeS + variable S, the sulphur above that required for the FeS molecules ranging up to 6%. The dissolved character of this extra sulphur has been proved in the Carnegie Geophysical Laboratory at Washington by actually dissolving sulphur in synthetic FeS up to a maximum of 6.01% at 600°.

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[9] It need scarcely be pointed out that such a question cannot be settled by the microscope, for the dissolved material is present in submicroscopic condition and does not affect the homogeneous appearance of the mineral.

E. H. Kraus and J. P. Goldsberry have recently completed a very suggestive study of bornite, a mineral whose formula has long been in doubt, owing to a striking divergence in the results of analyses of specimens from different localities. These investigators show that bornite is not a definite compound in the ordinary sense, but is made up of a mixture of Fe_2S_3 (a compound not found uncombined in nature) and Cu_2S in proportions ranging from $3Cu_2S\ Fe_2S_3$ to $38Cu_2S\ Fe_2S_3$, the majority of analyses corresponding to $5Cu_2S\ Fe_2S_3(Cu_5FeS_4)$, which represents the dominant type of bornite found in nature.[10] These mixtures are not confined to the range occupied by bornite, but in other combinations give rise to the common chalcopyrite and chalcocite and the rare copper-iron sulphide, barnhardtite, as indicated in the accompanying tabulations:

THE COPPER-SULPHIDE COMBINATIONS

	Fe_2S_3
Chalcopyrite	$Cu_2S\ Fe_2S_3$
Barnhardtite	$2Cu_2S\ Fe_2S_3$
Bornite	$3Cu_2S\ Fe_2S_3$ $4Cu_2S\ Fe_2S_3$ $5Cu_2S\ Fe_2S_3$ etc.
Chalcocite	Cu_2S

Other series of sulphide minerals, such as the As_2S-PbS series, the Sb_2S_3-PbS series, etc., are shown to be analogous in make-up to the Fe_2S_3-Cu_2S series, and a great number of other minerals may be regarded as derived from members of these series by isomorphous replacement in one or both component parts.

THREE TYPES OF SOLID SOLUTION

Solid solution is not confined to crystalline minerals, but shows itself, as we have seen, in colloidal ones also—for example, in chrysocolla. Thus we may have three types of solid solution, according to whether the components are (1) isomorphous crystalloids, (2) nonisomorphous crystalloids or (3) colloids. Variations in composition may arise further through isomorphous replacement in one or both members of a nonisomorphous mixture or through a mutual solution of a crystalloid and a colloid.

We come now to a consideration of those changes that may take place within the mineral itself to alter its make-up. We know that conditions within the earth's crust are constantly changing and that minerals are often subjected to surroundings unfriendly to their existence. As in organic nature, so among minerals, there is a struggle for existence. Minerals are stable only in the habitat of their birth; with changing conditions somes chemical attack. Hence the tendency of minerals to alter. So today a chemical examination always precedes the quantitative analysis, not only for the purpose of detecting crystallized impurities, but also to determine if chemical alteration has taken place. And while well-developed crystals are usually most free from chemical degradations, even these may show incipient alteration, so insidious and penetrating are forces hostile. Examples are too abundant to enumerate, from the olivine with its microscopic network of serpentine to the complete pseudomorph, where we find, for example, that a crystal of pyrite (FeS_2) has changed completely to hydrated iron oxide (limonite).

Minerals vary greatly in their inherent susceptibility to decay. Some, like quartz, inert chemically, are stable under varied conditions; others, like marcasite, extremely sensitive to surroundings, alter with ease and rapidity, even amid the sequestered surroundings of a mineral cabinet. So prone indeed are some minerals to decay that perfectly fresh specimens have never been obtained, and with such it becomes necessary to interpolate, so to speak, using the knowledge gained from other minerals to arrive at an understanding of these altered examples.

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Chromite Production Increasing

The chromic ore mines of the Pacific Coast have been recently examined by J. S. Diller, of the United States Geological Survey, who reports an increase of production since the transcontinental railroads have so reduced freight rates as to enable the chrome ore produced on the Pacific Coast to compete with the ore imported on the Atlantic border.

For many years California has been the only state producing chromite, and it is still the chief producer. Its production is far greater than ever before. Its output during the first six months of 1916 was more than three times the greatest annual yield of former years and is still increasing. The chief producing areas are the belts of serpentine in the Sierra Nevada and Coast Ranges, which are distributed through a score of counties. Shasta County is still the greatest producer and contains the largest ore body yet discovered in the state.

Nearly all chrome ore is taken out of open quarries. Most of the orebodies are small and lenticular in shape, containing from 1 to 200 long tons of ore. Few contain as much as 1,000 long tons of ore. Bodies of chrome ore have recently been discovered in different parts of Oregon, where production has already begun. The development of some promising bodies is awaited with interest.

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Conditions at Pachuca, Mexico

Operating conditions in Mexico during the last few years have been affected by many unusual difficulties, although the Pachuca district, perhaps, has been as good as any for maintaining a fair rate of work. This has been due principally to its advantageous geographical location, numerous railroad connections and steady power service. Added to these favorable factors, there has been coöperation among the mining companies and considerable resourcefulness in looking after the labor and in bringing in supplies.

Like other countries at present under strain, Mexico has found it necessary materially to increase all taxes, including those on mining property and on metals produced and exported. Luckily the prevailing high metal prices still enable the silver and base-metal producers to make a profit, but the gold-mine owner is hard hit with no rise in the market price of his product to offset steadily increasing costs as affected by the taxes, higher prices for supplies, etc. The labor outlook is not encouraging. As a natural outcome of several years of revolutions, labor is also passing through a similar period of unrest and much tact combined with fair and firm treatment will be necessary to meet this situation successfully.

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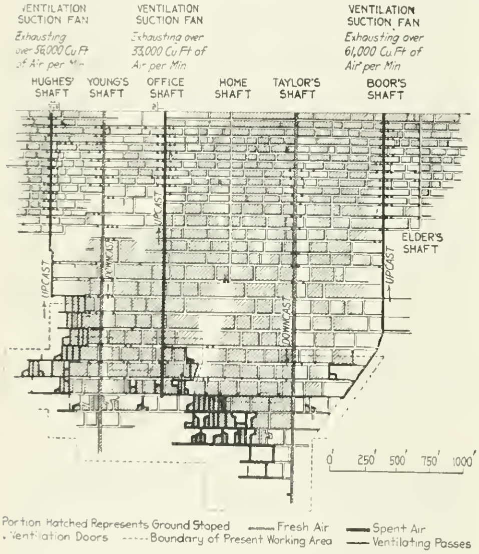
[10] A. F. Rogers, commenting on the work of Kraus and Goldsberry, has advanced the belief that bornite is a solid solution of Cu_2S in Cu_3FeS_3, the variable composition being due to the variable quantity of Cu_2S held in solution.

Details of Practical Mining

Ventilation at Wallaroo Mines

The increasing depths at Wallaroo mines and the lengthy levels to be operated emphasized the importance of providing the best ventilation possible, says the annual report for 1915 of the Wallaroo & Moonta Mining and Smelting Co., Adelaide, South Australia. A great deal of work has been done to improve the circulation of the air currents, in connection with which a Sirocco fan has been installed at Office shaft. This additional fan, in conjunction with those controlling the drafts at Boor's and Hughes' shafts, has provided a much more satisfactory atmosphere than would otherwise have been possible in connection with the rapidly increasing depths to which it has been necessary to extend operations. The shafts mentioned have been deepened so that they may command the air currents at the lower levels. Special attention has also been paid to the maintenance of subsidiary fans, besides over 350 doors in the levels throughout the mine, as well as to a considerable number of "stoppings" at various places. The accompanying illustration shows a section of the ventilating arrangements in the workings at Wallaroo mines and gives some idea of the magnitude of the scheme in operation and the efforts being made to give the best possible conditions in the working faces. The six shafts are shown, their comparative depths and the level communications at various depths. The shafts equipped with ventilating apparatus are noted with the volume of air moved per minute.



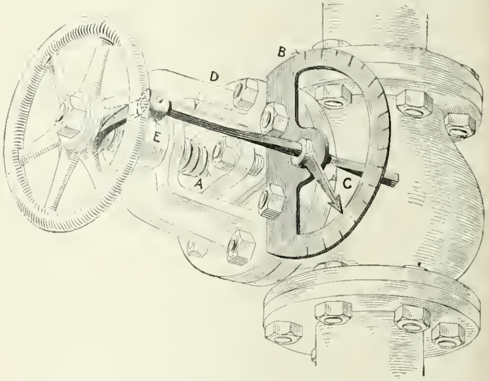
SHAFT AND VENTILATION SYSTEM AT WALLAROO, AUSTRALIA

An Ingenious Valve Indicator*

By S. F. Jeter

The need for an indicator or telltale to show the exact position of a throttle or other valve, particularly where it is not readily accessible for trial, is often experienced by engineers. The writer recently saw a simple and ingenious device for this purpose, which is applicable to any type where the stem travels with the valve. Such a contrivance is used on the throttle valves of the large reciprocating units at the Pratt Street power house of the United Railways and Electric Co., of Baltimore, Md., and was designed by Malcolm Wright, chief engineer.

The construction and operation are shown in the illustration, where *A* is the valve spindle and *B* a graduated quadrant fastened rigidly to the body of the valve. The pointer *C* is fastened to the quadrant, but is free to revolve over its face. The center of pointer *C* is pierced by a square hole that fits neatly over a square rod *D*. The rod *D*, through a clamp *E*, is made to follow the movement of the valve stem in and out as the valve is operated, and the part of *D* that engages the pointer *C* is twisted so that from the open to the closed position of the valve the pointer *C* will travel 180° over the quadrant.



INDICATOR ATTACHED TO VALVE

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A Drill-Collaring Machine

By E. W. R. Butcher†

A contrivance for upsetting collars on mine drills and augers has been devised in the blacksmith shop of the Republic Iron and Steel Co., at Gilbert, Minn., which has given satisfactory service. The parts were made entirely of scrap material, consequently the cost was small. As will be seen in the illustration, a piece of 12-in. pipe is placed under the shop floor in a vertical position, its top flush with the floor. The pipe rests on the top of an old car wheel that has been plugged up with iron and planed on one side, the planed side being placed up. This arrangement permits the handling of long drills. When the device is not in use, the hole is covered with an iron lid, *D*.

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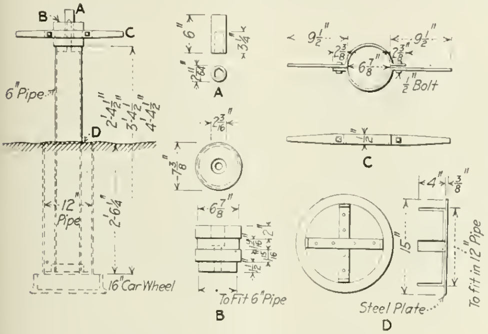
*"Power," June 27, 1916.

†Gilbert, Minn.

Three types of drills are in use—3, 4 and 5 ft. in length—for which there are three lengths of 6-in. pipe, as indicated. Each piece of pipe is fitted with a flange to keep it in a vertical position. In upsetting auger drills a piece of steel 9 in. long is used. The collar is upset in a manner similar to that used for the drills, the die being placed on the steam hammer or other solid surface instead of on the 6-in. pipe. After the collar is made, the piece is welded to the auger proper. The die *B* is made from an old locomotive axle and is fitted with a set of handles *C*. The cup *A* is of tool steel and tempered on top. It can be made with either a circular or a hexagonal hole. When a circular hole is used, it is necessary to reheat the end of the drill and reshape it slightly. In either case the outer end of the hole is made a little larger than the inner end to allow the drill to slip off more readily.



DETAILS OF COLLARING MACHINE

In upsetting the collar on the drill, the end of the steel is first heated to the proper temperature and then dropped through the hole in the die, heated end up, and the cup placed over the end. The cup is then hammered down quickly, causing the steel to spread out below the end of the cup and forming the collar. The hole in hollow-drill steel is not closed up in this process. The drill is removed with the die by means of the handles, a tap on the end of the drill being sufficient to loosen it.

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An Inexpensive Exploration Plant

Often the preliminary examination of a prospect warrants a small amount of development work prior to a more detailed examination. The necessary plant to accomplish this must be cheap, easily available and in good enough condition to last out the short time it is in operation without excessive renewals.

Being called upon for a plant of this character in a region where mining was not a common industry and which was a prohibitive distance from mine-supply houses, it was necessary to procure what equipment was available rather than specially designed apparatus.

A canvass was first made of the two nearest large cities to find the general cost of pumps, piping, hoists, compressors, etc. A visit to a few dealers in this type of machinery soon showed that the cost of new machinery was prohibitive. A tour of the second-hand machinery dealers gave much more favorable results. With a little dickering it was possible to make an arrangement with them whereby machinery could be bought in good second-hand condition—that is, in operating order for a short time—and if brought back in acceptable condition within a year, a refund of 50% allowed.

A horizontal wood-burning boiler of the type used for operating small sawmills, about 15 to 20 hp., cost $150. A hoist of 2 tons capacity, of the type used in connection with hoisting masts in construction work, was available at $125. A small boiler-feed pump, having a capacity of 35 gal. per min., cost $60. A small air compressor cost $150. Three air drills from a quarry cost $60 each. Four contractors' hand-dump cars cost $25 each. A crude skip was made by the second-hand dealer out of an iron barrel and two pairs of car wheels for $50. Pipe fittings, pipe, track, drills and tools cost $185. This entire plant thus cost $1,000, with a possible return of $400 if the large pieces were returned within a year in any usable condition. Of course the pipe, drill steels, etc., were best counted as nonreturnable.

Such a plant was capable of considerable flexibility in use. The pump could be used for sinking or could be given a permanent location at the completion of sinking operations. An arrangement of valves provided for the use of the hoist or compressor at will.

A plant of this character is crude, inefficient and trying on the nerves of the operator, but it can be made to operate and will greatly assist the development of a property at the minimum outlay for the plant.

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Sampling Placer-Gravel Deposits

By Irving Herr*

It was desired to determine as closely as possible, before starting to drill a certain gravel deposit, what would be the probability of obtaining reasonably accurate results with a given number of holes and the advantage of increasing the number of holes with variable spacing. The deposit in question had already been partly worked by hydraulic methods and was known to consist of a major portion of low-grade gravel with occasional portions containing fairly rich paystreaks near the bedrock, and also irregular areas of enrichment on the bedrock. These rich portions were irregular both in area and in location.

In order to obtain this information the following experiment was tried: A field 10 in. square was laid out on a piece of tracing cloth to represent a gravel deposit 2,000 ft. square. On this miniature field irregular areas of varying size, shape and location were plotted to represent the rich areas, and the total area of these patches was made for convenience one-tenth of the total area of the field. They were assumed to increase the average value of the gravel overlying them to $0.25 per cu.yd.; and the remaining nine-tenths of the field was assigned an even value throughout of $0.05 per cu.yd. The average for the entire field was $0.07 per cu.yd.

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*Mining engineer, Cambridge, Mass.

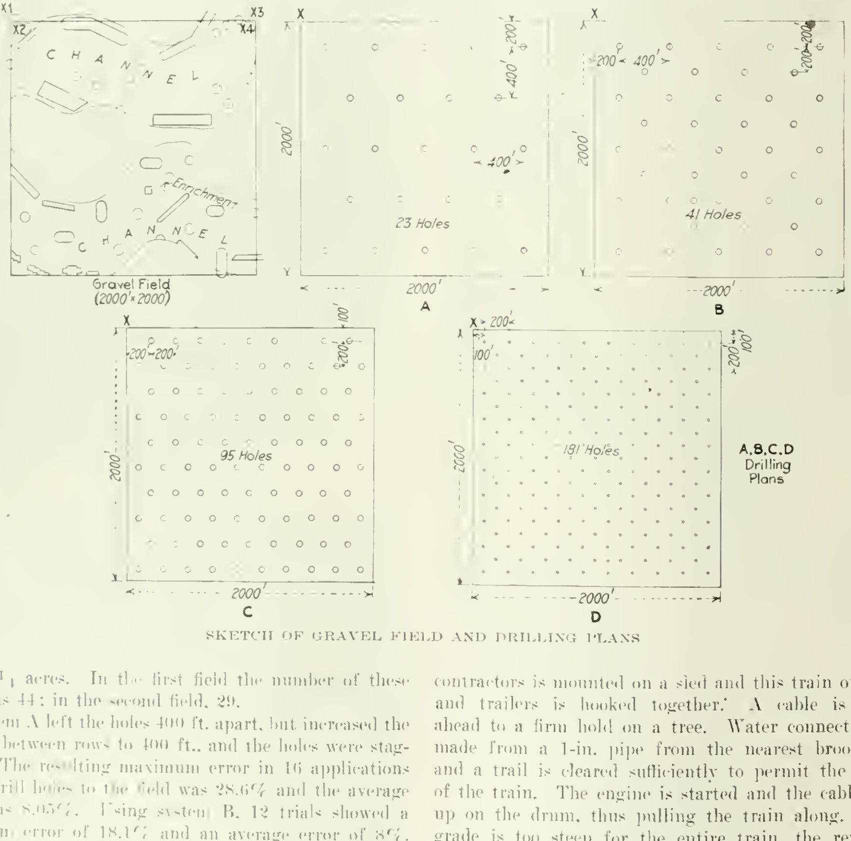
The various drilling systems were plotted on cross-section paper, each 1 in. square representing an area 400 ft. square, or 1% of the area of the field. The tracing cloth was then superimposed upon the drill-hole plat and the number of drill holes striking the enriched areas was counted. To eliminate the personal equation, the exact position of the gravel field on the drilling plat was fixed by drawing corners slightly outside or inside of the real corner of the field and at small angles to the sides of the field, and the field was then applied so that this arbitrary corner coincided with the corner of the drilling plat.

Each system of drilling could be applied to the gravel field in 8 different positions by making two such corners in each of the four corners of the field.

Four systems of drill-hole spacing were used, beginning with 23 holes and increasing to 181, or slightly less than 2 holes per acre. The enriched areas varied in size from 0.07 up to 11¼ acres. In the first field the number of these spots was 44; in the second field, 29.

System A left the holes 400 ft. apart, but increased the interval between rows to 400 ft., and the holes were staggered. The resulting maximum error in 16 applications of the drill holes to the field was 28.6% and the average error was 8.05%. Using system B, 12 trials showed a maximum error of 18.1% and an average error of 8%. This system consisted of 400-ft. spacing of holes and rows 200 ft. apart with holes staggered. Using system C, with holes and rows each 200 ft. apart and holes staggered, the maximum error in 12 trials was 12% and the average error for the 12 trials was 5.17%. Using D system, with holes 200 ft. apart and rows 100 ft. apart, staggered, the maximum error obtained in 16 trials was 7% and the average error using the first field was 3.58%, while with the second field it was 2.78%.

If a drill hole entered an enriched portion of the field, it was tabulated as a hit; if on the line bounding such an area, it was counted as one-half a hit.



SKETCH OF GRAVEL FIELD AND DRILLING PLANS

Heavy Mountain Transportation

The transportation of sectionalized machinery over mountainous country is slow and difficult. This is accomplished in the North in the following manner: Sleds are constructed of timber upon which the sections are securely lashed. These sleds are made of 12x12-in. timbers with the ends hewed to assist in surmounting obstacles, a flooring of 2-in. planks covering these runners and serving as a platform for the machinery. Flywheels come in two parts and one part is put on each sled. Crankshafts, hoisting drums, etc., are fitted similarly. A stationary hoist engine of the type used by contractors is mounted on a sled and this train of engine and trailers is hooked together. A cable is carried ahead to a firm hold on a tree. Water connections are made from a 1-in. pipe from the nearest brook above and a trail is cleared sufficiently to permit the passage of the train. The engine is started and the cable winds up on the drum, thus pulling the train along. If the grade is too steep for the entire train, the remainder of the sleds are hauled up with the cable after the engine has reached the end of its haul. Blocks are sometimes used to give greater leverage to pull the entire train at once if this method is thought to be easier than breaking the train up. When the anchorage has been reached the cable is carried ahead and the operation is repeated. One thousand feet is about the limit of a stage in heavy country. Rough wooden timbers are used for idlers when these are considered necessary.

Details of Milling and Smelting

Metallurgical Experiments at Santa Gertrudis Mill*

Upon the publication of results obtained at Nipissing with desulphurization and aluminum-dust precipitation, similar experiments were undertaken at the Santa Gertrudis mill, Pachuca, Mexico, by A. W. Hahn. Desulphurization, as was to be expected, gave no beneficial results on the ore, which contains no tellurides, arsenides, etc. On the other hand, aluminum-dust precipitation showed a considerable improvement over the zinc-dust method, and its adoption has only been delayed by war conditions that have practically put aluminum dust off the market. Comparison of the two methods was based upon normal prices of aluminum and zinc dust—30c. and 7c. per lb. respectively.

As practically all the existing equipment can be used conveniently in the aluminum-dust process, the problem as worked depends for commercial success upon an economical method of converting the lime in solution, and that added during milling for neutralizing and settling, into calcium carbonate with the formation of the necessary caustic soda as a product of this reaction, all prior to precipitation by aluminum dust. Any lime present in solution during precipitation will be converted to calcium aluminate, lowering the grade of the precipitate and causing difficulty in melting. The conversion and elimination of lime can be accomplished by the addition of carbonate or bicarbonate of soda, as follows:[1]

$$\mathrm{Ca\ (OH)_2 + Na_2CO_3 = Ca\ CO_3 + 2NaOH}$$

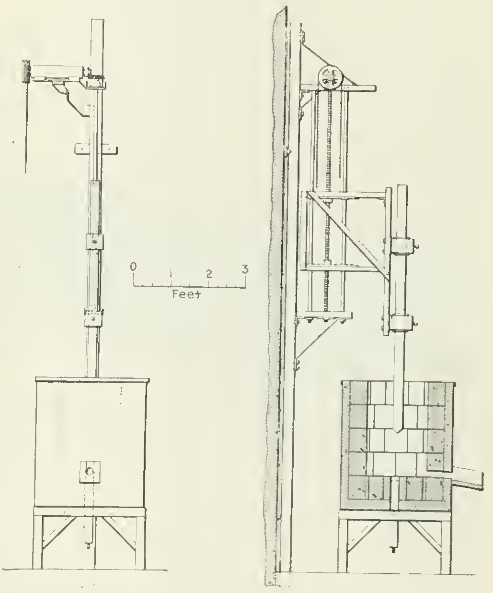
$$\mathrm{Ca\ (OH)_2 + NaHCO_3 = Ca\ CO_3 + NaOH + H_2O}$$

In place of commercial carbonate or bicarbonate of soda, laboratory tests showed the probable successful use of an impure local product know as *tequesquite*, obtained from the dried-up bed of Lake Texcoco and containing approximately 56% carbonate and bicarbonate of soda in about equal quantities. In practice the *tequesquite* solution would be added to the pulp flowing to the collecting tanks above the Merrill filter presses. In experimental work the aluminum-dust precipitate yields a bullion 975 fine. The consumption of aluminum dust was about one-third that of zinc dust, or 0.34 oz. to 1 oz. fine bullion. The slightly increased cost, per ton of ore, of aluminum dust is more than offset by decreased chemical consumption of cyanide, the net saving being calculated at $0.15 per ton of ore.

Electrolytic Regeneration of Cyanide

Prior to the favorable conclusions reached in the aluminum-dust tests, a lengthy investigation was conducted on the regeneration of cyanide in the mill solution by electrolysis. Anything like a comprehensive description of this interesting work cannot be taken up here, and only the important features will be outlined.

The principal difficulty presented was in finding an anode of high conductivity that would not dissolve or disintegrate. Graphite, lead, plumbago, carbon, charcoal, magnetite and peroxidized lead were tried without much success. An alloy of lead with 6 to 9% of antimony was selected as fairly satisfactory in filling the requirements. The following conclusions were then worked out:



ELECTRIC FURNACE AT SANTA GERTRUDIS MILL

The solution to be treated by electrolysis must be barren of gold and silver to avoid their precipitation. The question of enlarging the scope of the process to include electrolytic precipitation of these values was also investigated separately. The regeneration of cyanide takes place at the cathode, with a destruction of cyanide at the anode which may be principally overcome by maintaining a high protective alkalinity at the anode. A porous diaphragm, such as canvas, separating the anode and cathode, assists in maintaining an alkaline anolyte, circulation of anolyte and catholyte being accomplished individually. Power consumption is affected by resistance of electrodes, electrolyte and diaphragm, by temperature and circulation rate of electrolyte and by spacing of electrodes.

The voltage drop per cell, at a current density of 15 amp. per sq.ft. of anode surface, treating barren solutio containing 0.5% total KCN and 0.115% CaO, with canvas diaphragm and electrodes spaced 1½ in. apart, is 6 volts at 70° F., under which conditions the solution flow should be at least 0.25 gal. per sq.ft. of anode surface. The deposit on the cathode analyzed 71% zinc, with impurities of copper, iron, arsenic and organic matter. The recovery of this zinc might be turned to some commercial advantage. The reaction representing the regeneration of cyanide is presumably as follows:

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*From an article by Hugh Rose in August, 1916, Bulletin A. I. M. E.

[1] For chemistry and details of aluminum-dust process refer to: "Aluminum Dust Precipitation at Nipissing," E. M. Hamilton, "Eng. and Min. Journ.," Vol. 95, No. 19, and Vol. 99, No. 13; "Aluminum Precipitation at Deloro, Ont.," S. F. Kirkpatrick, "Eng. and Min. Journ., Vol. 95, No. 26; "Nipissing Mill and Metallurgical Practice," James Johnston, Bull. A. I. M. E., 95; "The Mill and Metallurgical Practice of the Nipissing Mining Co.," G. H. Clevenger, A. I. M. E., July, 1914.

$$Na_2Zn(CN)_4 + Ca(OH)_2 + \text{Current} = 2NaCN + Ca(CN)_2 + Zn + H_2O + O.$$

The net reduction of cost was estimated at $0.12 per ton of ore. The equipment outlay, however, proved to be several times greater than that required to convert the precipitation plant to the use of aluminum dust, and as the latter process at the same time indicated a somewhat larger cost reduction without further complexities of plant, its adoption in place of regeneration was decided upon.

Electrolytic Precipitation, Regeneration and Refining

Following the experience gained in the experiments with regeneration, the next step was to endeavor to combine with it the electrolytic precipitation of gold and silver from solution. Difficulty was encountered in obtaining a coherent cathode deposit. It was found uneconomical to attempt a complete precipitation, the limit of commercial work being about 1.3 oz. silver remaining in solution. Plant cost would be high. Altogether the proposition did not present sufficiently attractive possibilities to warrant following it up thoroughly. With the perfection of the diaphragm cell it is probable that both precipitation and regeneration electrolytically could be worked out to a fair success.

A preliminary investigation has been made of electrolytic refining of precipitate from the present zinc-dust installation. The chief difficulties to be overcome are resistance of the precipitate to the current, purification of the electrolyte, high acid consumption due to impurities, and refining and melting of the gold slime.

Tests on Flotation Concentration

As previously stated, the ore is clean with only small quantities of base metals. A representative analysis is: Au, 0.067 oz.; Ag, 12.0 oz.; Pb, 0.10%; Cu, 0.20%; Zn, 0.15%; Fe, 4.10%; SiO_2, 86.67%; S, 1.00%.

Most of the silver value is present as argentite, Ag_2S, about 0.05%. It is therefore evident that little benefit in recovery is to be expected by water concentration. At the time of building the plant complete experiments were conducted on a working scale, the recovery by concentration representing from 8 to 10% of the value of the ore. This did not justify the installation of water-concentrating equipment plus added cost of operation as against direct cyaniding. The growing success of flotation concentration in the United States led naturally to local investigation of the problem which, though still in the laboratory stage, already shows encouraging results. If the process is worked out to a commercial success, a detailed description of results should be of interest. Meanwhile a summary of preliminary conclusions is given as an indication of possibilities.

A large variety of vegetable and mineral oils have been tested, the best results thus far having been obtained with one-third pine oil or wood creosote and two-thirds Mexican gas oil, such as is used locally in the oil-fired melting furnaces. The pine oils and wood creosote tried are imported, but doubtless satisfactory substitutes can be made near at hand. Several coal tars and a number of Mexican oil-field products remain to be tested. The addition of acid shows no particular benefit. A slight alkalinity, not exceeding 0.03 lb. lime per ton solution, is satisfactory. Heating the solution does not materially improve results. The flotation tailings are cyanided readily, the presence of the small quantity of oil having no deleterious effect.

Possibility of Replacing Cyaniding by Flotation Process

The raw flotation concentrates cyanide with no more difficulty than water concentrates, the cyanide consumption maintains more or less the same ratio as in the crude ore—4 grams sodium cyanide per gram silver. A 98% extraction of gold and silver in the concentrates is obtainable. In the small laboratory machines, without cleaning cells a recovery by flotation of 65 to 70% can be made at a ratio of concentration of between 80 and 90 to 1. In the 100-ton trial plant now under construction equipped with middlings return and cleaning cell, it is expected that these results can be improved. It is possible, though not certain, that flotation even with this clean ore, may replace cyanidation to a large extent.

Melting the precipitate in an electric furnace built after the Alaska-Treadwell design is under trial. Alternating current at 120 volts is used, the input being about 600 amp. working at full heat. Trouble has been experienced with dusting and with burning a hole through the bottom of the furnace. A renewable iron plug may provide a convenient remedy for the latter. The dusting is probably due to the precipitate being wet, the intense heat at the electrode setting up a center draft of steam and air. Either the precipitate should be dried or some dust-collecting apparatus attached to the furnace top. The advantages of this system over the oil-fired crucible method of melting are rapidity of melting and discontinuance of use of crucibles and oil, both of which require a long-distance haul. No data are available yet as to the comparative economy, but further investigations will be made of the subject.

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Platteville District Milling

The zinc and lead output of the Wisconsin-Illinois-Iowa district is the product of about 65 concentrating plants having a milling capacity of from 7,130 to 12,000 tons daily, depending on the grade of ore handled. The lower figure of 7,130 tons is based upon the former method of rating a mill treating rich culled ore running 20% blende. Thus the standard 75-20 mill of former days meant one guaranteed to handle 75 tons of 20% blende ore in 10 hours. Such a mill had one rougher jig of 7 cells, each 40x30 in., and one cleaner jig of 7 cells, each 36x30 in. Such a standard mill treats the lower grade ores milled today with greater capacity per day, handling approximately 125 tons daily of dirt running 1 to 3% sulphides. On the basis of the lower-grade ore now mined the capacity of these plants is about 12,000 tons daily.

While it is probably unfair to compare the mills of this district with those of the Missouri districts, it is interesting to note that those of the latter comprise about 134 plants having a daily capacity of 29,900 tons.

The Argonaut Mine, Calif.

By Lewis H. Eddy*

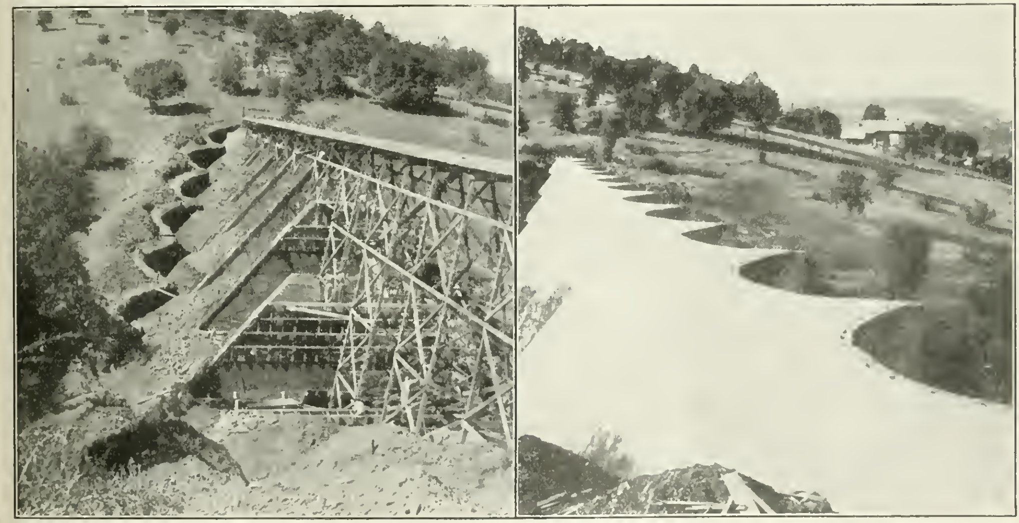
SYNOPSIS—Apex litigation having been disposed of, improvements are being installed. The old mill is being replaced by a 60-stamp mill. Arrangements are being made for impounding the tailings by means of an Eastwood multiple-arch dam. Hoisting and pumping facilities are being greatly increased to accommodate the increased production.

Two years ago the *Journal* published an article detailing briefly the plans then contemplated by the Argonaut Mining Co. at Jackson, Amador County, Calif., for remodeling and increasing the capacity of the 40-stamp mill and the installation of a gravity system for disposing of tailings.[1] At that time the apex suit of the Kennedy Extension Gold Mining Co. vs. the Argonaut Mining Co. was pending in the Superior Court. On June 29, 1914, Judge Fred V. Wood, without a jury, rendered decision that the continuity and identity of the Argonaut vein was sufficiently shown to meet the requirements of the law.[2] Subsequently the case was kept out of the Supreme Court, and early in the present year the differences between the plaintiff and defendant were settled out of court and the Argonaut company came into possession of the Muldoon mine, in which the Kennedy Extension claimed that the Argonaut vein apexed.

The development of plans and further preparations for reconstruction of the mill and installation of tailings plant have been in progress during this period, and at the time of my last visit to the Argonaut, at the beginning of April, 1916, the work was well under way. The installation of an underground hoist on the 3,900-ft. level had just been completed and started operation. Construction of a gravity system for disposing of tailings, including an Eastwood dam for conservation, was in progress. The plans contemplated in 1914 for improving the milling plant had been elaborated, and it was decided to rebuild the 40-stamp mill and add 20 stamps to it and to begin reconstruction about the first of May. The installation of electric pumps and the exploration of new ground were also arranged for.

In order economically to carry the tailings from the mill to the storage ground, it was deemed necessary to change the situation of the mill; and as the increased capacity will necessitate additional and new metallurgical appliances, the installation will be practically a new mill, using some of the old parts and stamps that are still serviceable. The old mill was used for about 18 years without extensive repairs. It was badly worn out, and the time had come when the whole mill would have to be generally overhauled. The old mill site was inadequate for an increase in capacity, and rather than install an expensive tailings-elevating system or move the old mill to the new site, it was decided to reconstruct and practically build a new mill. The elevation of the new mill above the present shaft collar will necessitate raising the ore a farther distance of about 225 ft. to the new mill bins. The new mill is 800 ft. west of the old mill site. Construction started the first week in May, all labor and material being supplied under contract. The main machinery parts are built by the Knight foundry at Sutter Creek.

N. S. Kelsey, mine manager, said that after extensive and thorough examination and experimenting with other processes, it had been decided to stick pretty close to the



THE EASTWOOD MULTIPLE-ARCH TAILINGS DAM

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*Associate editor, 3430 Peralta St., Oakland, Calif.

[1] "Eng. and Min. Journal," Feb. 14, 1914, p. 380.

[2] "Eng. and Min. Journal," July 18, 1914, p. 100.

present metallurgical practice of stamping, inside and outside amalgamation and concentration. The mill will be equipped with thirty-six 6-ft. vanners of Allis-Chalmers make; 4 Darrow multiple-deck buddles, 3 of which will be used for treating the slimes, and the product from these 3 buddles will be recleaned on the fourth and smaller buddle. By this process it is expected to get a shipping product from the slimes. One or two tables may be put in for cleaning some of the slimes. So the only changes made in the practice of the past are along the lines of classifying. Each five stamps is provided with separate classifiers so that each forms a separate unit. The feed to the first two rows of tables will be the coarse from the classifiers; the fines from the classifiers will go to Callow tanks to be thickened before feeding onto the third row of tables. The classifiers are merely home-made V-boxes. The vanners are set in 3 rows of 12 machines each.

EXPERIMENTS WITH FLOTATION AND OTHER METHODS

Before deciding on this final arrangement, the Argonaut management spent a good many thousand dollars and much time experimenting with cyanidation, regrinding, amalgamation and re-treating and did some extensive experimenting in flotation. While able to better the past extraction by most of these methods, the additional changes and labor required for regrinding, etc., and cost of equipment, did not insure sufficient increase in extraction to offset the additional cost and to pay reasonable interest on the investment. Mr. Kelsey said that the best extraction was obtained by flotation. The Argonaut mill has been getting 70% of its total extraction by amalgamation, and when contemplating other methods that have been tried, including cyaniding, it was with the idea of adding these methods to the present practice, still retaining amalgamation.

The past duty of the 40 stamps of the old mill has been at the rate of 5 tons per day per stamp. In the new mill this will be reduced to about 4½ tons to the stamp. Close track is kept of the work by numerous screen tests, and when the greatest loss is found in the coarse, then finer screens are provided; and when the losses are in the fines, the screen opening is increased and coarser crushing practiced. This was the method in the old mill and will be continued in the new one, which has been designed to accommodate whatever treatment may be developed in the future. There is ample headroom to install regrinding apparatus or flotation machinery if the time comes for the adoption of such process. This could not have been done in the old mill for lack of headroom. All elevation in the new mill, after the final elevation of the ore to the bins, will be eliminated. At the headframe of the shaft two large Blake-type crushers are installed, and the ore will all be crushed to pass a 1½-in. ring. Each one of the crushers will be of sufficient capacity to crush all the ore, so that when there is dry ore, one crusher can be held in reserve against the time when there is wet, sticky and gougy ore, and still crush fine by using both instead of one crusher.

The grizzly capacity is increased, reducing the amount of material that is passed through the crusher. This material will all [illegible] into the bin at the headframe, from which the in[illegible] skips will be loaded and the ore will be hoisted in balance into the mill bins. The elevation of the dump of these skips over the mill bins will be sufficient to provide for making a distribution of ore in the mill bins by a system of chutes and slides and the use of triangular cones or deflecting baffles. This will give a uniform distribution of the coarse and the fine.

The increased capacity of the mill necessitated provision for largely increased storage for tailings. It is also necessary for all the Mother Lode mines in Amador County to meet the requirements imposed by the courts on behalf of the farmers on the several creek bottoms. The Argonaut owns sufficient acreage of land of ideal topography for just such storage basin and for conservation of tailings for future re-treatment.

The new Eastwood multiple-arch dam is 420 ft. long and 46 ft. high at the highest point, ranging in thickness from 30 in. at the base to 12 in. at the top; 13 full arches with bases on the end. It is estimated that 25 years' storage capacity for tailings from 40 stamps, crushing a total of 200 tons per day, will be provided. The tonnage will be increased to nearly 300 tons a day by the addition of 20 stamps to the mill and thus reduce the life of the storage; but the dam can be raised to accommodate the additional demand, as the construction is in such form as to allow a raise of 30 ft. above the present height. During the first few years the storage will fill up the bottom of the basin very quickly, and the last or upper portions of the basin will really give the longest storage. This arch type of dam is approved by the California state engineering department. It has the best possible foundation, made of concrete, the material being obtained locally from the dumps of hydraulic diggings, which supply large amounts of gravel from ancient river wash. The gravel is screened, washed and crushed.

REINFORCED WITH HOIST CABLE

In the arch type of dam it is possible to use hinged joints where the arches meet, but in the construction of the Argonaut dam the hinge is not used. The concrete was poured solid instead of hinging, full account being taken of stresses from slime and water. A 1⅛-in. hoisting cable is used for reinforcing the concrete by passing it through the arches. Engineers claim that old cable is as good as new after the excess grease has been cleaned off and will serve as good purpose as iron bars, because the stretch has been taken out and the little grease that is left in an old cable will not interfere with the concrete. The dam will be completely finished before any water or tailings are turned in, so that the concrete will have ample time to set.

The storage basin is formed of two large ravines. The watershed is not extensive, but in the season of rains a large volume of water comes through the ravines, so it will be necessary to put in a fairly elaborate system of laterals to bypass this flood water; otherwise the storage would be decreased by the débris washed into the basin behind the dam. A simple spillway is provided at the end of the dam. The impounded tailings will some day be an asset and by this system of storage will be available for re-treatment. The construction work was done under contract by Bent Bros., of Los Angeles. The plans and specifications were provided by John S. Eastwood, of San Francisco. The estimated total cost of the dam was $23,000.

The main Argonaut shaft is 4,485 ft. deep, inclined 65° east, down to the 4,350 level. Between the 4,050 level and the 3,900 the hoist is connected with the main shaft on an easy curve. This short section of shaft lies in the hanging wall of the main shaft. The new hoist installed on the 3,900 level is practically a duplicate of the surface hoist and was built by the Knight foundry at Sutter Creek. The gears are cut steel, helical-type, built by the Falk Co., Milwaukee, Wis. The rope transmission, motor drive, is built by Meese & Gottfried, San Francisco. A 225-hp. Westinghouse motor is used. A number of improvements over the surface hoist have been made in the way of reinforcing some of the parts in the new hoist found to be weak in the old one. The new one is also heavier than the old. Replacement has also been made in the surface hoist. The plant is now sufficient to warrant the deepening of the shaft 3,000 ft., which will make a total incline depth of 7,000 ft., or a vertical depth of more than 6,000 ft.

The skips coming up through the lower section of the shaft will be emptied into a large-capacity ore pocket at the 3,900 level, and the ore as needed will be drawn off from this pocket into the skips in the main shaft. In the past the Argonaut has been hoisting waste to the surface during shaft sinking. A crosscut has just been completed from the main vein, which taps the bottom of the waste shoot at the 3,900 level, so that in the future the waste from sinking will be hoisted only to the 3,900 level and then trammed back through the crosscut and dumped into the stope raise which will be maintained as the levels go down. The new hoist, if used only for handling stope filling, will save the expense of hoisting the further distance of 3,900 ft. to the surface and so make economic use of the waste.

One of the principal reasons for installing the underground hoist is that the shaft in the old upper portion is crooked, and a rope larger than 1⅛ in. diameter, carrying the requisite factor of safety for greater depth, cannot be made to run on the shaft idlers. Another reason is that for hoisting from a greater depth a larger and differently designed hoist would have to replace the present surface hoist. For these reasons hoisting in relay has proved the most economical for the present.

Two Deane Vertical Power Pumps Installed

In past years the water hoisted from the Kennedy mine adjoining the Argonaut on the north has drained the latter. The Kennedy has been very much deeper and consequently has kept the water drained ahead of Argonaut development. But the Argonaut having a shorter oreshoot, has been obliged to go down faster than the Kennedy, until now the Argonaut shaft is practically at the same vertical depth and will soon be at a greater depth than Kennedy. The result is that the Argonaut is getting more of its just portion of the water and before many years will be draining the Kennedy ground. The water has increased rapidly in the last year or two, and the Argonaut has been hoisting 1½ skips of water to every skip of ore and waste.

The contemplated increase of mill capacity has brought development to the point where the water must be taken care of by pumping equipment instead of skip hoisting. So at the time of my visit, the company was preparing to install pumps to handle the water. As soon as this installation is completed, the hoist will be relieved of hoisting water and able to handle a greater tonnage of ore. The pump installation includes two 4½x12-in. Deane vertical single-acting triplex power pumps. Gears are double-helical type. The pumps have extended motor base; are direct connected to 75-hp. Westinghouse three-phase, 2,200-volt 60-cycle motor of 585 r.p.m. The two pumps will be used to raise the water in two lifts through a 5-in. discharge column. The discharge from the pump at the 3,900 station will flow into a large tank on the 2,000 level. So there will be two complete units or two separate sections so far as the pumps are concerned. These pumps will be capable of handling 65,000 gal. of water per 8 hr.

The Argonaut now has south of the oreshoot a large amount of territory which remains unexplored owing to the congested condition of the working shaft and to the apex litigation. Installation of pumps will provide relief from hoisting water, which will give opportunity to run out to the south and explore this territory. The first exploration will probably be started from the 3,900 level by means of a long hanging-wall drift to the south, with numerous crosscuts to the vein opening. This work will be done as room is made in the stopes for the spoil broken, which will be used for filling. The company is rushing work on the second exit to connect with the surface in order to fully comply with the law covering second exit in deep mines and also to provide better and natural ventilation. This second exit, will be at the south through the old Muldoon shaft and through a series of raises that are being carried in the south end of the mine.

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National Engineer Reserve

In a circular letter recently issued by the Joint Committee of the Engineering Societies, it is reported that its desired legislation was embodied in the Army Reorganization Act of 1916, passed by Congress, and effective July 1, 1916.

This bill contained provisions for the organization of an Officers Reserve, including engineers. The War Department will soon issue an invitation to the engineers of the country to apply for commissions in the Reserve Corps of Engineers. Information will then be available as to the requirements for commissions graded from second lieutenant to major and the method of procedure necessary to secure commissions.

The following is a brief abstract of the Act relating to the Officers Reserve:

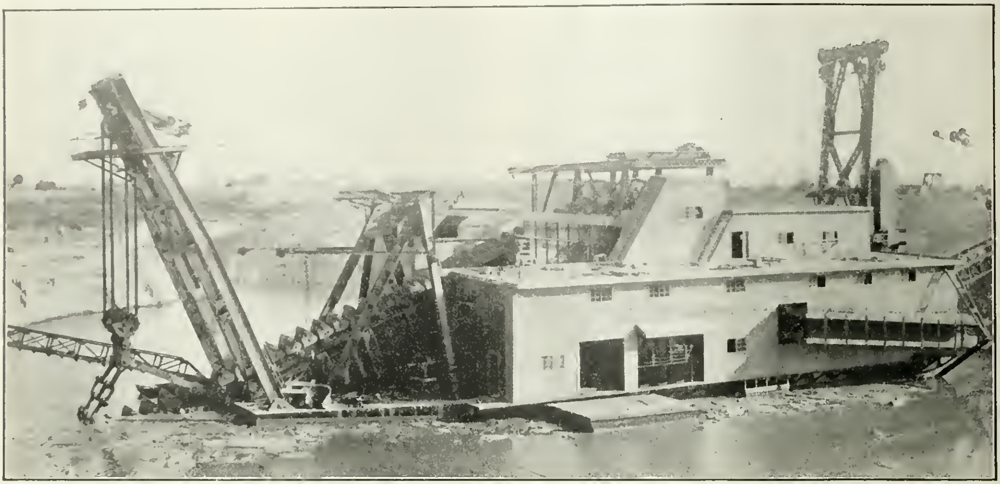
For the purpose of securing a reserve of officers available for service as temporary officers in the regular army . . . there shall be organized an Officers Reserve Corps of the regular army. The corps shall consist of sections corresponding to the various arms, staff corps, and departments of the regulars. A member of the Officers Reserve Corps shall not be subject to call for service in time of peace.

The President alone is authorized to appoint and commission the officers in the various sections of the reserve corps. Commissions shall be in force for 5 years unless sooner terminated at the discretion of the President.

In time of threatened or actual hostilities, the President may order members of the Officers Reserve Corps to temporary duty with the regular army in grades which cannot for the time being be filled by promotion or to duty as officers in volunteer or other organizations.

The Secretary of War is authorized to order reserve officers to duty with troops for field exercises or for instruction, for periods not exceeding 15 days in one calendar year during which such officers will receive the pay and allowances of their respective grades in the regular army.

Photographs from the Field



MARIGOLD NO. 5 DREDGE DIGGING IN THE YUBA BASIN FIELD, CALIFORNIA

This new 16-cu.ft. dredge of the Marysville Dredging Co. began operating May 7, 1916, construction having been started Dec. 27, 1915. It is an all-steel dredge, designed to dig 70 ft. below water level and a bank 20 ft. above. It was built by the Union Iron Works Co. and contains a number of new features. Total weight is over 2,000 tons, and the cost of the dredge over $400,000

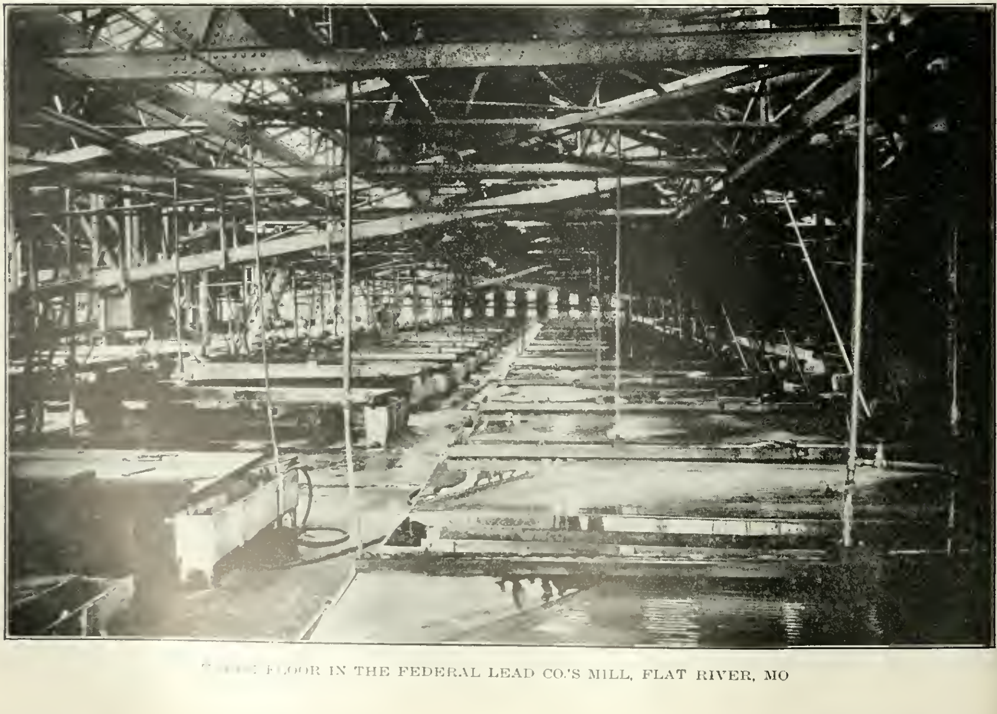
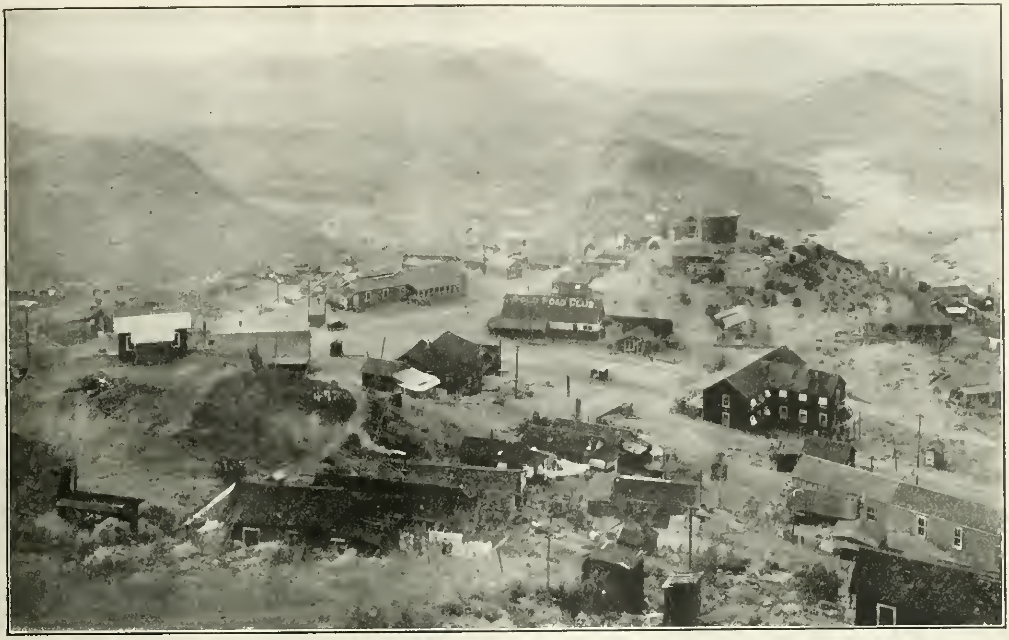
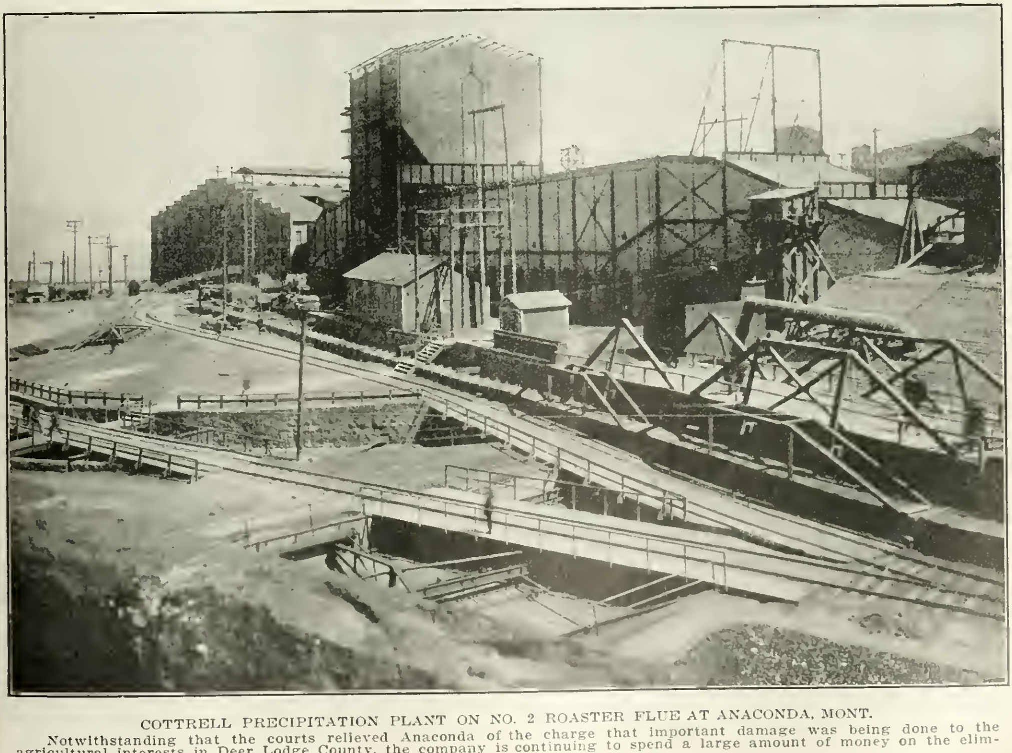


TABLE FLOOR IN THE FEDERAL LEAD CO.'S MILL, FLAT RIVER, MO



THE TOWN OF GOLDROAD IN MOHAVE COUNTY, ARIZONA, ABOUT ONE MILE FROM OATMAN



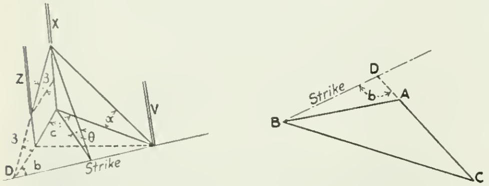
COTTRELL PRECIPITATION PLANT ON NO. 2 ROASTER FLUE AT ANACONDA, MONT.

Notwithstanding that the courts relieved Anaconda of the charge that important damage was being done to the agricultural interests in Deer Lodge County, the company is continuing to spend a large amount of money on the elimination of any possible smoke nuisance

Correspondence and Discussion

Dip and Strike Calculations

Referring to the article entitled "Dip and Strike Calculations from Drill-Hole Data," by George E. Burton, in the *Journal* of July 15, I wish to call attention to a paper dealing with the same subject in the *Journal* of Apr. 11, 1914. The final equation for the angle which, in combination with one of the given bearings, gives the strike of the vein, may in the last analysis be considered analogous in both papers. It would seem, however, that not only is the derivation of the equation in my solution infinitely simpler, but the final formulas themselves are much simpler in that the values *abcd* are eliminated therefrom and combined into one unmistakable term "*m*." This makes the formula easy to remember and much handier for a universal application to numerical problems.



DIP AND STRIKE CALCULATIONS

The formulas referred to and applied to Fig. 1, as adopted from Mr. Burton's paper, are:

$$Tan\ b = \frac{sin\ n}{m + cos\ n} \qquad (1)$$

in which $m = \frac{tan\ a}{tan\ \beta}$ and $n = (180° - c)$.

If it is preferred to use angle c directly, the formula is

$$Tan\ b = \frac{m - cos\ c}{sin\ c} \qquad (2)$$

My formula for the angle of dip is

$$Tan\ \theta = \frac{tan\ \beta}{sin\ b} \qquad (3)$$

To apply the formulas to a numerical problem:

Draw any irregular triangle, *ABC*, Fig. 2, assuming, for instance, *C* to be the bore hole whose bottom is highest, *A* to be the bore hole whose bottom is the next highest, *B* to be the bore hole whose bottom is the lowest. Always produce the line connecting the highest with the next highest hole (*CA* in the assumed case) to a point *D* and connect *D* with remaining hole (*B* in our case). The angle *b* is always at this point *D*; the angle *β* is always the adjoining, and *a* the opposite angle of inclination of lines drawn from the bottom of the highest to the bottom of the other two holes. Angle *c* is always the surveyed horizontal angle at the highest bore hole. This is all there is to be remembered in my formulas, whereas in Mr. Burton's the relative position in space as well as the respective meaning of the distances *abcd* and that of the angles *S* and *e* would have to be remembered in order to apply these values correctly in a numerical problem.

The much quicker graphical solution in my paper will usually give results sufficiently accurate for all practical problems. THEODORE SIMONS.

Butte, Mont., July 20, 1916.

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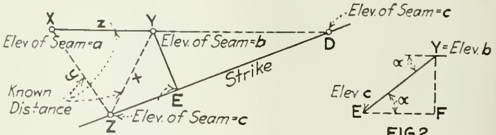
Dip and Strike Calculations

In the *Journal* of July 15, in an article by George E. Burton, entitled "Dip and Strike Calculations from Drill-Hole Data," it seems to me that his solution is unnecessarily long and cumbersome. A simpler solution would be as follows:

In the diagram, suppose three drill holes, *X*, *Y* and *Z*. Of these, *X* strikes the ore (or rock) at an elevation *a*. *Y* strikes it at *b* elevation, *Z* strikes it at elevation *c*. Supose *c* elevation is the lowest and that *b* is lower than *a*. Then in a known distance *z* or *XY* the seam drops *b-a* ft. It is only necessary to extend the line *XY* to *D*, a point where the elevation of the seam, produced, would equal the elevation *c*, and connect *Z* and *D*. This line *ZD* is the strike, and its bearing may be figured from the triangle *XDZ*, in which *XD*, *XZ* and the angle *YXZ* are known.

To deteremine the dip, assume a line from *Y* at right angles to *ZD* and intersecting it at *E*. The elevation of the seam at *E* is the same as at *Z* and *D*, since it intersects the line of strike between *Z* and *D*. The line *YE* represents the hypotenuse of a right triangle, since it lies along the dip. In the second diagram *YF* is the difference in elevation between the seam at *Y* and the seam at *E*, or *c-b*. *EF* is the actual distance on the diagram at Fig. 1 represented by *YE*, since it is the projection of *YE* on the horizontal plane. Since (Fig. 2) *YF* and *EF* are both known, $\tan \alpha = \frac{YF}{EF}$ = angle of dip. The actual distance *YE* on Fig. 1 (*EF* on Fig. 2) may be figured from the right triangle *YZE* (Fig. 1), since *YZ* and the angles *YZE* and *EYZ* are known.



Plan
FIG.1

FIG.2

DIP AND STRIKE CALCULATIONS

Negaunee, Mich., July 19, 1916. J. F. HANST.

Burma Corporation Ltd. Report

The Bawdwin mine of upper Burma is probably the greatest body of silver-lead-zinc ore whose exploitation has been successfully consummated in the last decade. At a recent London meeting of the Burma Corporation Ltd., Theodore Hoover made a report on the progress made in the past six months, the outstanding features of which follow:

Begun in April, 1914, and driven by hand labor for eight months, the Tiger tunnel heading advanced at the rate of 100 ft. per month. Upon installing mechanical equipment in January, 1915, the rate of progress for the 12 months following was 250 ft. per month working from one heading only. Since the completion of an internal shaft down to the tunnel level in January, 1916, work has progressed at the rate of 440 ft. per month working from two headings. With only 910 ft. to drive the completion of the tunnel is now expected in September.

In the years past, the smelter has been employed largely upon old Chinese slag using only about 10% mine ore with 90% slag. With the approaching exhaustion of this slag, however, the proportion of mine ore in the charge has been increased to 50% in recent months, without any disastrous decrease in the amount of metal produced.

During the last six months reported 1,000 ft. of drift, 1,150 ft. of crosscuts, and 400 ft. of raises have been driven. As a result of this work the orebody has been increased on the third level to an area of 67,700 sq.ft., on the fourth level to 72,100 sq.ft., and on the sixth level to 3,900 sq.ft. One of the crosscuts on the third level shows a phenomenal width of 136 ft. of high-grade ore.

This development has increased the proved ore by 350,000 tons bringing the total to 2,085,000 tons, and increased the probable ore by 200,000 tons making the total 765,000 tons. Anticipated, or speculative, ore is now placed at 650,000 tons, thus bringing the probable total in the mine above the Tiger tunnel level to 3,500,000 tons.

REMARKABLY HIGH-GRADE OREBODY

An inner core of the orebody above delineated is described as a phenomenal high-grade body 750 ft. long and 35 ft. wide on the third level, which assays 33 oz. silver, 37% lead and 23% zinc, or 60% solid metal. On the fourth level its dimensions are 850 ft. long, and 45 ft. wide, assaying 42 oz. silver, 42% lead and 24% zinc, or a total of 66% solid metal. These two levels are connected by raises driven all the way in solid ore assaying 44 oz. silver, 41% lead and 26% zinc, or a total of 67% solid metal. It is estimated that this block contains at least 600,000 tons averaging about 37 oz. silver, 40% lead, and 23% zinc, or 60% solid metal.

On the basis of milling experiments so far made, it is estimated that the whole orebody of 3,500,000 tons above the Tiger tunnel will be handled at an average profit of at least £3 per ton totaling between £10,000,000 and £12,000,000.

A plant for the treatment of 1,000 tons of ore per day is now being designed, and when finished it should show a profit of at least £1,000,000 per annum. Additional capital to the extent of £200,000 is necessary to complete this plant and development so far undertaken. The company has £95,000 cash resources uncalled for at the present time.

During 1915 the mine produced 14,000 tons of lead from which was realized a gross return of £325,000. During 1916, the output is expected to be as great as 1915 for which £30 per ton, or £7 more than in 1915, is expected will be realized, increasing the 1915 income by about £100,000. In other words the profits during construction of the new plant are expected to finish paying for it since the present smelter plant will treat 3,000 tons per month of high-grade on which the profit is £1 per ton.

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Tungsten in Inyo County, Calif.

The tungsten development and operation at Bishop, Inyo County, has advanced to a point where the camp is no longer a prospect. Two companies are preparing for extraction and milling ore and on a scale that indicates the establishment of a permanent camp. The Standard Tungsten Co., which was practically the pioneer in the field, sold a part of its holdings to the Tungsten Mines Co. and erected a first mill of 50 tons' daily capacity. The company is now adding to the capacity of the mill another 50 tons. Ore has been extracted and milled to the amount of about 200 tons of tungsten concentrates. A. J. Clark is president and L. Porter general manager of this company, which is a close corporation. The Standard mill is equipped with Dodge crushers, Davis rolls and Isbel tables. The ore is extracted by quarrying and will be carried to the mill by an incline surface tramway 1,600 ft. long, being built by Fulton Iron Works, of Los Angeles.

CONSTRUCTION OF A MODERN MILL

The Tungsten Mines Co. is also a close corporation, of which T. M. Townsend is president, L. L. Stevens, general manager and Cooper Shapley superintendent. This company is building a 300-ton modern mill equipped with Allis-Chalmers rolls. The mill is situated about halfway between the two mine openings. Development is done by tunnels. One of these openings will furnish the first ore that goes to the mill, and a substantial surface track is being constructed for hauling the ore in cars direct from the tunnel, a distance of 700 ft. This track runs across the end of the gulch near the portal of the tunnel and continues along the side of the gulch to the mill. Haulage will be by locomobile engine rigged on a truck constructed at the shops of the company in camp. The tungsten-bearing ore in this camp is a scheelite, which is associated with garnet. The country rock is granitic. The situation is in a narrow cañon locally known as Deep Cañon. At the head of this cañon, or gulch, the formation inclosing the scheelite is exposed by large croppings and in the Standard Co. holdings so boldly exposed that it forms a quarry.

The camp has naturally an aspect of newness, but at the same time a very positive appearance of permanence. The offices and stores and some of the dwellings are neat, portable wooden houses. There are also a number of substantial tents occupied as dwellings. But most of all, the permanent construction and installation of treatment plants and practical methods adopted in mining and extracting the ore are indicative of the purpose of the operators to make the camp a permanent producer of tungsten. The situation is about seven miles west of Bishop. The road to the town is by no means a good one, though sufficient excuse may be offered by the fact that all the machinery going into the installation of the mills has been wagon- or motor-hauled from Laws, the railroad station on the narrow-gage branch on the Southern Pacific, which runs south from Tonopah Junction to Keeler. Bishop is situated six miles off from the railroad, which is a distinct disadvantage to the town, but since the dependence of the town is largely upon agriculture and horticulture in Owen's Valley, the people of Bishop are not much disposed to grumble about inadequate railroad transportation convenience. The permanent establishment of the Tungsten Mines Co.'s camp will most likely awaken the people of Bishop and Inyo County to the necessity for better wagon roads and more adequate rail transportation.

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The Silver Position in China

The position of silver in China has a very strong effect on the market. Concerning it Messrs. Samuel Montagu & Co. write from London as follows:

"The situation of silver at the present time, considered from the point of view of China, is more than usually interesting. The rise in the price to the neighborhood of 37d., which took place in the early part of May, could not fail to affect strongly the trade, prices and currency of that country, all of which depend largely upon the gold value of silver. In the case of so vast an extent of territory as China and one so ill-provided with communications, the influence of silver prices, though sure, can only permeate in a slow fashion, and it is possible that recent sales on Chinese account were set in motion by the rise, even though it occurred 10 weeks ago.

"Another cause of the freedom with which China has sold silver may have been the moratorium proclaimed in that country. A suspension of specie payments would create a fear in the minds of the Chinese, always upon their guard against officialdom, lest their silver treasure might be annexed. Thus a steady flow, as secret as possible, would ensue toward the Treaty Ports. The accumulation of such fresh stocks would naturally provoke sales of silver to India and London.

Possible Export of Silver

"The permanent currency requirements of China however, must not be overlooked. It is only possible to hazard guesses as to the amount of silver of which China has been relieved during the last year and a half, but without doubt it is extremely large. Shipments to the extent of 8,500,000 taels were made on Russian account in 1915. Assuming a third of that amount to have been remitted in the current year, the total during 18 months would be some 13,000,000 oz. Add to this at least 20,000,000 oz. in sycee or dollars sold to the Indian government, the Indian Bazaars and London, and a total of 33,000,000 oz. is arrived at. No one at all conversant with the currency requirements of China can imagine that that country can dispense with so large an amount of its stock for any great length of time, for in normal times China attracts annually an amount of the world's supplies which compares appreciably with the total lately disgorged.

"Hence, sooner or later, China will have to make good this efflux of specie, and the return of the silver may coincide with an agreement between the provinces recently at variance, and the restoration of public confidence which would follow that event. It should be borne in mind that the extent of the anticipated replacement would depend upon the price of silver. The higher the price the less silver is likely to flow back.

"The rumored loan of £6,000,000 to be made to China by the United States may be remitted partly in silver, though the latter country will endeavor to send as large a proportion as possible in manufactured goods."

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A. I. M. E. Tour of Arizona Mines

For the first time in its history, the American Institue of Mining Engineers will hold its meetings within the State of Arizona. A special train will leave New York on Thursday, Sept. 14, at 5:30 p.m., but members and guests may join it at other points en route.

Arrived at Santa Rita, N. M., on Monday, Sept. 18, an inspection will be made of the Chino Copper Co.'s mines and also of the Empire Zinc Co.'s mill, arriving at Hurley in the afternoon for inspection of Chino.

The program at Douglas, Ariz., the next day, includes visits to the reduction works of the Copper Queen and of the Calumet & Arizona companies. The first technical sessions will be held in the afternoon and evening on the subjects of smelting and leaching respectively.

Wednesday, Sept. 20, will find the party at Bisbee for an early visit to the mines of the district, to be followed in the afternoon by a technical session; subject, "Mining and Geology of the Warren District." The evening will be given over to a banquet and social evening.

Arrived at Globe the next morning, the party will visit the mines and reduction works of the Old Dominion company. The subject of the afternoon technical session will be, "Concentration and Flotation." The evening's banquet will be followed by a technical session on the subject of fine grinding.

Friday Sept. 22, will be spent in a visit to the reduction works of the International Smelting company and the concentrators of both the Miami and Inspiration companies. The technical session of the afternoon on the subject of mining and smelting will be followed by a banquet and social evening. The Ray Copper Co. will welcome members and guests who desire to visit its mine at Ray, but those taking this trip must rejoin the party at Phœnix.

Sunday, Sept. 24, is bound to be a memorable day. Arriving at the Grand Cañon of Arizona at 8 a.m., a visit will be made to the river 6,000 ft. below the level of the plateau. Leaving the Grand Cañon at 7:40 p.m. Sunday night, the return will be made via Alberquerque, Kansas City, and Chicago, reaching New York on Sept. 28.

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Chile Copper Co.

The production figures of the Chile Exploration Co., which is the operating company owned by the Chile Copper Co., for the first six months of 1916, are:

PRODUCTION OF CHILE EXPLORATION CO.

1914	Lb.
January, actual	2,066,782
February, actual	3,144,480
March, actual	3,536,796
April, actual	3,702,327
May, cabled	3,664,000
June, cabled	3,610,000

In future the company will publish its production figures monthly.

Editorials

The Average Price of Copper in 1915

All the principal copper producing companies now having made their public reports for 1915, if they do so at all, it is possible to compare their average receipts for copper in that year and also make comparison with our quotational average, as in previous years. Let it be noted at the outset that 1915 was a phenomenal period, and one in which conditions were extraordinarily confused; also that many of the important producers which previously had reported both their gross price (including freight to delivery point of the refined copper, etc.) and net price, in 1915 gave only one figure without explanation, leaving it uncertain whether it stood for the gross or net. In certain cases it is possible to deduce clearly that the gross price is given, and probably that is so in most of the other cases unless the contrary be stated. Anyway, it may be accepted that the several reports in the accompanying table do not mean the same thing; also, that the difference between net and gross price in 1915 was larger than usual, owing to the greatly increased cost of delivering copper both at home and abroad, but especially the latter.

However, a more important discrepancy arises from whether the companies reported their average receipt on the basis of copper sold and delivered or on sales alone. The year was one of steadily rising prices, which by the end had advanced hugely as compared with the beginning; and moreover, the production and sales expanded in volume during the year. Indeed, during the first quarter, when copper was low, about all the companies were operating on a curtailed basis and prices were then at the lowest. As the price advanced in the second quarter, production was increased and the latter tendency continued throughout the year, and there was a large carry-over of copper produced and sold in 1915, but not delivered and paid for until 1916.

If, therefore, a producer reckoned the proceeds of his 1915 production, awaiting the returns for such of it as was delivered in 1916, he obtained the credit of a much higher figure than another producer who reported only what he had sold and delivered. For example, the North Butte company delivered 19,725,510 lb. @ 16.703c. per lb., but it sold 27,805,869 lb. @ 18.114c. With conditions as they were, the quantitative average should have exceeded the arithmetical quotational average.

The discrepancy among the returns of the several producers is explained to a large extent in the ways previously indicated. The fact that Phelps, Dodge & Co. obtained only 16.079c. does not mean that its sales department was asleep, but simply that its accountants reported only the copper that had been produced and realized. Others evidently reckoned the copper produced in 1915, but not delivered and paid for until 1916.

It cannot be deduced positively from the Hayden-Jackling reports just what their figures mean. The Utah, Nevada, Chino and Ray companies reported an aggregate of 336,350,381 lb. @ 17.521c. All this copper was sold by the American Smelting and Refining Co., which reported a production of 551,798,000 lb. valued at 16.13c. The returns of other companies selling through that agency were more in line with the latter figure than the former. In 1914 there was no such discrepancy, for the matter of carry-over does not make so great a difference when the prices over the turn of the years is not very different, as often is the case. The Hayden-Jackling companies in 1914 reported 275,938,710 lb. of copper sold at an average of 13,313c., while the American Smelting and Refining Co. reported a production of 529,686,000 lb., valued at 13.46c.

COPPER SALES IN 1915

Company	Lb.	Proceeds	Av. Price
Chino	64,887,788	$11,303,957	17.42c. (a)
Miami	41,907,754	7,262,884	17.331 (b)
Nevada Consolidated	62,726,651	11,069,671	17.647 (a)
North Butte	19,725,510	3,294,752	16.703 (c)
Phelps, Dodge & Co.	194,925,668	31,342,098	16.079 (d)
Ray Consolidated	60,338,936	10,470,274	17.352 (a)
U. S. Sm., Ref. and Min	26,923,674	4,895,532	18.183 (e)
Utah Copper Co.	148,397,006	26,235,331	17.679 (a)
Total	619,832,987		**17.299**
E. & M. J. average			**17.275**

(a) Probably figured on copper produced and sold in 1915 but partly delivered and paid for in 1916. Whether gross price or net price not stated.
(b) Gross price.
(c) Produced and delivered in 1915. Whether gross price or net price not stated.
(d) Produced and delivered in 1915 Net price.
(e) Average of sales. Whether gross price or net price not stated.

PRODUCTION, SALE AND PRICE FOR COPPER FOR 11 YEARS (a)

Year	Total Production	Pounds Reported	Average Realized	Quotational Average
1905	219,000,000	82,372,955	15.597	15.699
1906	224,071,000	113,411,645	19.146	19.616
1907	220,317,041	66,316,025	18.043	20.661
1908	222,267,444	125,949,248	13.348	13.424
1909	226,602,134	136,005,773	13.221	13.335
1910	221,400,864	126,710,763	12.96	13.039
1911	216,112,867	135,329,098	12.657	12.634
1912	1,228,333,298	552,155,308	15.841	16.341
1913	1,406,448,665	658,533,402	15.222	15.269
1914	1,342,634,206	566,687,750	13.458	13.602 (b)
1915	1,411,652,418	619,832,987	17.299	17.275

(a) Up to 1912 the figures represent Lake copper production and sales, but few of the producers of electrolytic making detailed reports in that time. Beginning with 1912, the figures represent electrolytic copper only. The figures for "pounds reported" and "average realized" do not include the United Metals Selling Co. (Anaconda), which does not publish these details. However, it is a reasonable assumption that its results were not very different from those of the other companies, for John D. Ryan has stated that in the 10 years ending with 1913 his companies sold 5,560,000,000 lb. of copper at an average of 14.82c., delivered to the buyers in Europe and America. This would be equivalent to 14.62@14.67c., net cash, New York. During the same 10-year period, Phelps, Dodge & Co. reported an average of 14.56c. per lb., net cash, New York, actually realized. The arithmetical mean of the quotational averages for electrolytic copper in this period is 15.06c.

(b) Average for nine months. No quotations in August, September and October. However, the bulk of the copper sold in 1914 was disposed of before and after those months, wherefore the comparison on the nine months' basis is approximately correct.

A comparison of the production of copper, the quantity reported produced and delivered or produced and sold, the average price received and the *Journal's* quotational average—all these figures extending over a series of years—is given in an accompanying table. The quantity sold, from which the average is computed, is really larger in proportion to the production than is indicated by the table, for upward of 200,000,000 lb. annually of the A. S. & R. Co. is sold at about the same price as reported for Utah, Chino, etc., the sales of that agency being divided proportionately among the constituent producers. The largest part of the remainder of the production is represented by the Anaconda sales, the average of which is not given in the official report of that company.

The close agreement between the average realized by eight companies in the sale of about 620,000,000 lb. of copper in 1915, as officially reported by them, and the quotational average of the *Journal* is more of a coincidence than a check, for the realization is figured on proceeds computed in different ways. Nevertheless the actual agreement was probably about as close. The average realized by the companies for their copper produced and delivered in 1915 was probably about 16.08 to 16.50c., net cash, New York. The average realized on sales was probably about 17¼c., net cash, New York.

Reverting to the discrepancy among the company reports for 1915, when it was unusually wide, it would be an improvement if all the producers would reduce their figures to a uniform basis of net price and according to a uniform system of accounting. This is desirable not only for the purpose of comparison, but also for precise knowledge of just how the companies stand. So long as things are at sixes and sevens in this particular, there is a danger of confusion about overlaps, which there would not be if things were reduced to a uniform basis.

Non-Ferrous Metallurgy

The next award of the gold medal of the Mining and Metallurgical Society of America, which will be made in January, 1917, is to be for distinguished service in the art of smelting metals other than iron. It is rather unfortunate that we have no good term for the description of that branch of metallurgy and are obliged to refer to it as "non-ferrous," smelting, or more broadly "non-ferrous" metallurgy. There is a similarity among the metallurgies of copper and lead, and even of zinc, tin and antimony. Between those metallurgies and that of iron there is a great practical difference, wherefore there is a sharp division which is indicated by the terms "ferrous" and "non-ferrous" in default of anything better.

In selecting non-ferrous smelting for its next subject the council of the Society means practically copper smelting, for two reasons, viz: (1) Copper smelting is more important industrially by far than any other kind and (2) there is no other branch of the art in which there have been major improvements save perhaps in the case of lead. In tin there has been nothing, though electrolytic refining may become a major development. In antimony the Herrenschmidt method is without doubt an improvement of outstanding character, but the metal itself is of minor importance. In zinc the names of Wetherill and Hegeler, two inventors whose work made important and lasting impressions, rise among those that deserve high honor, but both of those men are deceased and among modern zinc-smelters there is no one who has put a deep stamp on his art.

With respect to the metallurgy of lead the condition is different. The introduction and development of the process of blast-roasting by Huntington and Heberlein, Dwight and Lloyd, was one of the great improvements of all time. That process is not, however, confined to lead, being used also in connection with copper smelting, wherefore we get back to our premise that the choice of the M. & M. Society means practically copper smelting.

In copper smelting there is a wealth of great ideas and great things to weigh and appraise. It is well that the award of the M. & M. medal is not limited to members of the Society. Anybody—American or foreigner—may be chosen for the honor. It is interesting to look over the field.

The development of the great modern smelting plants, of which the Washoe was the first, was a thing of high importance in the art. With this are associated the names of Frank Klepetko, the pioneer, and E. P. Mathewson and L. D. Ricketts. At one time pyritic smelting played a great part in the metallurgy of copper and there were several metallurgists who were eminent in it, paving the way for a process that added greatly to the wealth of the world. For a long time there was a ding-dong contest between the blast furnace (operated pyritically or semi-pyritically) and the reverberatory. The same Mathewson built furnaces of each kind of previously unparalleled proportions. The blast-roasting process overcame the fine-ore trouble and seemed likely to established the lead of the blast furnace, when coal-dust firing gave victory to the reverberatory. With the last feat the name of David H. Browne is undisputably preëminent. An accomplishment of equal importance in technology was the development of the basic copper converter with which the names of Peirce and Smith are associated. But before all of these things was that great stride—electrolytic refining.

Here we have a rich field out of which to select some metallurgist for special honor as the renderer of service that in the minds of professional men entitles him to honor above others.

What Is the Matter with the Copper Stocks

A question that is asked us as frequently as any other is, "What is the matter with the copper stocks?" It might equally well be asked "What is the matter with the railway stocks, industrial stocks and good stocks generally?" In market value all of them have failed to appreciate in comparison with the wonderful change in their financial position. Columns have been written on this subject, pointing out how many of the standard copper stocks are selling for less than they did just before the war why should this be?

The best answer to the question, we think, was given by a writer in the New York *Evening Post* last week, who said "The real, underlying factor is the fear of the investing and speculating public of the end of the war. That fear overshadows everything. Military experts may tell us that the war is going to last at least another year; the public does not know; it is not confident that the military experts know, and it is not betting its money on it. There is uncertainty both as to when the war will end and as to what will happen when it does end. We are not sure there will be a depression after the war is over, but we do not know; and the uncertainty is enough to stop buying."

Adding to this the knowledge that there has been large selling in our market of rails, industrials and coppers, which probably is still going on, and we have an adequate explanation of the failure of the stock market to respond to the improvement in corporate affairs.

People in the purlieus of Wall St., intoxicated by the huge profits that many of the industrial companies have realized, have worked themselves into the frame of mind that causes the return of peace to be regarded as a bogy. How can intelligent thought be so perverted? The return of peace would be the greatest conceivable blessing to mankind, and to his commerce and industry. It may be followed by disastrous conditions—even the bankruptcy of Europe—and may be not; but if the former, things will be the worse the longer they be put off, and if the latter, the better they will be. The return of peace is something to be welcomed, not merely from the humanitarian standpoint but also from the economic. That it should be regarded as a bogy is nothing but the manifestation of an unhealthy growth in swinish minds.

BY THE WAY

During 1915 secondary metals were recovered from scrap, sweepings, etc., in the United States to the value of $114,304,930, according to U. S. Geological Survey.

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While not generally regarded as interested in mining, the appraisement of the estate of the late J. P. Morgan, recently published, disclosed the fact that he held at the time of his death mining securities valued at more than $1,000,000. These included $268,000 of Cerro de Pasco Mining Co. 6% debentures, valued at $192,960; 5,500 shares, Cerro de Pasco Investment Co., $550,000; 27,784 shares, Champion Reef Gold Mining Co. of India, $69,864; 4,730 shares, Mysore Gold Mining Co., $121,716; 12,000 shares, North Star Mines Co., $132,000; 20,000 shares, Stratton's Independence, Ltd., $9,745; 1,125 shares, Transvaal Gold Mining Estates, Ltd., $15,759; Mr. Morgan owned worthless stocks of a par value of more than $7,000,000; among these were shares in three mining companies, probably acquired through trade as most of them were not of a type that would have appealed to him for investment; they included 4,000 shares of ordinary and 2,857 of preferred shares of the Nine Reefs Gold Mining Co.; 30,000 shares of Candelaria Mining Co. and 100,000 shares of the Bassick Gold Mining Co. The total estate was appraised at $78,149,024 of which $18,933,951 was in stocks and bonds, a nearly equal amount in art collections in the Metropolitan Museum of Art, and about $5,000,000 was represented in his library which was his crowning achievement as a collector. It is interesting to note that his mining securities represented about 5.75% of his stock-and-bond investments, an amount much larger than would have been generally supposed.

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July Mining Dividends

Disbursements in July to stockholders by 41 United States mining companies making public reports amounted to $11,878,960, as compared with $11,052,732 in July, 1915. Iron, industrial and holding companies allied to mining paid $3,842,094 in July, 1916, as compared with $2,469,821 in 1915, while Canadian, Central American and Mexican companies paid $1,201,912 as compared with $962,129 a year ago.

The record of United States mining companies for last month is a distinct change from that of the earlier months of the year, during each of which the amounts paid were greatly in excess of the dividends of the corresponding period in 1915. The smallness of the increase here recorded is probably accounted for by the fact that last year the Anaconda company paid its quarterly dividend in July, and this year will pay it in August. Also, Goldfield Consolidated, which paid over $300,000 last year is not now on the list, and the Tennessee Copper Co. passed its regular dividend, amounting to about $150,000. Other companies which paid in July, 1915, and not in July of this year were: Interstate-Callahan ($575,000), Stewart, ($133,392) and Utah Consolidated ($150,000), as well as a few smaller ones.

The Champion dividend was paid to the Copper Range Co. and the St. Mary's Mineral Land Co., each of which owns one-half of the stock. The payment by the Engels Copper Co. was its initial dividend. The New Jersey Zinc Co. dividend was an extra of $10 per share. The Hollinger payment of 5c. a share is the first dividend on the new stock of the Hollinger Consolidated Mines Co.; the rate is the same as before, as four shares of the new stock is equivalent to one share of the old. The Republic Iron and Steel paid the regular quarterly dividend of $1.75 on its preferred stock and $2 back dividends.

United States Mining Companies	Situation	Per Share	Total
Ahmeek, c	Mich.	$3 00	$600,000
Allouez, c	Mich.	2 00	200,000
Ariz. Copper, c	Ariz.	0 36	517,162
Bunker Hill & Sullivan	Ida.	0.50	163,500
Bunker Hill Con., g	Calif.	.025	5,000
Caledonia, l.s.c.	Ida.	.03	78,150
Camp Bird, pfd., g.	Colo.	.17	110,565
Center Creek, l.z.	Mo.	15	15,000
Champion, c.	Mich.	6 40	640,000
Continental Zinc, l.z.	Mo.	1 00	22,000
Eagle & Blue Bell, g.s.l	Utah	05	44,657
Engels Copper Co., c	Calif.	.01½	22,000
Golden Cycle, g	Colo.	02	30,000
Hecla, l.s	Ida.	15	150,000
Homestake, g	S. D.	65	163,254
Inspiration. c	Ariz.	2 00	2,318,942
Iron Blossom, s.l.g	Utah	10	100,000
Iron Cap Cop., pfd., c	Ariz.	35	16,558
Isle Royale, c.	Mich.	1 00	150,000
Joplin Ore & Spelter	Mo.	04½	18,000
Judge Min and Smelt., s.l.	Utah	25	120,000
Kenefick Zinc, z	Mo.	10	20,000
Nat. Zinc & Lead, l.z.	Mo.	05	25,000
New Jersey Zinc, z	U. S.	10 00	3,500,000
North Butte, c	Mont.	75	322,500
Osceola, c.	Mich.	4 00	384,600
Pacific Mines Corpn., g	Calif.	02	12,840
Portland, g	Colo.	03	90,000
Prince Con., s l	Nev.	.05	50,000
Reorg Booth, g	Nev	10	100,000
Shattuck-Arizona, c	Ariz	1 25	437,500
Silver King Coalition	Utah	15	187,500
Silver King Con	Utah	10	63,758
Success, z	Ida.	03	45,000
Tonopah Belmont, s	Nev.	12½	187,504
Tonopah Extension, s	Nev.	15	190,920
Tonopah Mining, s	Nev.	15	150,000
United Verde, c	Ariz.	75	225,000
Utah Apex, c.	Utah	25	132,050
Vindicator, g	Colo.	06	90,000
Yellow Pine, z.l.s.	Nev.	15	150,000

Iron, Metallurgical and Holding Companies	Situation	Per Share	Total
Am. Sm. Sec., pfd. A	U. S.	$1 50	$247,747
Am. Sm. Sec., pfd. B	U. S.	1 25	375,000
Bethlehem Steel, com.	U. S.	7 50	1,114,650
Bethlehem Steel, pfd	U. S.	1 75	260,890
Cleveland-Cliffs Iron	U. S.	2 50	184,253
Republic Iron & Steel, pfd.	U. S.	3 75	765,634
Sloss-Sheffield, pfd	U. S.	1 75	117,250
U. S. Smelting, com	U. S.	1 00	351,115
U. S. Smelting, pfd	U. S.	87½	425,555

Canadian and Central American Companies	Situation	Per Share	Total
Butters Salvador, g	C. A.	$0 24	$37,500
Cons. Min. & Sm., g.s.c	B. C	2 50	209,830
Hollinger, g	Ont	05	120,000
La Rose, s	Ont.	05	74,931
McKinley-Darragh-Savage, s	Ont.	.03	67,431
New York & Hond. Rosario, s	C. A	50	100,000
Nipissing	Ont	25	300,000
Peterson Lake, s.	Ont	01¾	42,032
Porcupine Crown, s	Ont	03	60,000
Standard Silver Lead, s l	B. C	02½	50,000
Temiskaming, s	Ont	03	75,000
Tough-Oakes	Ont	12½	65,188

The totals for the first seven months of the year are as follows: Mining companies, $96,533,884, as against $37,053,776 in 1915; iron, metallurgical and holding companies, $58,371,259, as against $36,633,973 in 1915; Canadian, Mexican and Central American mines, $12,630,599, as against $4,197,751 in 1915. The accompanying table shows details of the month's payments.

PERSONALS

F. C. Floss has gone from Oregon to Perseverance, Alaska.

Lloyd Owen has gone from New York to Anaime, Ibaque, Colombia.

J. P. Chadwick has gone from North Waterloo, Me., to Valparaiso, Chile.

George H. Church has gone from Brooklyn, N. Y., to Salt Lake City, Utah.

George F. Bridger is now in Los Angeles, Calif., having left Pachuca, Mexico.

Shang Lung Tung, recently at Cleveland, Ohio, has gone to Shanghai, China.

George H. Nolde, lately at Wisner, Neb., is now with the Carrara Marble Mines of Nevada.

C. G. Dobson, late of Butte, has gone to British Columbia where he is at the Brittania mine, Howe Sound.

W. B. Weller, lately at Berkeley, Calif., is now with the Boundary Red Mountain Mining Co. at Sardis, B. C.

William Seddon, of Brownsville, Penn., has been appointed consulting engineer for the Pioneer Coal Co. of Illinois.

E. E. Entwistle has been made mechanical engineer at the Steelton plant of the Bethlehem Steel Co. in charge of all construction.

Charles A. Mitke, ventilation expert for the Phelps Dodge Co., looked over some of the mines of the Lake Superior district recently.

John D. Ryan has been at Houghton, Mich., and will go from there to Montana, expecting to return to New York early in September.

P. A. Robbins, manger of the Hollinger Consolidated Co. in Ontario, has been elected a director and made managing director of the company.

H. P. Henderson returned to New York after an extended trip through the West and will shortly leave for Cuba, where he will remain for a few weeks.

F. S. Norcross, Jr., superintendent of the British Columbia Copper Co., went through some of the mines of the Cleveland-Cliffs Iron Co. on the Marquette range recently.

E. O. Welts, of Chattanooga, has been made superintendent of the Roane Iron Co., Rockwood, Tenn., succeeding Frederick H. Clymer, superintendent of the plant since 1907.

Ernest W. Ellis, for some years at the Washoe Reduction Works in Montana, is now superintendent of construction at a zinc plant at Edwards, St. Lawrence County, N. Y.

William F. Stein has resigned as superintendent of the crucible department of the Bethlehem Steel Co., South Bethlehem, and has been succeeded by Samuel T. Harleman.

W. H. Gould has been appointed manager of the New Idria quicksilver mine in San Benito County, California. He was recently at the Harvard gold mine in Tuolumne County.

John M. Baker and **Hamilton W. Baker** have resigned as general manager and mine superintendent respectively of the Baker Mines Co., of Oregon. Their address is now 1043 Emerson St., Denver, Colo.

Harrison A. Dunn is stil imprisoned in the City of Mexico. The latest information from the Department of State is that all of the papers in the case are before a military court and that an immediate conclusion has been ordered.

Earl McIntire, for several years civil engineer at the mills of the Republic Iron and Steel Co., Youngstown, Ohio, has resigned to take a similar position at Ojibway, Ont., at the Steel Corporation's new operation.

W. R. Hulbert, of the Goldschmidt Thermit Co., of New York, delivered an illustrated lecture, supplemented with many practical demonstrations, to the members of the Clinchfield Railway Club at Erwin, Tenn., July 25.

Louis D. Gordon, president and manager of the Cerro Gordo mine, Inyo County, Calif., and Round Mountain mine, Nevada, recently spent two weeks visiting the property, making the trip from San Francisco in a Mercer machine.

H. O. Hofman, professor of metallurgy in the Institute of Technology, Boston, was recently at San Francisco and is now at Salt Lake City. He has visited the lead smelters at Chicago, Omaha, East Helena, Northport, Trail, Selby and Tooele.

Albert T. Keller, who as chief engineer of the Indiana Steel Co., has had charge of construction work at Gary, Ind., has accepted the appointment as chief engineer of construction for the Bethlehem Steel Co., at Sparrows Point, Md., and will have charge of the extensive new work at the Maryland plant.

Charles Pascoe, former metallurgist for the Canadian Steel Foundries, Ltd., and recently connected with the Thos. Davidson Manufacturing Co., Ltd., of Montreal, as consulting metallurgist, has joined the Snyder Electric Furnace Co., Chicago, as metallurgist in that company's research plant, at Clearing, Ill.

H. M. Newcomb, of Haas Brothers, San Francisco, former manager of the New Idria quicksilver mine in San Benito County, California, recently made a visit to his old home place in Maine and also to New York, Boston and other cities in New England. The visit covered a period of five weeks and included the attention to important business matters in New York and Boston. Mr. Newcomb's recent retirement from the management of the New Idria mine was due to his inability to give sufficient personal attention to necessary improvements and developments.

OBITUARY

Cecil W. Pocock died at Edwards, N. Y., on July 19. At the time of his death Mr. Pocock was superintendent of the Northern Ore Co. in St. Lawrence County.

Llewellyn Humphreys died at Los Angeles, Calif., July 14, aged 54 years. Born in Wales he had been in this country for many years. During the last 20 years he had done a good deal of important inspecting work in the states of Utah, Nevada and Arizona.

John A. Kern, a pioneer miner and mine owner of Eldorado County, Calif., died at Placerville June 1, aged 78 years. He was born in Ohio and went to California 61 years ago. He mined on the Comstock and in other Nevada mining districts and married in 1870; his wife, sons and daughters survive him.

Franz Haniel died at Düsseldorf, Germany, in the last week of June, aged 74 years. He was one of the leading figures in the West German coal and iron industries, having been a director of the Gutehoffnungshütte, a partner in the engineering works of Haniel & Lueg, of Düsseldorf, and the shipowning firm, Franz Haniel & Co., of Ruhrort. He was also a member of the council of the Rhenish-Westphalian Coal Syndicate.

SOCIETIES

National Association of Sheet and Tin Plate Manufacturers—This association has been formed by 24 of the leading independent mills in the country. The formation of the National Association is significant, because it absorbs the Sheet and Tin Plate Manufacturers' Association, which had existed for a number of years. All members of the old society have become identified with the new body. Officers follow: President, W. S. Horner, American Rolling Mill Co.; vice-president, Joseph B. Andrews, Newport Rolling Mill Co.; directors: W. S. Horner, W. A. Thomas, Brier Hill Steel Co.; John O. Pew, Youngstown Iron and Steel Co., Ed. Langenbach, Stark Rolling Mill Co.; G. H. Jones, Inland Steel Co.; W. H. Abbott, Wheeling Corrugating Co. The association adopted a resolution strongly favoring contracts which will contain no provision guaranteeing prices against market decline and other objectionable features. It heartily approved the plan of the American Iron and Steel Institute to submit and recommend for the adoption of the manufacturers in all lines of the iron and steel industry a new form of contract, binding the parties to respect it and carry it out.

TRADE CATALOGS

Portland Continuous Filter. Colorado Iron Works Co., Denver, Colo. Pamphlet No. 28-B. Pp. 15, 6x9 in.; illustrated.

Traveling Water Screens. Chain Belt Co., Milwaukee, Wis. Bulletin No. 64. Pp. 8, 6x9 in. This illustrates and describes water screens designed primarily to remove refuse and foreign material from water before it enters power plants and other industrial plants requiring large quantities of clean water.

Monarch-Rockwell Double-Chamber Melting Furnaces and tilting reverberatory furnaces, core ovens, burners, blowers, etc. The Monarch Engineering & Mfg. Co., 1206 American Building, Baltimore, Md. Catalog "TM1". Pp. 28, 9x12; illustrated. This includes description of the "Steele-Harvey" crucible tilting furnaces for melting iron, steel, cyanides, ores, etc.

Editorial Correspondence

SAN FRANCISCO—July 27

Fire at the Mammoth Copper Mine in Shasta County on the night of July 25 destroyed the boarding house, warehouse and aërial tramway terminal. The fire started underneath the old aërial tramway terminal. The greatest loss was of mine stores and the warehouse. Extraction of ore was interrupted for a day because the main air line was warped and cracked by the heat. The line was repaired immediately and underground work resumed Wednesday night. New boarding house was reconstructed out of an unused bunk house and although the men are put to some inconvenience, they are as well cared for as possible. The fire was practically under control when the water supply gave out. George W. Metcalfe, manager, expressed appreciation of the men who—engaged in a strike the day before—fought the fire with great energy and courage. It was due to the service of these men that the compressor house and shops were saved. Had these been destroyed, operation of the mine would have been seriously crippled. Some men were temporarily overcome by smoke, but none seriously injured. The strike and the fire together have caused a delay of four or five shifts of underground work in the mine, but the smeltery has been in continuous operation and within a short time rebuilding and repairs of the burned property will bring conditions back to normal.

Infiltration of Water in the Oil Fields of California has been under investigation by the oil department of the State Mining Bureau. It has been found that a number of localities are in need of correction of damage from this source. One such area is in the northern portion of Buena Vista hills in Midway field, where there are two productive oil sands, with a third sand carrying a large amount of salt water lying between them. The chief oil inspector, Mr. McLaughlin, states that early operation did not clearly recognize these underground conditions, and as a result some wells have passed into or even through the water sand without landing the various strings of casing in such positions as to prevent the water from flooding the productive sands. The matter has been called to the attention of the operators involved and also the Federal receiver. The Bureau has given wide publicity to the legal requirement and the necessity of operators furnishing complete logs of their wells. The larger companies generally have complied and a number of the independents also; but the files are far from complete and the inspector has issued an order to his deputies not to approve any application to deepen, abandon, redrill or shut off water at a well unless the department has been furnished with a complete log as provided by the law of 1915.

BUTTE, MONT.—July 27

A Mine-Safety Station is to be established in Butte. Word has reached here that one of the three mine-safety stations authorized by Congress, for which an appropriation of $101,500 was made, will be established in Butte. The camp has been selected because of the great amount of mining going on in this locality and the importance of extending Government aid in that region. An all-steel rescue car for which contract will soon be let, is to be stationed here. The car will be of special design, equipped with the most modern apparatus for mine-rescue work. It will be manned by an expert crew of life savers, who when not employed at mine disasters will visit different mining camps and train miners in rescue and first-aid work Director Manning of the U. S. Bureau of Mines is expected to arrive in Butte soon to make preliminary arrangements. He will also look into the possibilities of the establishing in Butte of one of the three mining experiment stations for which $75,000 in all was appropriated. Montana people think that Butte is the logical site for such a station and efforts are being made by mining men and corporations to induce the Government to select Butte as the place for it, probably in connection with the School of Mines.

The Big Electrolytic Zinc Refinery of the Anaconda company at Great Falls is to be put into operation on Aug. 10, according to present plans. This is nearly a month earlier than the date set for starting when ground for the new plant was broken last year. The electrolytic and roaster departments are almost finished now and within two weeks everything will be in readiness to start operations at the greatest zinc refinery in the world. It will have a capacity of 5,000,000 pounds of zinc per month and the fact that this zinc will be of the high grade and purity now in great demand will add materially to the profit in getting this new department into operation. In June there were 2,800 men all told on the payrolls at the Boston & Montana reduction department the largest number of men that has ever been employed there at one time. The 2,000-ton concentrating plant at the Washoe Reduction Works at Anaconda is almost finished and it is planned to have it ready to operate by Aug. 5. President John D. Ryan and a large party of men prominent in the mining world are making arrangements to be present on that date and witness the starting up of the concentrator and they will go to Great Falls on Aug. 10 to watch the starting of the refinery. With the operation of both the zinc concentrator at Anaconda and the refinery at Great Falls, the zinc-producing mines of the company, which include the Poulin, Lexington, Emma, Gray Rock and Alice in Butte and the Douglas mine in Idaho, will be called upon to supply 2,000 tons of ore per day.

DENVER—July 25

Resumption of Activities in Silverton, this summer, includes most of the well-known properties. The Tucker-Ballard interests of Colorado Springs are pushing the construction of a modern mill to supplant the mill destroyed by fire some months ago at the Hamlet mine and expect it to be in operating shape soon. The old Silver Lake mill, while being somewhat remodelled to increase its capacity, is running on custom ores from the National Belle, Dora and Green Mountain mines. Otto Mears and J. H. Slattery have taken a long-time lease on the Highland Mary mine and are preparing to push new development systematically.

The Smuggler Mine, a short distance southwest of Rollinsville in Gilpin County, has been freed from litigation and purchased by Omaha men. This property was opened years ago but was never given rational exploitation until the tungsten excitement a year ago brought a group of investors into the district and they selected it and operated it as the A. K. R. mine, these letters being the initials of the purchasers. The new purchasers will immediately enlarge the mill by adding 20 new stamps to the 30 already installed. The ore is free-milling and the mine has already produced several hundred thousand dollars in gold.

At Leadville the owners of the Bartlett tunnel, on Sugar Loaf Mountain, are having a transmission line built to enable the installation of an electric-driven air compressor, it being the intention to renew the driving of this bore along the strong vein that has already produced well even under desultory operation. After it was thought the unwatering of the Fryer Hill area had been accomplished through the Harvard shaft, sinking of the shaft was abruptly postponed by the breaking out of bodies of water presumably in old stopes. At the Penrose shaft, both sinking pumps continue busy throwing approximately 2,800 gal. per min., the water probably draining from stopes somewhat remote from the shaft. Development is being pushed on several levels. Prospect Mountain, north of town, is being prospected carefully with the object of inaugurating operations at numerous points. Owing to the deep overburden covering the formations, mining men have been prevented from opening many mines although the typical Leadville series traverses the large mountain.

Marked Revival of Activity in Leadville is shown by the output of the district for the half-year just ended, during which 402,250 tons were produced, the high mark being reached in June, when 83,250 tons were mined. Production by months were approximately as follows: January 60,000 tons; February, 57,000; March, 63,000; April, 66,000; May, 73,000 and June, 83,250 tons. During these six months, 28 old mines have resumed operation. The most important at this time are: The Mikado recently taken over by George O. Argall, the Greenback owned by Patrick Mulrooney, the Harvard and Tip Top now under the control of the United States Smelting, Refining and Mining Co., the McCormick lately purchased by the Empire Zinc Co. with the Robert Emmet, and the Home Extension in the Down Town section. The others are smaller properties situated in various parts of the district, indicating the most unusual rejuvenation in the history of Leadville; several are already shipping ore. Extensive developments are planned in several sections that have long been neglected.

reaching from Iowa gulch on the south to Prospect Mountain and East Tennessee gulch on the north and including the remote areas in Twin Lakes, Half Moon, and Sugar Loaf on the west. A close canvass of the district shows 109 properties active, not including locations where yearly assessment work is now being done. The only dredge in the district, owned by the Derry Ranch Gold Dredging Co., is operating again and is obtaining a remarkable yield.

SALT LAKE CITY—July 28

Another Hydro-Electric Power Plant is being built by the Utah Power & Light Co. on the Bear River in Idaho, about 1½ mi. below the power station at Grace, which is 60 miles by river below Bear Lake. From Grace a transmission line, 135 mi. long connects with a terminal and substation 6½ mi. west from Salt Lake. This line, which at present transmits power from Grace and two other power stations operating considerably further down the river, will also carry the 11,000 hp. to be generated by the new plant. A dam is to be built across the river just below the Grace power station, and this will receive water after it passes through the Grace power house. A wooden flume—20 ft. wide by 14 ft. high, with reinforced concrete framing, and 6,000 ft. long—will deliver 1,250 sec.-ft. to the new plant. From Bear Lake the company has built a canal, which delivers water into Bear River in the dry season. To increase the efficiency of this canal, a pumping station is being installed between Bear Lake and Mud Lake. There will be five electrically driven pumps, having a combined capacity of 1,500 sec.-ft.

SPOKANE—July 26

Site of the Federal Mine Experiment Station is a subject of much discussion among mining men here and there is bitter opposition to the proposed selection of Seattle for this northwestern station. Protests have been sent from different parts of eastern Washington and practically all of Idaho and Montana to Franklin K. Lane, Secretary of the Interior, and the congressional delegations from the three states. Commercial organizations and mining associations in the different districts have joined in the protests, and the result has been that Secretary Lane has announced that Director Manning of the U. S. Bureau of Mines will be in Spokane about Aug. 6 to investigate the situation. The protests are based on the contention that Seattle is not a logical site for the station, in that it is remote from all the producing metal-mining regions of the northwest, and that if the plant is located there it will defeat the government's purpose in establishing it. Different points in the intermountain region have been suggested as a site for the experimental plant, but there is a tendency to unite on any place in the mineral region that will be satisfactory to the majority, and the fight at present is being confined to convincing Secretary Lane that Seattle should not be considered in any event. Spokane and Butte have both been suggested as more logical sites for the new station.

OATMAN, ARIZ.—July 26

The Oatman Water and Sewer Co. may relieve the Tom Reed Company of the obligation to supply water to the town of Oatman. Inasmuch as the town was the outcome of the development of the Tom Reed mine, it was natural that the company should have supplied the town with water but now that Oatman has grown beyond a one-mine town, the obligation has become a little onerous, especially as the Tom Reed now desires to use this water for its own purposes. The Arizona corporation commission, however, notified the company that it could not suddenly withdraw from this public-utility service. It appears now that a new corporation, the Oatman Water and Sewer Co. has been formed and granted permission by the corporation commission to furnish water to the townsites of Oatman, Mazona and Old Trails. The company has purchased the Lexington, Arizona and the Mazona water works systems, the old Orion pipe lines and the water production of the Big Jim and will pump water about 11 mi. from wells near the Colorado River. The wells are estimated to yield about 150,000 gal. every 24 hr. and the Big Jim will furnish about 100 gal. per min. The new company will also furnish water for the old Orion mill, which is being overhauled and modernized for the purpose of doing a custom business. Its 20 stamps are expected to be dropping in about 60 days. The mill proposes to treat ores from the Big Jim, Golconda, Arizona Tom Reed, Lexington Arizona, Boundary Cone, Paramount and the Oatman Belle. The officers of the water company are W. H. Wise, of Los Angeles, president; V. S. Rowely, vice-president, F. F. Brush, secretary-treasurer.

JOPLIN—July 29

Restoration of Electric Service for the mines of this district was established last [illegible] [illegible] the completion of repairs to the damaged turbine [illegible] [illegible] District plant at Riverton. Continued curtailment of production is threatened, however, by a shortage of water. Only slight showers have fallen in the Kansas and Missouri sections of this district since June 19, and many properties are unable to get sufficient water for mill operation. Mines at Neck City and in the West Joplin camp are down and others may have to close. In the Arkansas field the water famine is even more important as most of the mines there depend on small creeks. The Bonanza mill on Cow Creek is able to operate only half time. The Dixie Girl mill, a new plant, can get no water for operation. The Bear Hill has been down for some time on this account. The water supply for the Omeara on Boat Creek has failed.

DULUTH—July 29

Work Has Been Resumed on the Mesabi Range by about 50 per cent. of the striking miners and there are more mines operating this week. There have been a few demonstrations of late, but the remaining strikers are not taking the interest that they did. Many are holding out because they believe that the dock workers at Duluth, Two Harbors and other places will strike unless certain demands that they have made to the railroads are complied with. The dock men want higher wages, as do the crews on the lake carriers. It looks almost certain that if the raises are not granted the iron-ore business is going to suffer. The mines can get out all of the ore that is required, but if the dock men and boat hands should start trouble there would be a tie-up. The Minnesota branch of the American Federation of Labor held its meeting a few days ago and decided to give assistance to the striking miners of the Mesabi district. They stand ready to send in leaders and funds, but the Industrial Workers of the World, which started the strike, is not in favor of such a move. The men are coming to realize that they cannot hope to win out as long as they are associated with the I. W. W., as the mine operators are firm in their stand not to treat with that organization. Secretary of Labor Wilson sent two Federal investigators to the range this week, to try and bring about a settlement. They will never be successful because the companies will not send representatives to a meeting where I. W. W. leaders are in evidence. The hearing of the 14 men who are charged with murder was held in Duluth this week. Four of the men were ordered released as they did not have a hand in the affair at Biwabik. The others will have to await the action of the grand jury at Virginia.

TORONTO—July 29

International Nickel Co. has taken the first step toward the establishment of a Canadian branch by the securing of a federal charter of incorporation for the International Nickel Co. of Canada, Ltd., capitalized at $5,000,000, with head office at Toronto. As is usual in the case of large corporations, the real interests involved are not indicated, the nominal incorporators being lawyers and clerks. The establishment of the head office in Toronto leads to the inference that a site in Ontario will be selected for the plant, possibly in the Sudbury district, though representatives of the company are this week looking over sites in the Niagara district.

The Dispute Between Miners and Operators at Cobalt will be dealt with by a royal commission, which will shortly be appointed by the Canadian government. The miners have been agitating for an increase in wages, and complain that the management of the Mining Corporation of Canada, operating the Cobalt Townsite and Cobalt Lake mines, has dismissed workmen for belonging to the union. The mine operators have refused to confer with the representatives of the men, because they are affiliated with the Western Federation of Miners. Hon. T. W. Crothers, Minister of Labor, was appealed to and asked to appoint a board of investigation and conciliation under the Industrial Disputes Investigation Act. This was considered impracticable, owing to the lack of organization among the operators, as unless the latter came together for common action it would be necessary to appoint a separate board to deal with the situation in each mine. As a way out of the difficulty the appointment of a royal commission was suggested by the Minister and approved by the miners. The constitution of this body rests entirely with the government, but it is understood that they will accept suggestions as to the personnel of the commission from both parties to the dispute. No definite demands have been made on the operators, but the miners wanted a general raise of 50c. a day. When the question of higher wages first came up, the operators granted a raise of 25c. a day to all employees, and a further bonus of 25c. a day to underground workers when silver sells during the month for 70c. an ounce or over. This bonus was paid for only one month, and the employees, particularly the surface men, to whom the bonus did not apply, appear to be dissatisfied. Drill runners are now receiving $3.50 per day, and the minimum wage for surface men is $2.50. There are between 2,500 and 3,000 miners in the district and a vigorous campaign has been carried on for some time to strengthen the union, the membership of which has been increased during the last few months from 200 to over 1,000 miners.

The Mining News

ALASKA

ALASKA MEXICAN (Treadwell)—In June, mill ran 25 days, 21 hr., crushing 15,820 tons yielding $16,505, or $1.05 per ton; operating expense $24,992; operating loss, $8,486; construction $4,405.

ALASKA TREADWELL (Treadwell)—Crushed in June 78,918 tons yielding $131,730, or $1.69 per ton; operating expense, $95,894; operating profit $35,835; construction $17,392; net profit, $18,443; other income $11,200.

ALASKA UNITED (Treadwell)—In June crushed in Ready Bullion mill 24,220 tons, in 700-ft. Claim mill 20,335 tons, yielding $49,019 and $20,210 or $2.04 and $1 per ton respectively. Ready Bullion operating profit $18,725; construction $4,003; net profit, $14,721. 700-Ft. Claim operating loss $20,337; construction $6,597; net loss $26,934.

ARIZONA

Cochise County

CALUMET & ARIZONA (Warren)—Producing copper at rate of 70,000,000 lb. a year, output for first six months having been 34,875,000 lb.

COPPER QUEEN (Bisbee)—Water from Czar and Holbrook shafts, after running through the precipitating plant, will be pumped back through the upper and shallower workings, passing through old filled stopes and low-grade orebodies and ultimately through the leaching plant again.

Gila County

COUNTY ROAD being extended with force of 22 men from mouth of Russell's gulch to summit, thence down old Bob Tail road across Panadosa Copper Co.'s property to Greater Miami and the Arizona Zinc and Lead, thence to the Ray road. Will open rich mineral district.

GREATER MIAMI COPPER (Miami)—N. M. Tanner and W. L. Card making detailed examination. Contractors McGee & Sikes 75 ft. in new tunnel.

INSPIRATION (Miami)—Making preparations to add 19th and 20th units to mill; mine hoisted 19,700 tons in one day, while the mill has put through as high as 17,800 tons.

Mohave County

RAILROAD AND A WATER SYSTEM are now promised for Oatman. The water supply may be undertaken by Oatman Water and Sewer Co.; would relieve Tom Reed company of obligation to furnish town with water it needs for milling purposes.

UNITED EASTERN (Oatman)—Headframe over new No. 2 working shaft practically completed; shaft, down 375 ft., will be sunk at increased speed.

ORION (Oatman)—This company's stamp mill will be reopened as custom mill, affording an outlet for ore now being piled on the various dumps.

Pima County

AMERICAN SMELTING & REFINING (Tucson)—This company has taken lease on Morgan mine, an old producer in Twin Buttes.

LOST FRENCHMAN (Ajo)—Opened by E. H. Johnson and associates; gold quartz outcrop traceable 3,000 ft.; crosscut at 50-ft. depth has 16 ft. good ore; high-grade ore on dump.

BUSH-BAXTER (Twin Buttes)—E. G. Bush will continue development at Minnie mine, option on which was relinquished by American Smelting & Refining Co. as payment of $100,000 became due before development of another lens was accomplished.

Pinal County

TROY-ARIZONA (Troy)—Sulphide ore assaying $4.50 gold and 5% copper struck in Rattler shaft.

PINAL DEVELOPMENT (Kelvin)—Preparing to ship 6 cars of copper-gold ore from Renfro mine to Hayden smeltery; 600-cu.ft. compressor, hoist and machine drills ordered.

Yavapai County

SUNNYSIDE (Prescott)—Optioned to H. A. Groom, of Phœnix.

PITTSBURGH-JEROME (Jerome)—Main shaft down 695 ft.; building road to property.

McNULTY & McBRIDE (Prescott)—Sold 50 claims in the Copper Creek section to the Daly-Crawford-Lewisohn syndicate for approximately $300,000.

ARKANSAS AND ARIZONA (Jerome)—Unwatering resumed; W. H. Gallaghan, formerly of the Cobriza in Cochise County, is superintendent.

HOMESTEAD (Walker)—Acquired by J. J. Shockley and associates of New York; at 75-ft. depth, 3 ft. of gold ore of milling grade found in loose formation.

SHELDON MINING (Walker)—Acquired holdings of Major Mining and Milling, Stuckey Bros., Metals Milling and the Empire Mining, which will be merged into one group; John F. Pell, Newark, N. J., president.

ANGLO-SAXON SMELTING CO. (Prescott)—This company, incorporated by British interests, to build a custom smelting plant; construction to begin in December, if Federal tax on copper is not imposed. Contemplate two copper reverberatories, and one lead stack of 250-tons capacity. May erect concentrator, also.

CALIFORNIA

Amador County

KENNEDY (Jackson)—High-grade ore reported on lower levels. Tailings dam to be increased in height.

PITTS (Pine Grove)—Installation of 10-stamp mill nearing completion; was formerly at Climax mine. Bonded to M. Robinson.

CONSOLIDATED AMADOR (Sutter Creek)—Water lowered to 380-ft. point below collar and shaft repaired. Upon reaching the 600 level additional pump will be installed. Timbers found in good condition thus far, many sets requiring only renewal of one member.

CENTRAL EUREKA (Sutter Creek)—Preparations made for sinking shaft below 3,200 level. Twenty stamps are dropping and 10 more will be started in a few days; ore supply coming from lowest three levels.

SOUTH EUREKA (Sutter Creek)—Underground hoist being installed at 2,200 level of the Oneida to sink winze and carrying on development work. New hoist has capacity of 1,500 ft. Main shaft unwatered to a point within 400 ft. of sump and the ground between shaft and winze will be thoroughly explored. Twenty stamps dropping at Oneida and 80 at South Eureka. H. Malloch, of San Francisco, general manager, and William H. Schmal, superintendent.

Inyo County

KEAN WONDER (Bishop)—This old mine in Death Valley region, owned by the Frances Mohawk Co., of Goldfield, Nev., is to be reopened. Cyanide plant operating on tailings from the old mill but management decided to concentrate future work on development of new ore reserves; if results warrant new mill will be installed.

REWARD (Independence)—Reported sold to Crown Reserve Mining Co. of Montreal; work will be started on large scale soon.

TUNGSTEN MINES CO. (Bishop)—Large vein disclosed in Little Sister claim 390 ft. from portal of tunnel and 210 ft. below the collar of the shaft.

Nevada County

RED LEDGE (Nevada City)—Chrome ore being hauled to Nevada City for rail shipment to Eastern buyers. Between 300 and 800 tons of chrome ore developed.

GRASS VALLEY CONSOLIDATED (Grass Valley)—Preparing for extensive work at the Allison Ranch property. Electric pumps, hoist, compressor and power drills will be installed.

NORTH STAR (Grass Valley)—Operating mine from Central shaft which has been completely equipped. Old surface equipment of the North Star, proper, being dismantled, only foundations remain of buildings that have been in existence for 40 years. Mill is to be enlarged. Some of best ore now going to the mill is from the 6,300 level at bottom of inclined shaft. Executive and administrative operation will be from Central shaft.

Sacramento County

NATOMAS (Natoma)—Natoma No. 1 dredge which is being rebuilt has been floated and installation of machinery is in progress. Expected to be digging by October, between Fairoaks and Jura.

Siskiyou County

VICTORY (Yreka)—Mine being operated by Los Angeles men who have installed tube mill and concentrators. Hauling ore to mill with 1½-ton motor truck. Preparing also to build 700-ft. gravity tramway from tunnel mouth to the truck road. Oreshoot is 3 ft. wide. Sinking of shaft contemplated. Property situated 3 mi. from confluence of Russian Creek and Salmon River. John Nefroney, manager.

Tuolumne County

OMEGA (Jamestown)—Property on western slope of Table Mountain being prepared for resumption of mining and milling. Shaft being unwatered.

GLOBE DEVELOPMENT CO. (Chinese)—Chrome ore opened. Four cars shipped in July.

BONANZA (Sonora)—Leased to Senator J. B. Curtin and George Weston who will reopen.

SPRINGFIELD TUNNEL (Springfield)—Assessment levied to install additional drills and extend tunnel to tap gravel channel by a raise Joseph Cademartori, superintendent.

COLORADO

Chaffee County

TURRET COPPER MINING AND REDUCTION (Turret)—Developing two copper-gold veins, one high in copper and the other in gold. F. B. Radon, superintendent.

Dolores County

ENTERPRISE (Rico)—Lessees shipping to Durango smeltery.

EMMA (Dunton)—Being developed under option by Tonopah-Belmont Development Co. Shaft being unwatered preparatory to exploring sixth level. C. S. McKenzie, superintendent.

Gilpin County

PROSPECTING IN ROLLINSVILLE DISTRICT is extending over greater area as snow recedes. On Humdinger claim, west of town, production of tungsten ore being made at high altitude; good float found at several places well above timber line on other claims. District was gold producer, both lode and placer, before tungsten excitement started. Two principal gold mines are Perigo and Gold Dust.

San Juan County

MAYFLOWER (Silverton)—This property in Arrastre Gulch leased to Mears, Pitcher & Slattery. Work will begin at once in upper tunnel, and a 175-ft. raise will be extended from lower to upper tunnel. Wirerope tramway to connect tunnel with Mears-Wilfley mill under consideration. Body of lead-copper ore opened in upper tunnel about 200 ft. from portal; winze sunk in ore 40 ft.; vein averages 5 ft.

Teller County

GRANITE (Victor)—Dillon oreshoot exposed for 500 ft. on 1,400-ft. level; recently cut on 1,600-ft. level.

MODOC (Victor)—Shipping about 100 tons per week; developing on new 1,200 level.

ACACIA (Cripple Creek)—Shipped recently two cars, coarse and screenings, from Eagles vein of South Burns 1,200-ft. level.

ILLINOIS

FLUORSPAR PRODUCTION STOPPED since July 18 at the Rosiclare and Fairview mines owing to strike following organization in May of a local of the Western Federation of Miners and refusal of state to send militia to preserve order. Mines continued to operate until shooting of four men on July 17. These mines in southern Illinois supply most of U. S. fluorspar production, only about 1% being produced outside the Illinois-Kentucky field. Shortage at openhearth-steel plants feared. (Later—Dispatches, Aug. 1, stated nonunion men arming, would order Federation leaders to leave.)

MICHIGAN

Copper

COPPER RANGE CONSOLIDATED (Painesdale)—South levels in No. 4 Champion shaft now extend to limits of property. Further improvement being made in milling, in table recovery.

WINONA (Winona)—Slater leaching process has given good results in reducing copper content of tailings; tested in experimental plant over long period.

AHMEEK (Ahmeek)—Steel work for new No. 2 shafthouse nearly completed. Construction is not interfering with production.

MOHAWK (Mohawk)—No. 6 shaft now down below 15th level; No. 5 is below the 18th level; grade of ore from northerly shafts has not declined.

MICHIGAN COPPER MINING (Rockland)—Work is being done in Butler lode, largely in mass and "barrel" rock.

KEWEENAW (Mandan)—Trestle to mill being rushed. Milling to be started this month. All drills working in drifting; no sinking being done.

HANCOCK CONSOLIDATED (Hancock)—Shipping about 800 tons daily; more than 600 tons from Pewabic lode through No. 2 shaft, this rock being of better grade than at any previous time. Limited shipments through No. 7 Quincy include a good proportion of mass, 3- to 6-ton masses not being infrequent.

MINNESOTA

Mesabi Range

CANISTEO (Coleraine)—The Oliver company is digging drainage ditch here about ¾ mi. long and 22 ft. deep.

WALKER (Coleraine)—Ore now being removed from this pit operated by the Oliver company. Property had been idle so far this season.

CHESTER (Chisholm)—Dry house completed at this mine. Spray is used instead of basin or sink; only mine on the range employing this method; result said to be satisfactory.

CHISHOLM (Chisholm)—Tener shaft, through which ore from the Chisholm mine is now hoisted, is to be relined with concrete. Shaft is 6x18 ft., inside, and is 300 ft. deep. This is the second shaft on the Mesabi Range to be concreted. The process of relining, used last year at the Monroe mine, will be adopted.

MISSOURI

Joplin District

LUCKY JOE (Klondike)—Contemplate building mill.

AMERICAN ZINC (Granby)—Tearing down mill; will erect larger plant.

SHERIDAN (Cardin)—Will build new mill on lease near Cornfield mine.

CONSOLIDATED (Aurora)—Has drills at work and Texas pump draining lease recently acquired. Mill contemplated.

FLANNERY (Sarcoxie)—Good ore being produced from Optimo shaft, recently opened. Third Deisel engine to be installed soon.

SWEETMAN (Duenweg)—Has opened silicate mine, near old McGee mine which was district's greatest silicate producer. Has 15-ft. face at 75 ft.

HANDFORD (Joplin)—Completed draining of 30-acre lease recently acquired and 20 sub-leasing companies are at work. Handford company mining in original 40-acre lease.

Northern Arkansas

AT YELLVILLE, Mineral Belt Traction Co. has been incorporated to operate 50-passenger motor car on recently built railroad to Rush.

SUMMIT HOME (Rush)—Milling with Jeffrey pulverizer and tables. Entire outfit operated by 25-hp. gasoline engine.

CAPPS (Rush)—Gasoline motor installed to pull ore cars from mine to Morning Star mill. First used in Arkansas field.

PHILADELPHIA (Rush)—Averaging 12 to 16 tons of concentrates daily. On three successive days had turn ins of 23, 18 and 22 tons; best record ever made by any Arkansas mine.

MONTANA

Fergus County

HANOVER GYPSUM CO. (Lewistown)—This company which began operating its new gypsum plant at Hanover, 7 mi. west of Lewistown about 10 days ago, has been sold to a syndicate headed by Charles T. Boettcher, president, Denver & Salt Lake Railway Co. It will proceed at once with installation $1,000,000 cement plant to supply Montana and the Dakotas. For present D. R. Brown will act as manager.

Madison County

REVENUE CONSOLIDATED GOLD MINES (Norris)—Formed last fall to develop old mines of Richmond Flat. Force of 25 men working. Mill may be built. G. D. B. Turner, superintendent.

Silver Bow County

TUOLUMNE MINING CO. (Butte)—At the Colusa-Leonard, recently taken over by company, hoist was started July 21 for inspecting shaft and underground workings; found in good shape; as soon as unwatered, sinking will be started to 800 level. At Butte Main Range properties, retimbering in progress; shaft will be ready Sept. 1. Drift from Main Range shaft disclosed ore running as high as 8 or 9% copper. At Tuolumne mine, will explore vein below 2,600 level.

BUTTE & SUPERIOR (Butte)—Report for June shows smaller amount of ore treated in flotation plant and less concentrates recovered than in May. Tons treated in June were 48,475 and concentrates produced 10,830 tons. To decrease further the loss of zinc in tailings, company is making changes in jigs at the mill, using the system of the Timber Butte mill. At Butte & Superior mill tailings run from 0.91% to 1.1% zinc, while at Timber Butte mill loss averages only 0.45%.

NORTH BUTTE (Butte)—Recent developments encouraging. On 800 level Speculator vein is 15 ft. wide, carrying 5% copper and 2 oz. silver per ton. The Sioux Chief on 700 level averages 8.8%. The Edith May on 2,800 level shows 5.5% copper and 2 oz. silver. The North Berlin passed through fault on 2,200 level and now shows 8% copper with as high as 12 oz. silver per ton. June output amounted to 2,096,326 lb. of copper, 90,713 oz. silver and 143 oz. gold. An average of 1,500 tons of ore was hoisted daily.

NEVADA

Elko County

SURPRISE (Jarbidge)—High-grade gold ore up to 3 ft. in width struck in this property owned by J. G. Dufner.

Esmeralda County

LONE STAR (Goldfield)—Development confined to eastern portion of property; south drift from Neligan shaft is yielding encouraging assays.

SANDSTORM-KENDALL (Goldfield) — Southeast crosscut on 350-ft. level encountered vein beneath old lease workings from which rich ore was mined.

REORGANIZED CRACKER JACK (Goldfield) — Drifting north and south on 115-ft. level; south drift in low-grade quartz. Development of 300-ft. level to start soon.

JUMBO EXTENSION (Goldfield)—June profit $36,500 from 2,429 dry tons mined and 563 tons dump ore; total value $92,000. At annual meeting all officers reëlected except A. I. D'Arcy who was succeeded by Charles D. Olney as director.

ATLANTA MINES CO. (Goldfield)—West crosscut on 1,750-ft. level being driven two shif's with about 150 ft. to go to reach projection of ore mined on 1,580-ft. level Grizzley Bear ground. Arrangements made with Goldfield Consolidated to bear major portion pumping expense; water used in Consolidated mill.

Eureka County

PALISADE COPPER (Palisade)—Have opened good orebody; recent shipments ran 13% Cu. Expect to ship carload every fortnight. F. W. Smith, manager.

Lincoln County

PRINCE CONSOLIDATED (Pioche)—Company's new 200-ton concentrating plant at Bullionville is completed. Erected to treat Bullionville and Dry Valley tailings aggregate 120,000 tons. A 1-mi. spur is being constructed from the Caliente & Pioche Ry. to the Dry Valley dumps.

Nye County

TONOPAH ORE PRODUCTION for week ended July 22 was 10,139 tons valued at $208,582 compared with 10,360 tons for week previous. Producers were: Tonopah Belmont, 3,065 tons; Tonopah Mining, 2,300; Tonopah Extension, 2,200; Jim Butler, 1,300; West End, 845; Halifax, 220; Rescue-Eula, 156; North Star, 53 tons.

TONOPAH EXTENSION (Tonopah)—Receiots for June $125,754; expenses $73,594; operating profit $52,160.

KANROHAT (Round Mountain)—Property, comprising 16 claims and small mill in Jefferson Cañon, being sampled. Under option to Sprague interests of Goldfield.

JIM BUTLER (Tonopah)—At recent directors' meeting it was decided to appeal decision of Nevada Supreme Court in apex case against West End Consolidated.

TONOPAH MINING (Tonopah)—June profit $19,950 from treatment of 9,060 tons; average value $12 per ton; 119,325 oz. bullion produced, value $97,250. The 70-ft. headframe at Red Plume shaft is to be moved to the Sand Grass shaft.

WEST END (Tonopah)—At annual meeting, Oakland, Calif., directors and officers reëlected. Report for 1915 shows total operating profit of $270,416; of this amount $109,212 is profit from disputed ore and placed in escrow to await final decision of courts.

GOLD HILL NEVADA GOLD MINES CO. (Tonopah)—On this property in Lone Mountain district, shaft has been sunk 500 ft.; crosscut being driven to tap gold vein. Galena vein also outcrops. Equipped with hoist, air compressor and piston drill. May install Jackhamer. William G. Herman, superintendent. Daniel Hurton, of San Francisco, president.

Storey County

OVERMAN (Virginia)—Began general repairs underground, July 18.

HALE & NORCROSS (Virginia)—Surface tunnel now in good condition to 1,052-ft. point.

CROWN POINT-BELCHER (Gold Hill)—Work in Jacket discontinued on account of change in air conditions; overhauling electric equipment continued; 255 tons ore sent to gloryhole from shaft. Jacket mill received 319 tons mine ore and 486 tons dump rock.

UNION CONSOLIDATED (Virginia)—Extracted 363 tons; gross value over $12,000 as follows: 2,400 level, 144 tons, $62.29; 2,500 level, 41 tons, $12.75 and 177 tons, $12.62. Union shaft reopened by pumping association to 180-ft. point below 2,500 level.

MEXICAN (Virginia)—Extended 2,500 level south drift to 56-ft. point, face shows porphyry and quartz of low assay. Alterations to winze station continued on 2,700 level. Mexican mill received 362 tons custom ore averaging $34.56 and 193 tons Mexican dump rock averaging $14.12.

NEW MEXICO

Grant County

CHINO (Hurley)—Copper output in June, 7,243,618 lb.

Lincoln County

WHITE OAKS (White Oaks)—Reported that Minor S. Keith, of Boston, has taken an interest and that properties will be developed for gold, subordinating tungsten production.

Socorro County

OAKS CO. (Alma)—Developing Clifton mine; encountered good-grade milling ore in winze from adit. Shiping to Sorocco mill.

MOGOLLON MINES CO. (Mogollon)—Mill treating about 900 tons per week; new working shaft at Last Chance mine, now about 800 ft. deep. Company has inaugurated new system of freight delivery from Silver City; transfer station, including oil storage tanks, erected at Glenwood, 12 mi. from Mogollon, and fuel oil and other supplies are delivered there by truck, whence they are hauled over the heavy mountain grades to Mogollon by teams. Other operators still depending on teams or trucks for entire trip of over 80 miles.

PENNSYLVANIA

MIDVALE STEEL AND ORDNANCE CO. (Philadelphia)—Has awarded contract for 500-ton blast furnace at the Worth Brothers Co. plant at Coatesville.

SOUTH DAKOTA

Lawrence County

DEADWOOD STANDARD (Terry)—Property turned over to leasers and 100-ton mill being prepared for operation.

ECHO (Maitland)—Some 20-oz. silver ore encountered on 200-ft. level. New electric pump handling water.

CUSTER PEAK (Roubaix)—New 100-hp. boiler and compressor installed to sink shaft from 250-ft. level where orebody carrying native copper was disclosed.

ANCHOR HILL (Galena)—Bolger & Hammond are getting good results with an arrastre at this property.

RATTLESNAKE JACK (Galena)—William Sansom, of New York, won the first suit of a series which caused operations to be suspended at this mill and mine. Work will be resumed as soon as litigation is cleared.

Pennington County

COLUMBIA (Keystone)—Drifting on vein at 200 level continues with satisfactory results.

HOMELODE (Silver City)—Shaft being deepened; vein maintaining size and contents with depth.

VIRGINIA

CRIMORA MANGANESE CORPORATION (Crimora)—Mill now producing about 40 tons of washed ore daily. Company intends to increase gradually to 200-ton output.

UTAH

Beaver County

MOSCOW (Milford)—New shaft practically completed to the 1,000 level, and work of making connections with old workings will be started. Shaft will do away with unnecessary hauling and give added depth. In June shipped six cars.

Salt Lake County

UTAH COPPER (Garfield)—Production in June, 17,877,432 lb. copper.

CONGOR (Bingham)—Daily shipments of about 50 tons of copper ore from upper working, 200 ft. from surface.

MICHIGAN-UTAH (Alta)—Heavier shipments than ever before being made. Ore coming from Triangle lease in Grizzly and City Rocks workings.

OHIO COPPER MINING (Bingham)—Reorganization proposed with new $5,000,000 corporation—$2,750,000 in stock and $2,250,000 in convertible bonds. Bingham Central Ry. to be included.

SOUTH HECLA (Alta)—New strike in Kate Hays fissure opening satisfactorily. The new ore is 600 to 700 ft. from surface and 2,200 ft. or more southeast of Wedge stope, from which company has been shipping.

SILVER SHIELD (Bingham)—Conditions show improvement. Faulted ore reported by manager to have been found again in bunches in west drift of stope. Plan to sink 8-in. drill hole from surface to facilitate development of Back vein; for this work will sell 10,000 shares of treasury stock at 50c.

WASATCH MINES (Alta)—This company owning 900 acres —600 patented—will soon begin work on its 4,000-ft. tunnel to give an added depth of 300 ft. below the 400 level. Excavation for power plant completed, and machinery on ground. Two 180-cu.ft. compressors will be installed.

Summit County

NEW QUINCY (Park City)—Seventh car shipped from the recent strike in this property.

JOHN THE REVELATOR (Park City)—Funds reported to have been provided; plans to sink shaft on 10-in. vein opened 150 ft. from surface.

AMERICAN FLAG (Park City)—Mines Development Co., operating part of this property under lease, has in bins 35 tons of silver ore of good grade.

Tooele County

OPHIR DISTRICT is active. Larger shipments being made; railroad from St. John to Ophir is running two trains a day.

IN DRY CANYON DISTRICT, the Dry Cañon Consolidated, Queen of the Hills, Kearsarge and Brooklyn are producing.

OPHIR HILL (Ophir)—Some crude ore being shipped; mill treating 300 tons daily.

BULLION MINES COALITION (Stockton)—Water problem appears to have been solved by tunnel 12,800 ft. long and at face 1,800 ft. below surface; mining is being done 200 ft. below the tunnel level. Flow is 1,200 gal. per min., and a 3,000-acre ranch owned by company is being irrigated. B. F. Bauer president.

WASHINGTON

LAURIER (Laurier)—Shipments of 5 to 7% copper ore being made to Granby smeltery. Grant A. Stewart, superintendent.

NEW CRYSTAL MINING (11 Fall City Block, Spokane)—Has about 1,000 tons of $23 ore at the mine near Miles, awaiting completion of roads for hauling by auto truck to Davenport. John O'Connor, manager.

WYOMING

COLORADO FUEL AND IRON (Sunrise)—Company has been shipping copper ore from a pocket in its iron property; pocket said to be much larger than those previously encountered. Thomas Tucker, superintendent.

PLATINUM MINING AND MILLING (Holmes)—This company operating old Rambler mine has been operating 100-ton mill at full capacity for some time. Julius Thielman, president and manager.

CANADA

Ontario

SHAMROCK (Cobalt)—Six veins have been cut at the 400-ft. level.

KING EDWARD (Cobalt)—Old concentrating apparatus being removed to make room for Callow flotation system.

WEST DOME (Porcupine)—Will sink new four-compartment shaft. Diamond drilling results have been satisfactory.

MINING CORPORATION (Cobalt)—Optioned Burke claims in West Shining Tree district.

TEMISKAMING (Cobalt)—Main shaft is down 1,180 ft., will be sunk to lower contact between the diabase and Keewatin.

McKINLEY-DARRAGH (Cobalt)—New ore discovered beyond fault on 400-ft. level; may be of much importance. Vein shows about 2 in. of 2,000-oz. ore.

NIPISSING (Cobalt)—Considering flotation plant to treat cyanide tailings. On July 1, cash in bank was $1,073,966; ore and bullion on hand and in transit valued at $891,953.

McINTYRE (Porcupine)—Annual report shows ore reserves of 201,900 tons, averaging $11.12 per ton, gross value $2,247,128, as compared with $854,000 the previous year.

DOME LAKE (Porcupine)—Proposal to issue 459,688 shares to shareholders at 20c. ratified. Company owes Hudson Bay Mines, $35,653; balance will be used for mill extension. Report shows 83,600 tons; gross value $1,246,500.

WRIGHT HARGRAVES (Kirkland Lake)—This operation incorporated into a company with capital of $2,500,000 in $1 shares. There will be 1,000,000 shares in treasury, balance representing the property; will be offered to public at 50c.

MOND NICKEL (Coniston)—At London meeting profits for year reported at £322,000; 20% dividend on ordinary shares declared. Lorne Power Co., of Ontario, a subsidiary, completed its plant, providing ample power for present and future needs. Large stocks of nickel-copper matte accumulated in Great Britain to assure supply for refining plant at Clydach, Swansea, Wales, in case of interruption to ocean traffic. Additional unit added to refining plant during year. Output, however, does not equal British requirements of nickel.

MEXICO

LAUGHLIN MINING (San Javier)—This American owned mine in central Sonora kept running during recent disturbances; mill handling about 4,000 tons monthly.

CUBA

WEST INDES DEVELOPMENT CO. (25 Broad St., New York)—Will develop copper properties in Cuba and Haiti—not Hawaii, as reported last week owing to typographical error.

CHOSEN

TUNGSTEN OPERATORS in Chosen have been much affected by the drop in price; many have suspended work.

AFRICA

TRANSVAAL GOLD PRODUCTION in June was: Witwatersrand, 735,194 oz.; outside districts, 26,570 oz.; total, 761,764 oz., which is 15,917 oz. less than in May, but 6,484 oz. more than in June, 1915 For the half-year ended June 30 the total was 4,408,049 oz. in 1915, and 4,631,867 oz. in 1916; an increase of 223,818 oz. The number of negro laborers reported in the mines in June was 204,773, a decrease of 1,262 from May.

The Market Report

Metal Markets

NEW YORK—Aug. 2

Copper advanced further and held firmly, although no great amount of business was done. The renewed decline in spelter went further. Lead also declined. Neither in spelter nor lead was there any important business, the declines occurring in a dull market under the pressure to sell by producers.

Copper, Tin, Lead 'and Zinc

Copper—The advancing tendency that we reported last week, following the transactions at low prices on July 20, continued. In the early part of July there was an extensive readjustment of conditions, resulting especially from the overbought position of a good many domestic manufacturers. The latter found in numerous cases that they had overestimated their requirements, either through the failure of expected business to materialize, or through impossibility of maintaining their rate of output by reason of increasing inefficiency of labor. Producers were therefore requested to defer contracted deliveries until later, and commonly did so: but when that could not be arranged, the released copper was offered for resale.

Producers on their part were in an excellent statistical position, and indeed were bothered about making their deliveries owing to the same causes that affected manufacturers. They were therefore in general ready to agree to transfers of deliveries. Anyway, these readjustments, which affected the market, were apparently completed soon after the middle of July, whereupon persons who needed copper then had to pay more for it, producers being firm in view of the excellent statistical position. But little copper is available for delivery until after Oct. 1, and the major market at the present time is for October-December delivery. August and September copper is very scarce and buyers are compelled to pay premiums for it, but there is only an occasional demand for those near-by deliveries.

During the last week there were some sales for export to Italy and France, but we heard of nothing for England. London cabled that the British government is supplying consumers at £121, prompt delivery, which is equivalent to about 25.65c., c.i.f., and 24.40@24.65c. here, according to whether the cost of delivery comes to 1 or 1¼c. per lb. There was some buying by domestic consumers and in the latter part of the week, 25½c., r.t., corresponding to 25¼c., net cash, New York, was realized for October-December copper. At the close the market appeared to be firmly established at that figure, with 26c., r.t., asked for near-by copper. Sales of October-December copper at 25½c. r.t., were made in several quarters, and there is evidently a general willingness to make the market on that basis.

Copper Sheets are nominally unchanged at 37½c. per lb. for hot rolled and 38½c. for cold rolled. Copper wire is 29@30c. per lb. for carload lots at mill.

Tin—Fluctuations during the week were but trifling. Business was very quiet. There was practically no demand from consumers.

Lead—Business in this metal was of much smaller proportions than in the previous week. Producers on all hands reported a competition from one quarter that was upsetting the market. The A. S. & R. Co. maintained its price at 6.50c., New York, while most of the outside producers were sellers at 6.15@6.20c. Although they made occasional sales at about that price, in general they reported failure to consummate business on their offers. The market having been disturbed in this way, it is impossible to quote it accurately in absence of knowledge of all that may have been done privately, and probably our quotations right through the week are too high. This also explains the unusual variations between the quotations for New York and St. Louis. It is certain that August-October lead was sold in tonnage business on Aug. 1 at a price netting producers less than 5.85c., St. Louis, and 5.75c., St. Louis, was reported done, this being in meeting the sharp competition from one quarter. On the same day sales were made at 6c., St. Louis. Much depended upon the information of the buyer. On Aug. 2 [illegible] business was done by outside producers at about [illegible], New York, in the morning, but about the middle of the afternoon the A. S. & R. Co. reduced its price to 6c., New York, and at other points correspondingly. This reduction was forced upon the A. S. & R. Co. by the competition above referred to, and was made in contradiction to its judgment of market conditions, which were not regarded as justifying the development of such a state of things as has happened. The statistical position in lead continues without any doubt to be excellent, but there appears to be an aversion on the part of producers to see any accumulation of stock.

Spelter—A fair tonnage of business was reported in the early days of the week, and after that very little. On the other hand, there was considerable pressure to sell, and the decline from the short-lived rally which began last week

DAILY PRICES OF METALS IN NEW YORK

			Copper	Tin	Lead		Zinc
July Aug.	Sterling Exchange	Silver, Cts. per Oz.	Electrolytic, Cts. per Lb.	Spot, Cts. per Lb.	New York, Cts. per Lb.	St. Louis, Cts. per Lb.	St. Louis, Cts. per Lb.
27	4.7588	63¾	24½ @25	38¼	6.15 @6.20	5.95 @6.05	8.75 @9.25
28	4.7588	63⅝	24¾ @25¼	38½	6.15 @6.20	5.95 @6.05	8.50 @9.00
29	4.7588	63½	24¾ @25¼	38½	6.15 @6.20	5.95 @6.05	8.50 @9.00
31	4.7581	64⅛	24¾ @25½	38½	6.15 @6.20	5.95 @6.05	8.25 @8.75
1	4.7588	64	24¾ @25½	38¼	6.15 @6.20	5.75 @6.00	8.25 @8.75
2	4.7581	64	25 @25½	38¼	6.00 @6.15	5.75 @5.85	8.25 @8.75

The quotations herein are our appraisal of the average markets for copper, lead, spelter and tin based on wholesale contracts for the ordinary deliveries of the trade as made by producers and agencies; and represent, to the best of our judgment, the prevailing values of the metals, reduced to basis of New York, cash, except where St. Louis is given as the basing point. St. Louis and New York are normally quoted 0.17c. apart.

The quotations for electrolytic copper are for cakes, ingots and wirebars. Electrolytic copper is commonly sold at prices including delivery to the consumers and is subject to discounts, etc. The price quoted for copper on "regular terms" (r.t.) is the gross price including freight to the buyer's works and is subject to a discount for cash. The difference between the price delivered and the New York cash equivalent is at present about 0.25c. on domestic business. The price of electrolytic cathodes is 0.05 to 0.10c. below that of electrolytic. Quotations for lead represent wholesale transactions in the open market for good ordinary brands. Quotations for spelter are for ordinary Prime Western brands. Only the St. Louis price is herein quoted, St. Louis being the basing market. We quote the New York price at 17c. per 100 lb. above the St Louis price.

Silver quotations are as reported by Handy & Harman and are in cents per troy ounce of silver bars 999 fine.

Some current freight rates on metals per 100 lb. are: St. Louis-New York 17c.; St. Louis-Chicago, 6.3c.; St. Louis-Pittsburgh, 13.1c.

LONDON

		Copper				Tin		Lead		Zinc	
		Standard		Electrolytic							
July-Aug.	Silver	Spot	3 Mos.	£ per Ton	Cts. per Lb.	Spot	3 Mos.	£ per Ton	Cts. per Lb.	£ per Ton	Cts. per Lb.
27	30⅜	105	103	123	26.19	165¾	166½	28	5.95	59	12.58
28	30 5/16	111	108	124	26.40	168	168¾	28¼	6.01	60	12.77
29	30¼										
31	30 9/16	111	108	125	26.61	168½	169¼	28½	6.07	60	12.77
1	30½	109	104½	125	26.61	167¼	168	28⅜	6.04	55	11.71
2	30½	107	104	125	26.61	167¾	168½	28¾	6.13	50	10.65

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2,240 lb., except silver which is in pence per troy ounce of sterling silver, 0.925 fine. Copper quotations are for standard copper, spot and three months, and for electrolytic, price for the latter being subject to 3 per cent. discount. For convenience in comparison of London prices, in pounds sterling per 2,240 lb., with American prices in cents per pound the following approximate ratios are given, reckoning exchange at 4.80. £15 = 3.21c.; £20 = 4.29c.; £30 = 6.43c.; £40 = 8.57c.; £60 = 12.85c. Variations, £1 = 0.21⅜c.

continued further. There was no demand from abroad. London cabled that England has ample supply of spelter and that the government stands ready to take care of consumers. Domestic consumers were conspicuous by their absence. During the latter part of the week August-September spelter was offered at 8¾@9c., then down to 8½@8¾c., from some quarters, while other sellers offered at 8½c. On Aug. 2 a lot of 75 tons of Granby "Select" spelter was sold at auction in the New York Metal Exchange at 8½c., St. Louis, spot delivery. High-grade spelter is quoted at 15@17c., intermediate at 13@14c., high-grade brass special at 10c., and common brass special at 9@9½c., all of these being asking prices.

Other Metals

NEW YORK—Aug. 2

Aluminum—The market is quiet and a trifle easier. Business has been on a moderate scale and has been done on a basis of 58@60c. per lb. for No. 1 ingots, New York.

Antimony—Antimony was again weaker. We quote 12@12½c., with last sales reported at 12¼c. The principal interests continue to be unwilling to quote futures. It is gossiped in the trade that there are several dealers in antimony who are loaded with stocks which they are anxious to dispose of, and their position is believed to have been instrumental in depressing the market. Until these stocks are materially reduced, it is difficult to foresee a steady market.

Quicksilver—The market continued dull. We quote $77@78, New York. San Francisco reports, by telegraph, $78 per flask.

Gold, Silver and Platinum

NEW YORK—Aug. 2

Gold is coming in still and more is expected from Europe at New York.

Platinum—This market was again dull and was a little weaker. Sales were made at $58@60, which we quote as the market, although one sale was reported at $55 for a small quantity.

Silver—The tone of silver the past week has been steady to firm The China exchanges are still below London silver parity, so that the steadiness to the market comes from other sources, principally mintage orders.

Mexican Dollars in New York July 27 were quoted at 49@52c.; July 28 at 49@53c.; July 29 at 48⅞@53c. July 31 at 48⅞@53c.; Aug. 1 at 49¼@52c.; Aug. 31 at 49¼@53¼c. Pesos are rather scarce.

Zinc and Lead Ore Markets

Joplin, Mo., July 29—Quotations are as follows: Base price per 2,000 lb. ore assaying 60% zinc, $75 for premium ore, $70@60 for medium grades, down to $55 for low grade. Average for week's sales, $64.29. Calamine base price per 2,000 lb. ore assaying 40% zinc, $50@40; average for week's sales, $47.55.

Lead base price per 2,000 lb. assaying 80% lead, $70; high price, $74.15; average realized for week's sales, $69.76 per ton.

Shipments for week ended July 29 were 4,989 tons blende, 489 tons calamine and 934 tons lead ore. For year to date, 200,967 tons blende, 15,752 tons calamine and 34,575 tons lead ore. Total value, $409,170 for the week; $24,198,020 for the year to date.

Repairs on electric power were installed in midweek, permitting the operation of a few mills, but with the low stage of water still existing it is but part of a loaf. The output is now down to "before the war" level, and many mines cannot restart on the price level now being paid. The 90% increase in powder, along with heavy advances in all other supplies, makes a higher price imperative for mines now idle and some still operating under low powder contracts. The average base price of blende for the month will warrant a further decrease in the wage scale, on the sliding basis in vogue, and may permit some mines to restart in August.

Platteville, Wis., July 29—Quotations are as follows: Base price per 2,000 lb. assaying 60% zinc, $65; medium grades assaying down to 50% zinc, $58. Base price per 2,000 tons, assaying 80% lead, $71. Shipments for week 2,325 tons zinc ore, 58 tons lead ore, 154 tons sulphur ore; year to date, 69,513 tons zinc ore, 2,418 tons lead ore, 16,340 tons sulphur ore. Shipped during week to separating plants 4,757 tons zinc ore.

Report for week ended July 22, delayed in transit, showed base price for 2,000 lb. blende, 60% zinc, $60@65; lower grades down to 50%, $53. Base price for lead ore, 80% was $74. Shipments for the week 2,035 tons zinc ore, 39 tons lead ore, 290 tons sulphur ore. Shipped to separating plants, 3,030 tons zinc ore.

OTHER ORES

Manganese Ore imports into the United States in May were 74,825 tons, being 56,180 tons more than in May, 1915. For the five months ended May 31 the total receipts were 27,157 tons in 1914 and in 1915, and 174,383 tons; increase of 147,226 tons this year.

Imports at Baltimore for the week included 8,800 tons manganese ore from Brazil.

Pyrites—Imports at Baltimore for the past week included 9,631 tons pyrites from Huelva, Spain.

The domestic production of pyrite in 1915 reached a new high level, due chiefly to the unprecedented demand for the mineral in making sulphuric acid. The production was 394,124 long tons, valued at $1,674,933, an increase of 57,462 tons in quantity and of $391,587 in value compared with 1914, the United States Geological Survey reports.

Antimony Ore—It is difficult to sell this ore in view of the uncertainty in the market for the metal. It is quoted nominally at $1.25@1.50 per unit.

Tungsten Ore—There was no change in this market, wherein buyers and sellers continued as far apart as ever. One of the largest producers was bid $27.50 per unit for scheelite ore of the highest class, but refused the offer and is holding for $30. We quote the market at $27.50@30 per unit.

Charles Hardy reports: "Buyers are still exceedingly shy and having contracted during the rush time for considerable quantities feel that unless consumers come again into the market they will not be buyers for a long time to come. One of the most curious features in the tungsten position is the often-repeated expression by the buyers of the ore that they are not too anxious to see the market go down further, as every drop in the prices for tungsten is utilized by the ultimate consumer to try and cancel contracts; and as most of the works have tungsten ores contracted for at high prices, such cancelations would have been disastrous on the general market condition."

Iron Trade Review

NEW YORK—Aug. 2

The iron and steel markets show very little change. Domestic business is still quiet, but export demand is extremely active and shows no sign of decreasing.

The great fire and explosion at Black Tom Island, the New York harbor freight terminus of the Lehigh Valley and other roads, on July 30, destroyed a great number of shells and other munitions waiting for export. The loss is roughly estimated at almost $20,000,000. It is claimed that most of this will fall on the buyers, as a great deal of the steel was sold on contract f.o.b. at mills. At any rate much of the material will have to be replaced. It is not likely that there will be much salvage from the wreck.

Intensely hot weather has continued to keep down work and production at the mills, the outturn in some cases being seriously limited.

Exports from Baltimore for the week included 2,257,680 lb. pig iron, 1,191,800 lb. steel billets, 6,037,056 lb. bars, 3,429,375 lb. wire rods and wire, 1,054,965 lb. rails and ties, 596,911 lb. nails and 438,208 lb. plates, all to Great Britain; 5,708,815 lb. billets and 367,570 lb. bars to France; 1,198 tons pig iron and 5,133 tons steel billets to Italy.

Steel and Iron Exports and Imports in the United States are valued by the Department of Commerce as below for May and the 11 months from July 1 to May 31:

	May		11 Months	
	1915	1916	1914-15	1915-16
Exports	$26,536,612	$72,[illegible]8,913	$194,131,255	$545,018,533
Imports	2,098,145	[illegible]45,307	20,709,126	20,337,227
Excess, exports	$18,438,467	$70,173,606	$173,421,829	$524,681,306

The exports for the 11 months of the fiscal year were by far the largest ever reported. They show an increase of $350,887,278 over 1915, and of $312,465,814 over 1914.

PITTSBURGH—Aug. 1

The steel market continues to exhibit great strength despite the general dullness in the domestic market. Prices for all regular steel products are firmly maintained. There are irregularities in the prices of some manufactured steel products such as chain, spikes, rivets, shafting, etc., but these products had been advanced altogether out of proportion to the advances in the regular steel products from which they are made.

Exports demand continues good, but is met by a particular scarcity of bottoms just at the moment. The great strength of the unfinished steel market at this time is due almost wholly to the export demand, which absorbs everything offered for early delivery.

Quite unexpectedly the Carnegie Steel Co. this afternoon announced an advance in steel bars from 2.50 to 2.60c. Other mills are likely to follow within a short time. There was no market activity to provoke an advance at this time, but perhaps the Steel Corporation was nettled at the recent reports of bars being sold the implement makers at 2.35c. and some contract buyers at 2.50c. asking for a readjustment to 2.35c.

It is generally held in steel market circles that the situation is stronger today than was expected two or three months ago would be the case. The market has stood the summer dullness better than was expected and as increased buying can hardly be avoided in a month or two, as fall arrives, the prospects are excellent from the mill viewpoint. There is still a considerable tonnage of relatively cheap steel to be delivered and this will help to maintain consumption.

Pig Iron—The market continues very dull, so dull indeed that those who were predicting a buying movement in August, with an upturn in prices, have deferred the time until early September. The principal basis of the predictions is that steel making capacity is increasing while pig iron production cannot be increased. Additions to steel capacity this year foot up fully 2,500,000 tons, according to three separate summaries made in the trade, between a third and a half of the new construction being completed to date. Larger projects, which cannot be completed before 1917, involve about as much more, but for 1917 there will be a few more blast furnaces. There is some inquiry for foundry iron in small lots, with an occasional inquiry for the first half of 1917, on which delivery the furnaces are indisposed to quote, but no inquiry for basic, and only export inquiry for bessemer. We quote: Bessemer, $21@21.50; basic, $18@18.25; foundry and malleable, $18.25@18.50; forge, $18@18.25, f.o.b. Valley furnaces, 95c. higher delivered Pittsburgh. W. P. Snyder & Co. compute the average price obtained on all sales of 1,000-ton lots and over in July at $21, Valley, for bessemer and $18, Valley, for basic, the same as for June. The average quoted price of foundry iron in July was $18.25, Valley.

Steel—The market for billets and sheet bars is, if anything, stiffer than a week ago. While some observers regard the quotable market at $45 for both descriptions we continue to quote bessemer at $42@43 and open-hearth at $44@45, for either billets or sheet bars. Almost any description can be sold for export, the chief point being to arrange deliveries.

FERROALLOYS

Ferrosilicon, high grade, 50%, is still quoted $83@85 per ton at furnace. There is less pressure and early deliveries can be had at about the same price. Bessemer ferrosilicon ranges from $31 for 10% up to $41 for 16% at furnace.

Spiegeleisen is in better supply and a little easier, the prices being $45@50 per ton at furnace for 20%, and $60@70 for high grade, 25 to 30%, at furnace.

Ferromanganese—Demand for prompt ferromanganese is very light and the market is a narrow one with a range of $175@200, depending on whether the seller offers the material or the buyer inquires. Contract remains at $175, and deliveries in the latter part of this year are now offered, although recently sellers were supposed to be sold up for that period.

Ferrotungsten is in more demand abroad, and makers here have had several offers for export.

Exports from Baltimore for the week included 11 tons of tungsten metal to Italy.

FOREIGN IRON

Belgian Iron Works have not ceased operation altogether according to information from German sources. Among the plants in operation—most of them with reduced forces and on short time—are the John Cockerill, Marchienne-au-Pont, La Providence, Charleroi and the Constructions Electriques.

British Exports and Imports of iron and steel six months ended June 30 are valued as below by the Board of Trade returns.

	Exports	Imports		Excess
Iron and steel	28,978,562	5,343,496	Exp.	23,635,066
Machinery, hardware, etc	14,857,780	8,450,072	Exp.	6,407,708
Totals	43,836,342	13,793,568	Exp.	30,042,774
Totals, 1915	32,641,767	11,318,067	Exp.	21,323,700

The actual tonnage of iron and steel included in the exports was 1,148,502 in 1915 and 1,845,595 in 1916; imports, 511,012 tons in 1915, and 401,281 tons this year.

Chinese Iron Ore will be developed by Japan. An agreement for the development of the Taochung iron mine, at Taochung, Franchang-H[illegible], Anhui Province, China, has been made by Japanese interests according to the "Far Eastern Review." This mine is said to contain 60,000,000 tons of ore containing 65% iron against 60% usually contained in Taya ores. Negotiations which have been carried on since 1914 with the Chinese authorities by the Sino-Japanese Industrial Development Co. have recently been concluded and the rights to work the mine have been definitely conceded.

IRON ORE

The ore movement down the Lakes is excellent, so far as the tonnage goes, and the computations as to tonnage would indicate that barring accidents there is no serious prospect of a shortage. Attention is directed to the fact, however, that on account of the pressure to utilize the full carrying capacity of the lake fleet ore is shipped that would not be selected if the shippers could choose, and this results in two things, that the average iron content of the ores shipped is lowered, and the selection as to grade may not be just what is required. It is a fact shown by statistics published in past years that in seasons of heavy ore movement the average iron content goes down while in seasons of light shipments the average is higher. There is no doubt that old stockpiles are being cleared up and everything possible is being shipped at the present time.

COKE

Coke production in the Connellsville region for the week ended July 22 is reported by the "Courier" at 413,280 net tons; shipments, 412,021 tons. Shipments of Greensburg and Upper Connellsville districts, 42,130 tons. Production has been held down by short labor and extremely hot weather.

Connellsville—The market has stiffened a shade, and $2.75 is usually quoted to consumers for spot furnace. Dealers have been able to pick up odd lots occasionally at $2.50. There is no demand on contract. Foundry coke is $3.25@3.50 for prompt or contract. The advent of new byproduct ovens is regarded with less apprehension than formerly, on the basis that the good grades of Connellsville beehive coke will find a market, being supported in price by the better prices now obtainable for coal, while the poorer makes will simply disappear. The new byproduct coke plants of the Youngstown Sheet and Tube Co. at Youngstown and Corrigan, McKinney & Co. at Cleveland, 204 ovens each, are expected to be completed and put in operation this month. Many others are to follow.

United States Exports and Imports of Fuel five months ended May 31, in long tons:

	Exports		Imports	
	1915	1916	1915	1915
Anthracite	1,371,955	1,542,860	222	4,445
Bituminous	4,427,832	6,365,998	604,337	719,287
Coke	292,151	456,202	15,900	29,445
Bunker coal	2,713,277	2,989,912	..	...
Total	8,805,215	11,354,972	620,459	753,177

The bunker coal or coal furnished to steamships in foreign trade is practically all bituminous. The larger part of the trade, both imports and exports, is with Canada.

Belgian Coal Production in 1915 is reported from German sources as follows, comparisons being made with 1913, as there are no figures for 1914. The statement is in metric tons:

	1913	1915	Changes
Coal mined	22,847,000	14,244,000	D. 8,603,000
Coke made	3,410,000	484,000	D. 2,926,000
Briquettes made	2,580,000	1,202,000	D. 1,378,000

Most of the mines working are on short time. Costs are heavy owing to the reduced production and to difficulties in transportation.

Chemicals

NEW YORK—July 26

The general market is quiet and heavy chemicals are dull and apathetic. Prices are fairly well maintained.

Arsenic continues in light demand, but supplies are not heavy and quotations continue about $6@6.25 per 100 lb. for both spot and futures.

Copper Sulphate—The market is little changed, with fair demand and moderate sales. Very little is being taken for export just now. Quotations are $9@10 per 100 lb. for carload lots.

Nitrate of Soda—Current sales are small and this, with reports of heavy stocks, has tended to depress the market. Quotations are $3.05@3.10 per 100 lb. for spot, while futures are offered at $3@3.05. Shipments from Chile are now being made in sailing vessels.

Sulphur—A good demand exists for this article, which, combined with high freight rates has kept up the quotations. Current prices are $35 per ton, New York, for spot, and $30 for futures.

Sulphuric Acid—There is more competition and new orders are sharply looked after. Quotations for 60% acid are still about $20 per ton.

Assessments

Company	Delinq.	Sale	Amt.
Algomah, Mich.	May 18	....	$1.00
Cedar Creek, Ida	July 5	Aug. 5	0.01
Challenge, Nev.	Aug. 23	Sept. 13	0.05
Clear Grit, Ida	Aug. 7	Aug. 26	0.002
Columbus Ext., Utah	July 13	Aug. 8	0.02
Cons. Imperial, Nev.	July 18	Aug. 10	0 01
Cons Virginia, Nev.	July 27	Aug. 17	0.05
Crackerjack, Nev	July 3	Aug. 1	0.01
Emerald, Utah	July 15	Aug. 11	0.00½
Four Timbers, Ida	July 26	Aug. 26	0.002
Gold Mt. Champion, Utah	July 20	Aug. 10	0 0025
Great Bend, Nev	Aug. 15	Sept. 20	0.01
Great Western, Nev	July 24	Aug. 15	0.005
Hope, Calif.	July 17	Aug. 14	0.01
Hugo, Ida	July 29	Aug. 30	0 002
Iron Spar, Ida	July 17	Aug. 15	0.003
Jacket-C. Point-Belcher, Nev.	Aug. 14	Sept. 7	0.05
Jack Waite, Ida	July 27	Aug. 28	0.01
Kewanas Reor., Nev.	Aug. 2	Sept. 6	0 01
Lehi Tintic, Utah	Aug. 5	Aug. 25	0.0025
Lucky Calumet, Ida	July 20	Aug. 21	0 005
Morgan Argentine, Utah.	July 15	Aug. 5	0.01
Nevada-Douglas, Nev.	July 15	Aug. 16	0.10
Nevada Zinc, Nev.	Aug 14	Sept. 2	0.01
North Lake, Mich.	June 14	....	1 00
Old Veteran, Ida	July 8	Aug. 5	0.002
Ophir, Nev	Aug. 16	Sept. 6	0 05
Rico Argentine, Colo	Aug. 17	Sept. 2	0.01
Sierra Nevada, Nev	July 11	Aug. 3	0 10
Silver Moon, Ida	July 8	Aug. 3	0 005
Silver Pick, Nev.	July 5	Aug. 14	0.01
Southern Swansea, Utah	July 17	Aug. 5	0.001
Spearhead Reor., Nev.	July 3	Aug. 3	0 01
Springfield Tunnel, Calif.	Aug. 15	... ...	0 05
Sunrise ,Ida	July 27	Aug. 28	0.002
Swansea Ext., Utah	July 10	Aug. 1	0.0025
Tar Baby, Utah	Aug. 3	Sept. 4	0.01
Tarbox, Mont.	July 25	Aug. 12	0.005
Tiberius, Ida	July 8	Aug. 1	0.001
Tintic Central, Utah	July 12	Aug. 8	0 005
Ton. Gypsy Queen, Nev	July 11	Aug. 15	0.01
Victoria, Utah	July 8	Aug. 2	0.005
Wolf Mt. Copper, Utah	Aug. 2	Sept. 6	0 005

Stock Quotations

SAN FRANCISCO	Aug. 1
Name of Comp.	Bid.
Alta	.03
Andes	.09
Best & Belcher	.05
Bullion	.01
Caledonia	.40
Challenge Con.	.03
Confidence	.18
Cons. Imperial	.01
Con Virginia	.17
Gould & Curry	.03
Hale & Norcross	.07
Jacket-Cr. Pt.	.04
Mexican	.17
Occidental	.70
Ophir	.23
Overman	.04
Savage	.06
Seg Belcher	.02
Sierra Nevada	.30
Union Con.	67
Utah Con.	01
Belmont	4 10
Jim Butler	.86
MacNamara	05
Midway	.18
Mont.-Tonopah	.25
North Star	.16
Rescue Eula	.24
West End Con.	78
Atlanta	.10
Blue Bell	.01
Booth	.13
C.O.D. Con	.03
Comb. Frac	06
D'field B.B.	02
D'field Daisy	.02
Jumbo Extension	74
Pitts.-Silver Peak	‡.12
Round Mountain	45
Sandstorm Kendall	.04
Silver Pick	.12
Central Eureka	09
Argo	09
Ariz. Central	23
Big Jim	90
Lazy Boy	14
Oatman No. Star	10
Tom Reed	1 55
United Eastern	3 75
United Western	.10

LONDON	July 20
Alaska Tre'dwell	£5 17s 6d
Burma Corp.	3 5 0
Cam & Motor	0 12 6
Camp Bird	0 9 6
El Oro	0 9 6
Esperanza	0 12 6
Mexico Mines	4 0 0
Nechi, pfd	0 15 6
Oroville	0 17 9
Santa Gert'dis	0 13 0
Tomboy	1 2 6

SALT LAKE	July 31
Name of Comp.	Bid.
Alta Con.	25
Black Jack	05½
Colorado Mining	16
Crown Point	.03¾
Daly-Judge	7 78
Emma Cop.	.54
Gold Chain	20
Grand Central	65
Iron Blossom	1 70
Lower Mammoth	.03¾
May Day	.12
Opohongo	.01½
Prince Con.	1.40
Seven Troughs	.03½
Silver King Coal'n	2 85
Silver King Con.	3 25
Sioux Con	10
Uncle Sam	06
Yankee	20

COLO. SPRINGS	July 31
Acacia	.03¾
Doctor Jack Pot	.08½
Elkton Con.	.12½
El Paso	.71
Findlay	.03
Gold Sovereign	.03¾
Golden Cycle	2.05
Granite	57
Isabella	.17¼
Jack Pot	‡ 05
Jerry Johnson	.03¼
Mary McKinney	.25
Portland	1 60
Vindicator	2 10

TORONTO	July 31
Adanac	1 50
Bailey	07
Chambers Ferland	17½
Coniagas	4.30
La Rose	.60
Peterson Lake	.22
Right of Way	04
Seneca Superior	.50
T. & Hudson Bay	55.00
Temiskaming	56
Trethewey	‡ 21
Wettlaufer-Lor	.15½
Dome Exten	.35½
Dome Lake	38
Foley O'Brien	50
Hollinger	28.00
Jupiter	28
McIntyre	1 39
Newray	42½
Porcu. Crown	69
Preston E. D.	03
Vipond	39
West Dome	36

N. Y. EXCH.	Aug. 1
Name of Comp.	Clg.
Alaska Gold M	17¼
Alaska Juneau	7¼
Am.Sm.&Ref.,com	93⅛
Am. Sm. & Ref., pf.	111½
Am. Sm. Sec., pf. A	92½
Am. Sm. Sec., pf. B	84⅛
Am. Zinc	34
Am. Zinc, pf	63¾
Anaconda	79¼
Batopilas Min.	1½
Bethlehem Steel	435
Bethlehem Steel, pf.	125
Butte & Superior	68
Chile Cop.	20¼
Chino	47¾
Colo. Fuel & Iron	44
Crucible Steel	69⅛
Dome Mines	25⅛
Federal M. & S.	13
Federal M. & S., pf.	35½
Great Nor., ore ctf.	35
Greene Cananea	46⅛
Homestake	130
Inspiration Con.	48¼
International Nickel	44
Kennecott	45¼
Lackawanna Steel	71
Miami Copper	33½
Nat'l Lead, com.	63
National Lead, pf.	113
Nev. Consol.	17½
Ontario Min	6
Quicksilver	2⅛
Quicksilver, pf	4½
Ray Con.	22¾
Republic I&S, com.	47½
Republic I&S, pf.	109¼
Sloss-Sheffield	44¾
Tennessee Copper	25¼
Utah Copper	77
U. S. Steel, com.	87
U. S. Steel, pf.	117
Va. Iron C. & C.	42

BOSTON EXCH	Aug. 1
Name of Comp.	Bid
Adventure	2½
Ahmeek	91
Algomah	1¼
Allouez	58½
Ariz. Com., ctfs.	8¼
Bonanza	.25
Butte-Ballaklava	1½
Calumet & Ariz.	68⅛
Calumet & Hecla	520
Centennial	14½
Copper Range	57⅛
Daly West	2
East Butte	11¾
Franklin	6½
Granby	80
Hancock	10½
Helvetia	.25
Indiana	2
Island Cr'k, com.	45
Island Cr'k, pfd.	88½
Isle Royale	25½
Keweenaw	3
Lake	11
La Salle	‡1
Mason Valley	1½
Mass	11¾
Mayflower	2
Michigan	2¾
Mohawk	81
New Arcadian	4⅛
New Idria	11
North Butte	20¼
North Lake	1¼
Ojibway	1
Old Colony	1½
Old Dominion	62
Osceola	79¼
Quincy	80½
St. Mary's M. L.	68⅛
Santa Fe	1¾
Shannon	7¾
Shattuck-Ariz.	26
So. Lake	4½
So. Utah	.19
Superior	13
Superior & Bost.	3¾
Tamarack	36
Trinity	4½
Tuolumne	.30
U. S. Smelting	67
U. S. Smelt'g, pf.	50⅛
Utah Apex	3¾
Utah Con.	13
Utah Metal	8
Victoria	2¾
Winona	4¼
Wolverine	47¼
Wyandot	1¾

N. Y. CURB	Aug. 1
Beaver Con.	.38
Buffalo Mines	.75
Butte & N. Y.	1½
Butte C. & Z.	4⅛
Caledonia	.68
Can. Cop. Corpn.	1½
Cashboy	.05
Cerro de Pasco	35
Con. Ariz. Sm.	1⅞
Con. Coppermines	2
Con. Nev.-Utah	⁵⁄₁₆
Crystal Cop.	1
First Nat. Cop.	4⅛
Florence	49
Goldfield Con.	88
Goldfield Merger	.08½
Granite	20
Hecla Min	5¾
Howe Sound	4¼
Jerome Verde	1⁹⁄₁₆
Joplin Ore & Spel.	.52
Kerr Lake	4½
Magma	13¼
Majestic	⁹⁄₁₆
McKinley-Dar-Sa.	60
Mother Lode	.30
Nevada Hills	.16
N. Y. & Hond.	15¼
Nipissing Mines	6¾
Oro	.04
Ray Hercules	3¼
Rochester Mines	.58
St. Joseph Lead	15
Standard S. L.	1³⁄₁₆
Stewart	.21½
Success	.56
Tonopah	5¾
Tonopah Ex.	5½
Tribullion	⁵⁄₁₆
United Zinc	6½
White Knob, pf.	1¾
White Oaks	6½
Yukon Gold	2½

BOSTON CURB	Aug. 1
Bingham Mines	10
Boston Ely	1½
Boston & Mont.	.99
Butte & Lon'n Dev.	.66
Calaveras	4¼
Calumet-Corbin	.02½
Chief Con.	1½
Cortez	.35
Crown Reserve	.45
Davis-Daly	1¼
Eagle & Blue Bell	1¾
Houghton Copper	1
Iron Cap Cop., pf.	5
Mexican Metals	.29
Mines of America	2½
Mojave Tungsten	3¼
Nat. Zinc & Lead	1
Nevada-Douglas	1³⁄₁₆
New Baltic	1½
New Cornelia	12½
Ohio Copper	.12
Oneco	80
Raven Copper	.06
Rex Cons.	.21
Rilla	.18
United Verde Ext.	27¾

‡Last Quotations.

Monthly Average Prices of Metals

SILVER

Month	New York			London		
	1914	1915	1916	1914	1915	1916
January	56.572	48.855	56.775	26.553	22 731	26.960
February	57.506	48.477	56.755	26.573	22.753	26 975
March	58.067	50.241	57 935	26.788	23.708	27 597
April	58.519	50.250	64.415	26.958	23 709	30 662
May	58.175	49.915	74.269	26.704	23 570	35.477
June	56.471	49.034	65 024	25 948	23 267	31 060
July	54.678	47.519	62 940	25.219	22 597	30 000
August	54.344	47.163	.....	25.979	22 780	......
September	53.290	48.680		24 260	23 591	......
October	50.654	49.385	.....	23 199	23 925	......
November	49.082	51 714	. .	22 703	25.094	......
December	49 375	54 971	.....	22 900	26 373	......
Year	54 811	49 684	.. ..	25.314	23 675	....

New York quotations cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0 925 fine.

COPPER

Month	New York		London			
	Electrolytic		Standard		Electrolytic	
	1915	1916	1915	1916	1915	1916
Jan.	13.641	24.008	60.756	88.083	65 719	116.167
Feb.	14.394	26.440	63.494	102 667	*	133.167
Mar.	14.787	26.310	66 152	107.714	*	136.000
April	16.811	27.895	75 096	124 319	*	137 389
May	18.506	28.625	77 600	135 457	*	152.522
June	19.477	26 601	82.574	112 432	95 333	137 455
July	18.796	23.865	76.011	95.119	91 409	125 500
Aug.	16 941	......	68 673	....	82.333	. .
Sept.	17.502	......	68 915	.. ....	85.250	.. ...
Oct.	17.686	......	72.601	....	88.000	....
Nov.	18.627	......	77.744	....	93.273	..
Dec.	20 133	......	80.773	....	100.43	.. ..
Year	17.275	......	72.532	......	.... ..	.. ...

TIN

Month	New York		London	
	1915	1916	1915	1916
January	34 260	41.825	156.550	175.548
February	37.415	42.717	176.925	181.107
March	48 426	50.741	180.141	193.609
April	47.884	51.230	166.225	199.736
May	38.790	49 125	162.675	196.511
June	40 288	42 231	167.636	179 466
July	37 423	38 510	167.080	168.357
August	34.389	. ..	151 440	... ..
September	33.125	...	152.625	... .
October	33 080	...	151.554	..
November	39 224	. ...	167.670	. . .
December	38 779	.....	167.000	... ...
Av. year	38.590	......	163.960	..... .

LEAD

Month	New York		St. Louis		London	
	1915	1916	1915	1916	1915	1916
January	3.729	5.921	3.548	5.826	18.606	31.167
February	3.827	6.246	3.718	6.164	19.122	31.988
March	4 053	7.136	3.997	7.375	21.883	34.440
April	4 221	7.630	4 142	7.655	21.094	34.368
May	4 274	7.463	4 182	7 332	20.347	32.967
June	5.932	6.936	5.836	6.749	25.170	31.011
July	5.659	6.352	5.531	6.185	24.611	28.137
August	4 656	....	4.520	......	21.946	......
September	4 610	....	4 490	.....	23.151	......
October	4 600	.....	4 499	....	23.994	... .
November	5.155	...	5.078	.....	26.278	....
December	5.355	......	5.266	.....	28.807	......
Year	4.673	......	4.567	......	22.917	......

SPELTER

Month	New York		St. Louis		London	
	1915	1916	1915	1916	1915	1916
Jan.	6.386	16.915	6.211	16.745	30.844	89 810
Feb.	8.436	18.420	8.255	18.260	39.819	97 762
Mar.	8.541	16.846	8.360	16.676	44 141	95 048
April	10.012	16.695	9.837	16.525	49.888	99.056
May	14 781	14.276	14.610	14.106	68.100	94 217
June	21.208	11 752	21.038	11 682	100.614	68 591
July	19.026	8.925	18.856	8.755	97.250	50 750
Aug.	12 781	......	12.611	......	67.786	......
Sept.	13.440	......	13.270	......	67.841	......
Oct.	12 800	......	12.596	......	66.536	.....
Nov.	15.962	......	15.792	......	88.409	....
Dec.	15.391	......	15.221	......	89.400	....
Year	13 230	......	13.054	......	67.553	...

New York and St. Louis quotations, cents per pound. London, pounds sterling per long ton. * Not reported.

PIG IRON IN PITTSBURGH

Month	Bessemer‡		Basic‡		No. 2 Foundry	
	1915	1916	1915	1916	1915	1916
January	$14 59	$21.60	$13 45	$18.78	$13.90	$19 70
February	14.55	21.16	13.45	18.93	13.90	19.51
March	14 55	21.81	13.45	19.20	13.95	19.45
April	14.55	21.65	13.45	18.95	13.95	19.45
May	14 61	21.78	13.60	19.11	13 83	19 58
June	14 70	21.95	13.67	18.95	13.77	19.34
July	14.94	21.95	13.91	18.95	13.68	19.20
August	16 01	......	15.31	......	14 75	.... ..
September	16 86	......	15.95	....	15 70	.
October	16.95	......	15.96	...	15.80	.
November	17 57	......	16.47	... ..	17.20	
December	19.97	......	18.44	......	18 95	.
Year	$15.82	......	$14.76	......	$14.95	......

‡As reported by W. P. Snyder & Co.

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Engineering and Mining Journal

VOLUME 102 AUGUST 12, 1916 NUMBER 7

Exploitation of Chilean Mines

BY BENJAMIN L. MILLER[*] AND JOSEPH T. SINGEWALD, JR.[†]

SYNOPSIS—Huge investments of foreign capital in equipment for mining low-grade ore deposits have been object lessons to native Chileans. The mining laws of Chile are good. Transportation problems have been minimized by recent railway construction. The labor supply is ample and of good quality. Chile is likely to again rank second among the world's copper-producing countries. An American company will soon ship 1,000,000 tons annually of high-grade iron ore. Old silver mines may be profitably reopened.

Among the countries of South America, Chile has for many years particularly appealed to the mining profession because of the richness and variety of its mineral wealth. Since the recent development of its enormous deposits of low-grade copper ores and high-grade iron ores by American capital, and with the universal appreciation, since the outbreak of the European War, of the value of the monopoly in natural nitrates, interest is now more than ever directed to the "shoestring" country of the west coast of South America. With a length of about 3,000 mi. (four times as long as California and less than twice as great in area), the country is unique in the widespread distribution of its mineral wealth. In the extreme south are the placer gravels of Tierra del Fuego and the coal deposits of Punta Arenas, while in the far north are the sulphur and borax workings of the high Andes. From the Straits of Magellan to Valdivia the bleak climate has discouraged the prospector, and much of that region is uninhabited and practically unknown, yet the fact that gold-bearing sands are found at many points leads one to believe that section has also been extensively mineralized. Most of the mining, however, has been carried on in the central and northern portions of the country, extending from Concepcion, near which place the principal coal mines are located, to the Peruvian boundary, a distance of about 1,400 mi.

Chile owes its vast metallic mineral wealth mainly to its igneous rocks, which form such a large portion of the land, and its nonmetallic deposits to unusual climatic conditions. Sediments of Jurassic and Cretaceous age have been intruded by batholiths, stocks and dikes of igneous rocks of various kinds and are in other places interbedded with flows of lavas. Mineral solutions accompanying the igneous rocks have resulted in the formation of the rich deposits of minerals. Among the important nonmetallic products the nitrates, guano and borax deposits, all soluble and hence easily removed by solution, owe their origin to the extremely arid conditions that for centuries have prevailed in the northern portion. The nitrates and borax are the result of long-continued concen-

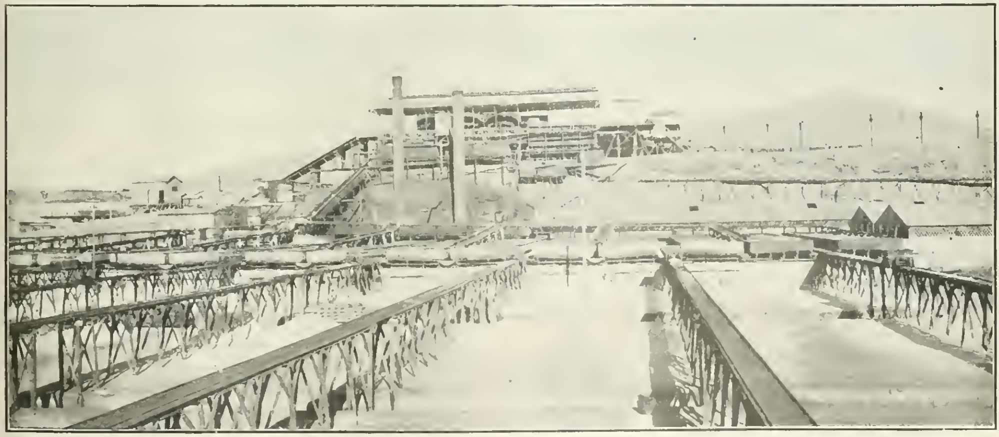

FIG. 1. NORTH LAGUNAS OFICINA, A TYPICAL NITRATE EXTRACTION PLANT

tration by precipitation from dilute solutions through evaporation.

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[*] Professor of geology, Lehigh University, South Bethlehem, Penn.

[†] Associate in economic geology, Johns Hopkins University, Baltimore, Md.

The mining industry of Chile has passed through several fairly distinct stages. Before the coming of the Spaniards both the Inca and the Araucarian Indians had developed some of the gold and copper mines. Under the régime of the Spaniards the mines produced enormous amounts of silver and also much gold. When the country finally secured its independence in 1826, the mining of copper and silver were of prime importance, while soon after the exportation of nitrate commenced. Since then the output of these three products has continued, but with a gradual decline in the production of copper and silver, as the mines increased in depth and pyritic ores were encountered, while nitrate production has increased. Within recent years a new epoch in the mining industry of Chile may be said to have started with the introduction of large amounts of North American capital to the development of the iron and copper mines.

Under the control of the native Chileans it was unusual to spend much money in the equipment of a mine. When bonanza orebodies were encountered the suddenly enriched mine owners lost all interest in low-grade ores, and when the rich pockets were exhausted, they retired from mining. It has been an object lesson to Chileans, therefore, to see the millions recently invested in the Braden and Chuquicamata copper mines and in the Tofo iron mines. If the example set by these companies in large initial investment of capital in development and equipment is followed, many of the abandoned *antiguas* may regain their former prominence through their reserves of low-grade ores receiving the attention they merit.

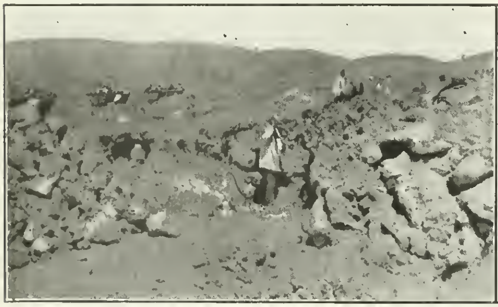


FIG. 2. MINING NITRATE CALICHE AT LAGUNAS OFICINA

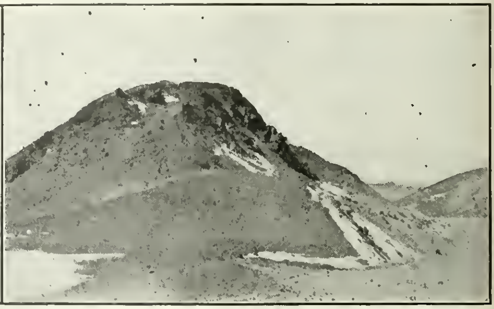


FIG. 3. SUMMIT OF MT. OLCA, ELEVATION 18,500 FT., WHERE SULPHUR IS MINED

MINES EXPLOITATION ENRICHES FOREIGNERS

It has been the good fortune of Chile to attract foreign capital to develop her mineral industries and at the same time her misfortune to have the product of her mines enrich the citizens of other countries. For a number of years the largest mines have been in the possession of foreigners, and this condition is likely to continue. Most of the nitrate companies are owned by English capital, with the German, French and American interests also extensive, while the leading copper and iron mines are financed by American capitalists. Native capital has been insufficient properly to develop the mines or too timid to take the necessary risks, and yet the Chilean cannot fail to look forward with apprehension to the time when the foreigner will have exhausted the mines and withdrawn. The ore reserves are, however, so extensive that one can predict many years of active mining before this condition is reached. Nevertheless, the policy of the Chilean government has been to make hay while the sun shines, and consequently it has levied heavy export taxes on nitrate, iodine and borax, while the repeated agitation for similar taxes on copper and iron ore lead one to believe that these products will also be called upon to bear their proportion of the expenses of the government before many years, although as yet they have escaped. As the country possesses a monopoly in its nitrate, the export tax does not materially affect the operating nitrate companies. The government can be depended upon to treat the other mining companies fairly and not impose confiscatory taxes. The mining companies must always suffer more from the almost universal "graft" that permeates all branches of the government than from the laws. In every mining district throughout the country one hears the same kind of stories of petty persecutions inflicted upon the companies by prefect, judge, sub-prefect, carabineros, etc.

The mining laws of Chile are very definite and seldom is there much litigation regarding titles. The government requires on each mining claim a yearly tax which amounts to 10 pesos (1 peso equals $0.36 U. S. currency) a hectare (2.471 acres) in the case of metallic ores and less for the nonmetallic. With the exception of deposits of nitrate, salt, guano and coal, the discoverer of any ore deposit can acquire possession by denouncement whether the land is privately owned or belongs to the state. In the first case, however, the original owner must be paid for any damage done to his property during mining operations. Coal deposits belong to the owner of the land, while guano, nitrate and salt deposits belong the the state and are sold at auction. Foreigners enjoy the same rights as citizens in the acquisition of mining property.

The transportation problem in Chile has never been as serious as in many of the other Latin-American countries, because all portions of the country are comparatively close to the ocean. No doubt railroads would have been constructed in greater numbers if the country had not been so well favored by water transportation. The first railroads were built to connect inland mining camps or inland cities, such as Santiago, with the nearest seaports, and there are many lines of this kind. The need of a longitudinal railroad, however, had long been felt, and for many years a line from Valdivia in the south to Arica in the north has been under construction. It has now been completed from Valdivia almost to Iquique, and in a few years will certainly be extended to Arica. As the line crosses at right angles the valleys of all the streams that flow from the high Cordillera to the ocean, its building was very expensive and in many places the grades are so steep that the rack system must be employed. During 1915 trains were run over portions of the line only once a month. The annual deficit of the whole line is large, yet many of the smaller mining camps which were previously without railroad facilities have been greatly benefited and the country as a whole profits by the enterprise. The northern part of the line passes through the desert section, where vegetation is scant or lacking, so that it may be said to have been built for the mining industry alone.

The labor conditions in the mines of Chile are somewhat different from those prevailing in other Latin-American mining camps. The laborers are the descendants of the early Spanish and the Indians, and so thoroughly have the two races intermingled that one seldom sees marked Indian characteristics except in the natives of southern Chile, where some of the Araucarians have kept their race fairly pure. The Chilean *roto* is strong, willing, and develops into a good miner. He is improvident and reckless, consequently always poor, yet orderly except when drunk. Liquor is the curse of the mining districts, and after each holiday (and numerous holidays there are) the *roto* is unfit for his usual labor for several days.

In a general summary of the mining industry only the chief products can be mentioned. In order of importance among the metallic substances are copper, iron, silver and gold, and among the nonmetallic are nitrates and iodine, coal, borax and sulphur.

Copper Production Will Rank Chile Second

Chile has long attracted the attention of the mining world because of its vast copper resources. It is said that the Spaniards began mining copper in 1601 and that the country has ever since had copper mines in operation. For many years it held first place among the copper-producing countries of the world, being surpassed for the first time in 1882 by the United States. In recent years Chile's copper production has been exceeded by several countries yet there is little doubt but that it will soon regain second place. The maximum output was reached in 1876 when the country produced 46,422 tons.

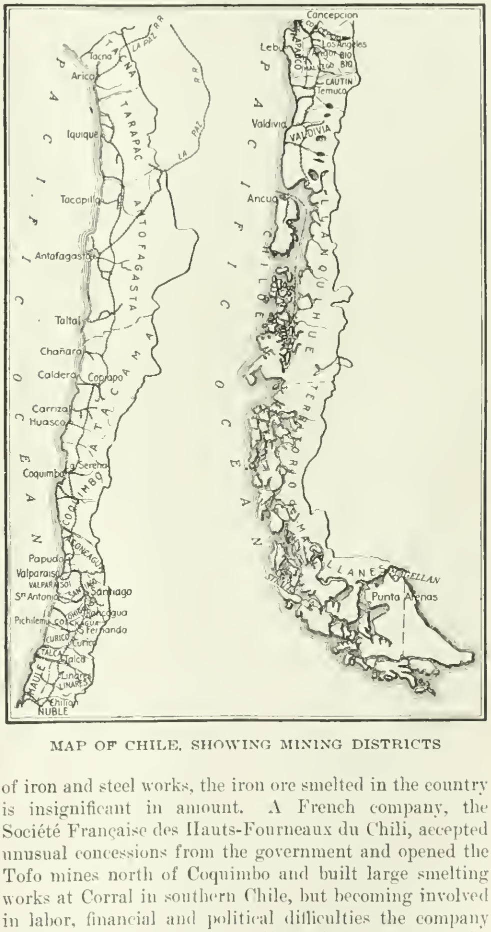
According to the statistics in 1913 there were 12,403 copper-mining claims that had been denounced aggregating 41,879 hectares, besides 686 silver and copper claims and 641 gold and copper claims, making an aggregate of 13,730 copper properties. These claims are widely distributed throughout the central and northern portions of the country but are mainly contained in the provinces of Tarapaca, Antofagasta, Atacama, Coquimbo, Aconcagua, Santiago and O'Higgins. The first four lie within the desert portion of north Chile, while the last three are in the semi-arid region where agriculture and horticulture rank in importance with mining. When the Chuquicamata plant reaches the capacity planned for it of 40,000 tons a day, the Braden Copper 6,000 tons, and the Anaconda Copper Co. develops its recently acquired extensive holdings in the Potrerillos field, Chile will surely again become the world's second greatest copper producer.

One of the most interesting and distinctive features of the Chilean copper deposits is the presence, in commercial quantities, of large bodies of minerals seldom seen in the other copper regions of the world. Among these are atacamite, brochantite, copiapite and chalcanthite, all of which owe their origin to the extremely arid condition of the regions where they occur. The saving of these minerals has called for new methods of treatment by leaching that are being introduced in several places, but most elaborately at Chuquicamata.

Iron Mines Little Developed

That Chile contains extensive deposits of high-grade iron ore has long been known, but until the advent of American capital little progress was made in their development. The best deposits are found in the provinces of Antofagasta, Atacama and Coquimbo. The ores are mainly hematite and are low in phosphorus.

In spite of the fact that the Chilean government has long offered special inducements for the establishment of iron and steel works, the iron ore smelted in the country is insignificant in amount. A French company, the Société Française des Hauts-Fourneaux du Chili, accepted unusual concessions from the government and opened the Tofo mines north of Coquimbo and built large smelting works at Corral in southern Chile, but becoming involved in labor, financial and political difficulties the company closed down in 1911 and later disposed of its mines to the Bethlehem Steel Co. This company is spending about $8,000,000 in improving the property preparatory to shipping 1,000,000 tons of ore a year, but all the ore leaves the country and Chile must still import its iron and steel.



MAP OF CHILE, SHOWING MINING DISTRICTS

Chile has had some of the richest silver mines ever discovered. The Chañarcillo mines, about 60 mi. south of Copiapo, and the Huantajaya mines, near Iquique, furnish ideal illustrations of bonanza mines. The latter were extensively worked to the close of the Eighteenth Century and were later allowed to remain idle until 1873, but are at present in operation. They are said to have produced more than $22,000,000 worth of silver. The Chañarcillo mines were discovered in 1832 and during the succeeding 30 years produced a great amount of wealth. The Caracoles district, 110 mi. east of Antofagasta, was another famous silver district and also Los Tres Puntos, near Copiapo. The principal silver output now comes from the Huantajaya mines and some others near Taltal. The production has been steadily decreasing for many years until it is now of minor importance, yet there are mining men in the country who firmly believe that it would be profitable to reopen some of these abandoned mines.

To the close of 1915 Chile had produced but $314,000,000 worth of silver, while the present production amounts to about $500,000 a year.

For many years little attention has been given to the gold deposits of Chile, yet the country has had many profitable mines at different times. Up to the present the gold mines have yielded about $221,000,000 and are still producing at the rate of between $200,000 and $300,000 a year.

Gold placers are widespread and in the early history of the country produced most of the gold. The Madre de Dios, near Valdivia, and the Malga Malga, between Santiago and Valparaiso, were two of the earliest and also the richest mines worked. Placers in the southern portion of the country continue to produce some gold, although the dredging operations near Punta Arenas have not been successful, but the chief productive gold area, containing both placer and lode workings, lies between Santiago and Coquimbo. The most important mines are located near San Felipe, Los Valos, Talca, Ovalle and Cachinal. In addition considerable gold is obtained from copper ores.

NITRATES BACKBONE OF GOVERNMENT REVENUE

In most countries the deserts are looked upon as waste land, but the arid regions of northern Chile constitute the most valuable portion of the country. The export tax on the nitrates from these desert sections amounts to over $30,000,000 a year and furnishes about 70% of the government's revenue.

The nitrate deposits occur in a series of basins, or pampas, lying between the coast ranges and the higher Andes to the east and extending in a north-south direction from Taltal to Pisagua, a distance of about 450 mi. Seldom has a country obtained such a rich war indemnity as fell to Chile when, in 1879, at the close of her war with Bolivia and Peru, she acquired the rich provinces of Antofagasta, Tarapaca and Tacna. By the terms of the treaty of peace a plebiscite was to be held some years later to determine the final status of the former Peruvian provinces of Tarapaca and Tacna, but Chile has declined to call for the vote and has shown plainly that she will never relinquish her hold on this territory except by force.

Frequent reports are spread concerning the rapid exhaustion of the nitrate fields, but these fears have little foundation. While during the last few years somewhat more than 2,500,000 tons has been exported annually, it will be recalled that in 1908 the government inspectors reported the known reserves as 220,000,000 tons, and later investigations greatly increase these figures. Improved methods of extraction in plants similar to that illustrated in Fig. 1, by which lower-grade caliche can be used, also tend to conserve the supply. In the earliest workings only the caliche containing upward of 55% of sodium nitrate was taken. In the Agua Santa region some ground is to be worked over for the fourth time and all the earth containing 10% of nitrate will be utilized. It is probable that even lower-grade rock will eventually be used. Fig. 2 shows a typical caliche mining scene. The introduction of the Butters filter is regarded by some of the oficinas as a great improvement in effecting higher recovery. The results obtained at the Agua Santa *maquina*, where the process has recently been installed, will determine the value of the filters.

There are about 170 companies operating in the nitrate fields. The tons of nitrate contained in the land owned by the different nationalities is as follows: English companies, 12,500,000; Chilean companies, 9,533,850; German companies, 5,048,750; other nationalities, 4,017,500. Recent purchases probably invalidate these figures, although they remain approximately correct. There is but one American company operating in the region.

Comparing the foregoing with the total reserves already given, it will be seen that the greater part of the nitrate deposits still remain in the possession of the government. At times parcels of land on which the tonnage has been estimated after examination by government engineers and on which a minimum price per quintal has been set are offered for sale to the highest bidder. At the last sale several parcels were offered, the minimum prices being fixed at 4 to 6 pence a quintal, or $1.58 to $2.37 a ton, but only one tract was sold. The sale price must be paid in cash at once, while in addition the government levies 28 pence a quintal, or about $11.20 a ton, export tax on the finished product. Until the outbreak of the European War the bulk of the nitrate went to Germany, and consequently when this market was closed, all but a few of the companies ceased operations. Most of them resumed, however, during 1915. At present the greater part of the nitrates come to the United States.

As a byproduct in the elaboration of the nitrate, considerable iodine is obtained. The annual production is in normal times about 450,000 kg., but since the war has created a greater demand for it in the dressing of wounds, the production has considerably increased. The export tax is $0.16 a kilogram.

COAL, BORAX AND SULPHUR INDUSTRIES

Coal was discovered in the vicinity of Concepcion in 1840, and mining operations started there about 1850. The coal is semibituminous in character, but inferior to that imported from England, Australia and North America. The production amounts to somewhat more than 1,000,000 tons a year. It is all used by the local railroads and steamship lines, and at present constitutes about two-fifths of the total amount of coal consumed in the country. The chief mines are at Lota, where brick, pottery and glass factories and a copper smeltery are located on account of the coal supply. The coal that is imported into the country is largely brought by vessels that carry the nitrate to the foreign markets.

In the high Cordillera near the Bolivian border are a number of extensive borax lakes containing sufficient material to supply the world's markets for several centuries. The industry is controlled by the Borax Consolidated Co., Ltd., which is operating at Lake Ascotan with its plant at Cebollar on the line of the Antofagasta-La Paz R.R. In certain places the deposit consists of almost pure

Ulexite, and this material is merely dried preparatory to shipment. The output varies from 30,000 to 50,000 tons a year, on which the government levies an export tax of $2.38 a ton.

In the northern portion of Chile near the Bolivian border there are a great number of recently extinct volcanoes that contain great deposits of native sulphur formed by the sulphurous gases given off through fumarolic vents. These deposits are in every case high up on the mountains or even at the summits, so that the difficulties of working them are very great. Fig. 3 shows a typical sulphur deposit at an altitude of 18,500 ft. above sea level. At present only those deposits near railroads are being worked, the chief activities being centered at Tacora along the Arica-La Paz R.R. and at Ollagüe along the Antofagasta-La Paz R.R. At the former place the sulphur is refined by volatilization, as in that vicinity there is an abundant growth of yareta, a mosslike plant containing much resinous matter. In the vicinity of Ollagüe only the pieces of practically pure sulphur are taken from the mines, the remainder being discarded and the sulphur shipped without any refining. During 1915 several new companies began operation, and the increased production will shortly demand foreign markets as the country only requires a limited amount.

In conclusion a few words should be said in regard to the active mining society of Chile, the Sociedad Nacional de Mineria, which corresponds to our American Institute of Mining Engineers. This organization has accomplished much in making known the mineral resources of the country. It publishes a bimonthly bulletin in addition to statistical volumes of mineral production and maintains in Santago a museum where can be seen specimens from the leading ore districts of the country.

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Mining Progress in California

The mining industry in California in the first half of 1916 compared to the first half of 1915 shows greater activity, due largely to reopening of old properties that have not only added to the production of metals, but have accounted for large amounts of money being spent for installation of machinery. Notable among these old mines that have been reopened are the Dutch-Sweeney-App in Tuolumne County and the Old Eureka in Amador County; the former had been a producer from the operation of the Dutch-Sweeney and added largely to its production by the taking over of the App, which had long been idle. The Rawhide, in Tuolumne County, which had also long been idle, has not yet been made productive, but is being prepared for resumption of productive operation. According to the report of Charles G. Yale, of the United States Geological Survey, aside from the gold, silver, copper and lead mining of the state, there has been in the first half of 1916 a heavy demand for such mineral substances as chrome, tungsten, magnesite, manganese, antimony and lesser minerals. For the first time in the mining history of the state many districts are shipping crude ores to the Eastern seaboard by rail, which has been permissible on account of extraordinarily high prices.

There has been no noticeable increase in the number of productive gold mines, and the local smelters and refiners are shown by the reports of the United States Mint at San Francisco to have received $366,000 less California gold and 22,000 oz. more silver in the first five months of 1916 than in the corresponding period of 1915. This may be due somewhat to the greater activity in other productions than that of gold. The five Mother Lode counties, Mariposa, Tuolumne, Calaveras, Amador and Eldorado, produced 61% of the output of siliceous ores. Deep mining outside of the Mother Lode region has been unusually active, particularly in Nevada County, where the North Star and Empire mines are the leading producers and are finding high-grade ore at depth. A strike of high-grade ore carrying telluride was made in the Champion group, and in this section a number of small mines that have been idle are coming into the possession of the larger companies in order to improve their position in the districts.

In the southern counties, notably Inyo, San Bernardino and Riverside, there is a distinct revival of mining activity and a noticeable improvement in transportation by the adoption of motor trucks and caterpillar tractors. The Cerro Gordo mine, situated east of Owens Lake, has been producing large shipments of zinc and lead ores as well as silver. At Randsburg the Yellow Aster has continued to be a large producer and it as present adding to its metallurgical equipment by the installation of a dry-screening plant with which to eliminate the coarse waste before the material reaches the stamps, doubling the plating area and putting in a Dorr thickener to recover the water.

The high price of tungsten made possible the development of new areas of scheelite at Randsburg and Atolia and the opening up of an entirely new camp at Bishop. While the declining prices of tungsten in the past two months has to some extent curtailed the output, the properties that have an appearance of permanancy are still being worked in the Randsburg and Atolia districts; and the tungsten miners in the Bishop district are going ahead with their mill installations in the belief that the market and price will continue to be equal to the requirements of economically operated mines.

Dredging, which produces 85% of the placer gold in California and 38% of the total gold yield, continues in a flourishing condition. There have been two large gold dredges completed in the Yuba Basin field, one by the Yuba Consolidated Gold Field and one by the Marysville Gold Dredging Co., and other installations are contemplated. There has been a good deal of talk in the past two or three years of decadence in gold dredging in California, due most likely to the fact that some of the fields are being worked out; but new fields are being found. In Trinity County the Guggenheim interests are building a new 9-cu.ft. bucket dredge, and the same interests are building one of the same size on Yuba River, near Smartsville. Another new dredge is being built by the Oro Dredging Co. in Calaveras County.

Hydraulic mining is still active in Trinity and Siskiyou Counties; a merger of hydraulic-mining interests is reported in the Slate Creek district, Sierra County, which contemplates the building of a large restraining dam across Slate Creek, which will permit hydraulic mining at Scales, Port Wine, Whiskey Diggings, Gibsonville, La Porte and other old camps in Sierra and Plumas Counties. Some new mines are reported also in central California.

There has been a revival of drift mining along the Magalia ridge in Butte County and also in Sierra County.

Copper mining has been very active in the first half of the year largely because of the high price of the metal. The larger companies have increased the wages of the miners in the form of a bonus during the period of high prices. New copper properties have been opened in Trinity, Siskiyou, Plumas and Madera Counties and in some counties of the south. The Engel Copper Co. in Plumas has adopted the flotation process of ores shipped to Nevada smelters. The Calaveras Copper Co. has increased the capacity of its flotation plant. The Penn Mining Co. won its first legal battle with the farmers who had brought suit in the United States District Court for alleged damages from sulphur-dioxide fumes.

Altogether the mining industry of the state is advancing, and there is good evidence of the advancement being of permanent character.

Mine Experiment Stations Named

The first two experiment stations provided for in the act passed by Congress last year, and appropriated for at the present session, will be situated at Fairbanks, Alaska, and at Tucson, Ariz. A third station, the situation of which has not been definitely settled, will probably be placed somewhere in the Pacific Northwest. In addition three mine-safety stations will be established at Butte, Mont., Reno, Nev., and Raton, N. M. The sum of $25,000 has been appropriated for each of the mining experiment stations, and $101,500 for the three safety stations.

The act authorizes the Secretary of the Interior to establish in the several important mining regions of the United States 10 mining experiment stations and seven mine-safety stations in addition to those already established, but provides that not more than three of the experiment stations and the same number of safety stations shall be established in one year. The purpose of all of the stations, according to the law, is to make investigations for the purpose of improving conditions in the mining, quarrying, metallurgical and other mineral industries, safeguarding life among employees, preventing unnecessery waste of resources, and otherwise contributing to the advancement of these industries.

Each of the mine-safety stations is to be equipped with an all-steel mine rescue car which will respond to disaster calls within its prescribed territory. Congress has appropriated $53,000 for the purchase of the three cars and the contracts are about to be let by the Bureau of Mines. These cars will be of special design and will represent the most modern thought in rescue work. They will be manned by expert crews of life savers, who, when they are not employed at a mine disaster, will go to the different mining camps and train the miners in rescue work and first aid to the injured.

"There has been a great deal of rivalry between the various mining sections for the establishment of these first experiment and safety stations," said Secretary Lane, in commenting upon the announced locations. "It has been difficult to make selections—in the future some of the other localities will be given their opportunity."

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Iron Mines of Yangtze, China, are to be opened and exploited by the Japan-Chinese Industry Co., which has obtained a concession for that purpose.

Ecuador Develops Oil Industry

The successful exploitation of the Peruvian petroleum deposits has led in recent years to the study of the neighboring deposits of Ecuador. Petroleum is said to exist in marketable quantities in the province of El Oro, near Santa Rosa, not far from the Peruvian deposits. The known deposits where outflows are frequently found are contained in an area said to extend from Puntilla, eastward at least as far as the town of San Vicente. This field is 90 mi. southwest from Guayaquil and 740 mi. from Panama.

A spongy blue shale of unknown thickness constitutes the petroleum-bearing stratum. This covers a known area extending about 6 mi. north and south and about 20 mi. inland. The existence of a small oil fountain, together with considerable gas, is thought to indicate that deep drilling will produce flowing wells. Judging from the depths at which oil is found in the adjacent Lobitos field of Peru, it is thought that oil in commercial quantities will be reached at a depth of about 1,000 ft. Drilling, including casing, costs about $7.50 per ft. to a depth of 1,500 ft., and about $10 per ft. to 2,500 ft. There is an abundance of native labor costing 50 to 75c. per day; the drillers and mechanics must be brought from the exterior, with wages from $100 to $150 a month.

The present local demand for about 25,000 bbl. of petroleum for fuel is satisfied by digging holes 10x10 ft. square to a depth not exceeding 50 ft., in which the oil collects by seepage. The demand is increasing considerably, however, and a number of industries in Ecuador would use oil for fuel if the supply were sufficient and steady. The present price is $12 per ton at Guayaquil.

Recently a law was promulgated exempting from all fiscal and municipal duties and taxes the production and exportation of petroleum and its derivatives for a period of 20 years.

The Ecuadorean oil-bearing properties are owned and controlled by local syndicates, but the proprietors are endeavoring to interest American capitalists in the development of the industry, with prospects of ultimate success.—*U. S. Commerce Reports,* July 15, 1916.

Manganese in the East

The demand for manganese ores and the high prevailing prices lend interest to a report on some manganese mines in Virginia and Maryland, by D. F. Hewett, of the United States Geological Survey. The demand for large amounts of manganese ores in this country began in the period 1865-1870, with the introduction of the Bessemer and openhearth processes of steel making, and has grown enormously. The domestic supplies have supplied only a small fraction of the manganese required by our industries—in 1915 only about 3% and from 1910 to 1914 only 1%.

Virginia has contributed more heavily than any other state to the domestic production. Five of the six deposits described are on the east side of the valley that lies west of the Blue Ridge. They coincide roughly in position with the outcroppings of a group of Cambrian shales and quartzites. The other deposit lies well east of the Blue Ridge. Psilomelane is the commonest manganese mineral of all the ores, but manganite and wad are also present.

Exploitation of Arkansas Zinc

By Lucius L. Wittich*

SYNOPSIS—Arkansas zinc ores are mainly carbonates occurring in the magnesium dolomite strata of the Yellville formation. The guiding-formation to the miner is the Key sandstone. Numerous new mills have been recently constructed in the district and others are building or planned.

Zinc- and lead-ore shipments from northern Arkansas mines are aggregating about 80 to 100 carloads a month. About 85% of this is zinc carbonate, 5% sphalerite and 5% lead, chiefly galena. At no time in the history of the Arkansas district has the output been so heavy: at no time has the activity in mill construction been so pronounced. The influx of miners to Arkansas fields is due to the high price of zinc ore, and the steady demand for it is resulting in the springing up of new mining camps at several points, while old camps are becoming greatly overcrowded.

The chief zinc- and lead-producing counties of northern Arkansas are Boone, Marion, Baxter and Searcy. Railroad shipping points are situated along the White River division of the Iron Mountain R.R., which runs through the western part of the district, and along the Missouri and North Arkansas R.R., which traverses the eastern part of the district. As many of the heaviest producing camps, such as Rush, Maumee and others, are far removed from railroad points, long hauls over the mountainous roads are necessary. The average cost of getting concentrates hauled to the railroad is from $1.50 to $3 a ton, native labor being exceptionally cheap in this respect. The transportation facilities at Rush, the largest producing camp, will soon be greatly improved through the completed construction of a narrow-gage railroad from Yellville Junction, 11 mi. distant. Owing to the isolated situation of many of the mills, it is too expensive to haul coal for fuel, and wood is the most common fuel. Oil engines are beginning to be used also.

Unlike the deposits of the Joplin district, which are found in the Mississippian series of the Carboniferous system, the Arkansas ores occur chiefly in the Yellville formation of the Ordovician system, which is a much older sedimentation than the Mississippian. The Yellville formation is composed of magnesian dolomites, outcropping being common in northern Arkansas. The base of this rock system shows no outcropping, and its depth is estimated only by deep drilling, which indicates that it may extend down to the pre-Cambrian crystallines. Where the Yellville formation outcrops along the White River, its width reaches 500 ft.

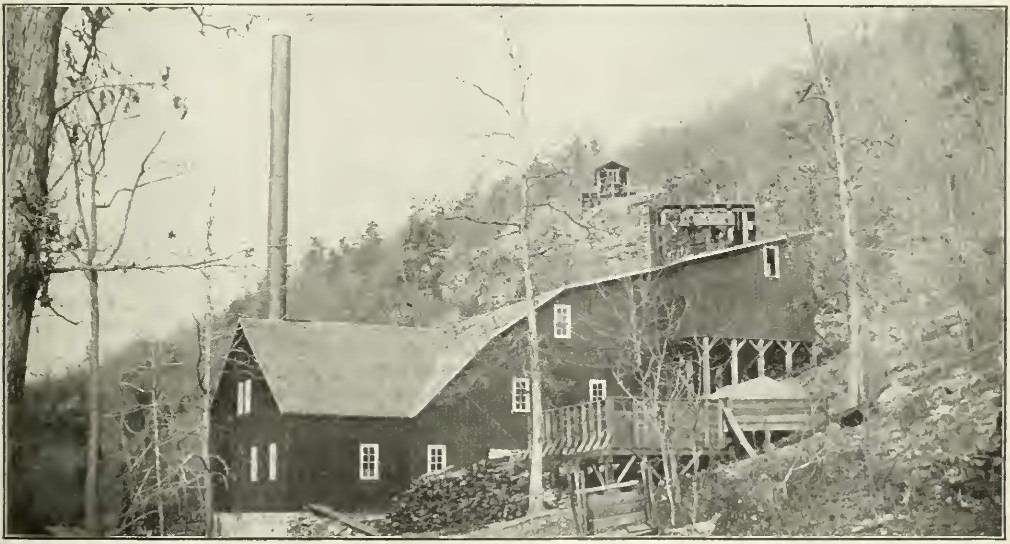

FIG. 1. McINTOSH ZINC CONCENTRATOR, RUSH, ARK.

Just as the oölitic limestone is the guiding geological formation of the Joplin district, overlying the Grand Falls chert or ore-bearing stratum of the sheet-ground regions, so in the northern Arkansas field the most valuable guide is the Key sandstone, which occurs in benching and usually marks the cap rock, overlying the dolomites in which the ore occurs. The Key sandstone is distinguished through its resemblance to coarse brown sugar and its decomposed appearance. Fracturing, jointing, faulting and slight brecciation characterize the areas where the mineral is most likely to be found. The ore, when a blende, usually produces a concentrate running as high as 62 to 64% metallic zinc, with no iron, while the carbonates produce a concentrate, or free chunk ore, running from 38 to 48% metallic zinc.

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*Recently deceased.

The first mining in the district was for lead in 1818, but not until 1857 was lead produced on an extensive scale. In the same year zinc carbonate was produced for the first time. In 1899 prices soared to a point that encouraged extensive mill construction. The greatest activity, however, began about six months ago, since which time about 20 new mills, chiefly of the most modern design, have been constructed, and 12 or 15 more are either in course of erection or will be built in the near future.

As the ore-bearing stratum usually is found outcropping high on the mountainsides, the method of mining in most instances is confined to drifting in on the orebody. Sometimes the ore formation is simply quarried, and where the ore is rich enough, mill concentration is sometimes dispensed with and the free carbonate (little blende is mined in this manner) is corded up and sold to the smelter. The ore is sold chiefly in the open market to the highest bidder, although where some producers have made long-time contracts with smelting concerns, the former are getting all the best of it, owing to the fact that the open-market prices have declined materially. The ore goes to smelteries in Illinois, Kansas and Oklahoma and is reputed to make an exceptionally choice grade of spelter, due to the almost complete absence of lead and to the high grade of ore.

Treating the Sludge Ore

A feature of concentration that has been overlooked by almost every operator in the district is the importance of treating the sludge ore. Believing that the carbonate ore did not possess enough specific gravity to respond to table concentration, producers were formerly wont to discard all the tailings without even so much as passing them through a settling tank, and without giving them a single table treatment. Recently, however, where experiments have been conducted, it has been proved that the percentage of loss can be cut down materially, as a result of which more tables are finding their way into Arkansas mills. The average Arkansas producer is inclined to consider it a boon to be enabled to discard his tailings directly into the creek or river that flows through the valley, on the precipitous side of which his mill is usually situated. Many of the district's largest plants are along Rush Creek and Buffalo River, and there is no doubt that hundreds of thousands of dollars in metallic zinc have been lost as a result of discarding the refuse from the mills into the streams.

The Big Hurricane No. 2 mill, operated by John Conness Shepherd, of Rush, and situated 4 mi. west of Pindall, Ark., or 40 mi. west of Rush, will soon be one of the most complete plants in the district. Among other machinery items it will have a 6-ft. by 16-in. Hardinge conical mill, the first of the kind to be used either in the Missouri or the Arkansas district. Other features of this new mill will be a Dorr thickener, 30 ft. in diameter by 10 ft. deep, 7 Wilfley tables and 1 Diester-Overstrom slimer. Feed for the mill will be furnished by a 3-in. suction pump. The mill will be run by a Fairbanks-Morse oil engine. Shepherd owns the fee to 588 acres on which the Hurricane is situated, having purchased it recently for $85,000. At the Hurricane No. 1, which is a mere "coffee mill," the output is already 25 to 40 tons of concentrates a week. A carbonate deposit, outcropping on a hillside and mined from an open pit that has reached a depth of 85 ft. and a length of 200 ft., furnishes the ore. The No. 2 mill will be situated across the valley north from No. 1 and will, for the time at least, handle only the tailings from the No. 1 property.

At the Philadelphia mine in Rush, steam power has been replaced with oil engines of the Fairbanks-Morse make, one of 100 hp. having been installed to run the mill machinery and another of similar capacity to operate a 600-ft. Ingersoll-Rand compressor. Sullivan Jackhamers are to be used for the lighter work of running prospect drifts, while the regulation drills will continue in use in the tunnel mining. A new aërial tramway, ¼ mi. in length and spanning a deep ravine, will connect the Monticello shaft on the south side of the valley with the mill. The tramway will be almost 200 ft. in height at its highest place and will be built at a cost of about $8,000. Mining at the Philadelphia, which is one of the steadiest producers in the Rush field, is carried on from three tunnels at various elevations above the bottom of the valley. The highest is about 225 ft. above the creek bed. Beneath this is a tunnel 175 ft. above the creek bed. From both these tunnels run numerous smaller drifts at varying levels, some rising above the floor of the main tunnel and others dropping below it, according to the trend of the orebody, which has made in breaks between limestone walls. The ore from both these tunnels is sent down chutes lined with railroad iron, to the mill hopper. From the third tunnel, which is only 30 ft. above the creek bed, the ore is hauled to the mill and hoisted up to the hopper. In addition to the two Wilfley tables already in use at this property, two additional tables are being installed.

New Mill Construction in the District

Two large new concentrating plants have just been completed in the south end of the town of New Rush, which is 1¼ mi. down Rush Creek from the old town. These mills are the Edith and the Yellow Rose, the former operated by E. Emanuel and the latter by James McCarty & Co. The Edith gets its ore, a white carbonate, from a tunnel in the mountainside and treats it at a 200-ton plant operated by two 50-hp. Chicago-Pneumatic oil engines. This mine is situated on a lease from the Buffalo Zinc and Copper Co. The Yellow Rose is equipped with Chicago-Pneumatic oil engines and has a daily capacity of 100 tons. The company owns a fee to 4 acres and has first lease on 40 additional acres.

Although the sidehill locations of most of the mills in the district provide conditions ideal for gravity milling, little advantage of their situation has been taken by most Arkansas mines, and the ore handling is much the same as in the average plant where ore is hoisted from a vertical shaft to a mill built on level ground. The one important exception to the rule is the McIntosh mill, shown in Fig. 1, a new plant of 100 tons' daily capacity, situated on an 80-acre lease between the new and the old towns of Rush, and owned by John Conness Shepherd. Steam power, wood being the fuel used, runs the mill. The ore passes from hopper to crusher, thence to rolls and revolving screen, thence through the ordinary process of mill concentration, each step, however, being at a lower level than the preceding one. Only one elevator is used, that being to lift the middlings back to the rolls.

The oldest producer in the Rush field, and one of the best known mines in northern Arkansas, is the Red Cloud, situated on a 400-acre lease from the Red Cloud Mining Co., on the right-hand bank of Buffalo River, opposite the Edith and the Yellow Rose mines. Recent improvements have been made in the Red Cloud mill, and the property is now producing about a carload of concentrates a week. More than 2,500 ft. of tunneling has been done at this property. Outcropping zinc blende led to the first development, but the blende formation proved only a veneer, beneath which an extensive formation of carbonate was found. The occurrence of the carbonate is in large and small fissures, the larger runs extending almost squarely back into the mountain, while smaller leads are followed at right angles from the main deposit. Occasionally a body of blende is found, but the chief production is of carbonate. R. C. Day, of the Day Rubber Co., St. Louis, is head of the Red Cloud company, which operates in addition to the Red Cloud mine the Buffalo Zinc and Lead Co. property, now constructing a new mill on Rush Creek.

In the vicinity of Zinc, Ark., are found the largest blende-producing mines, and in this field numerous new mills are in course of construction. These mines also produce a heavy tonnage of carbonate. Owing to better railroad facilities, development near Zinc has received quite an impetus of late. One mile east of Zinc is the Rising Sun mine, formerly known as the Jack Pot. Here a 100-ton concentrating plant has been constructed and both blende and carbonate are being turned out. Other new mills near Zinc are the Coker Hollow, owned by Judge J. M. Hayes; the Almy, owned by W. P. Kendall; the Gloria, owned by Col. W. H. Almy.

The Zinc district lies to the north of Rush. To the southwest of Rush is the Maumee district, near which is situated the Sure Pop mine, reputed to have the highest percentage of carbonate recovery of any Arkansas mine. A 50-ton mill produces a carload of carbonate a week, it is reported. The mine is on a lease of 160 acres. The Sure Pop No. 2 is run by F. M. Kennedy, of Maumee, whereas the No. 1 mine is one of J. Conness Shepherd's properties. The No. 2 mine is to be equipped with a 100-ton concentrating plant. In this same region is the Silver Run, located on the Reese land, mining through one shaft and one tunnel and operating a new 100-ton mill which produces both carboate and jack. Among other mines of the vicinity may be mentioned the Jack Pot, where Thomas Neal and associates are reconstructing a mill; the Churchill, equipped with a new 150-ton mill, and the Evening Star, also equipped with a new 100-ton mill, operated by N. W. Redwine, of Leslie, Ark.

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Metallurgical Industries in France in 1915

In the metallurgical industries of France the blast furnaces, rolling mills and other plants were actively employed throughout the year, almost exclusively on government work. As shortly after the outbreak of hostilities the great metallurgical centers of the northern and eastern districts of France were occupied by the enemy and possession taken of the rich ore mines and the important furnaces and rolling mills that are located in that region, a large proportion of the steel and iron supply of France was eliminated, according to the "Commerce Reports" of June 28, 1916, of the U. S. Department of Commerce.

By accelerated operation, by putting furnaces into blast that had been idle and by erecting new furnaces, the normal output in the other metallurgical districts in Normandy, Brittany, Anjou, the Midi, Pyrenees, Nancy, etc., was greatly increased. But the orders placed by the government for guns, projectiles, armor-plating for vessels, structural steel, etc., were so abnormally large that the home supply of raw or half-finished materials was not sufficient, hence great quantities of foreign steel and iron were imported. The receipts of pig iron in 1915 were 166,709 tons, against 15,886 tons in 1914; steel billets and bars, 581,482 tons, against 16,882 tons; machine iron and steel, 64,831 tons, against 5,160 tons; iron and steel rolled plates, 78,628 tons, against 7,763 tons; tin plate, 68,340 tons, against 24,878 tons; iron and steel plain and barbed wire, 46,105 tons, against 7,407 tons; and steel rails, 40,659 tons, against 517 tons.

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John F. Campion

Special Correspondence

By the death of John F. Campion in Denver, July 17, which was briefly noted in the *Journal* last week, Leadville lost one of its most loyal and successful pioneers. Mr. Campion entered the district in the spring of 1879, when Leadville was in the midst of the greatest mining boom in the history of the West. He had previously engaged in several ventures in California and Nevada, meeting with varied success, his most important undertaking being the purchase of the Pioche-Phœnix property at Pioche, Nev. The experience acquired through his activity in California and Nevada equipped him with an invaluable knowledge of practical mining, and upon his arrival in the Leadville district he was fitted far above the average man for taking advantage of the opportunities open to him. He made a careful study of the geology of the district and solved to his own satisfaction many of the intricate problems which confronted the mining men of the early days.

Mr. Campion has often been termed "lucky," but mining to him was more a matter of business than a gamble. He understood the risks and he also fitted himself against these risks by securing a thorough knowledge of a venture before entering upon it. Undoubtedly good fortune followed him in many of his undertakings, but he never ventured blindly.

The first activity undertaken by Mr. Campion in the Leadville district was on the Elk and Lucy B. Hussey properties, in what is now known as the Down Town section. These properties are in a territory that has been broken and displaced by many faults and where an intimate knowledge of the geology is necessary to develop the ground intelligently. Under Campion's trained and efficient management large orebodies were opened in both properties, and he extracted sufficient money from them to enable him to carry on other ventures which ultimately made him a millionaire.

It is stated that at one time in life every man has the "big adventure." In the life of John F. Campion, the big adventure was the Little Jonny Mine on Breece Hill, a property that is world-famous as a producer of gold. Campion always had a consuming faith in Breece Hill, believing that one of the largest mines in the district would be uncovered there. Several attempts had been made to sink what is now known as the Little

Jonny shaft, but the obstacles encountered, water and dolomite sand, forced the men to give up. These failures, however, had no effect on Campion's faith, and he succeeded in interesting a number of well-to-do men, including A. V. Hunter, G. W. Trimble, Charles Cavender and others, in the undertaking, forming with them the Ibex Mining Co. It cost a small fortune to sink the shaft, and at times the outlook was discouraging. Ore was first encountered in April, 1893, and after that there was no doubt of the success of the venture. The Ibex company quickly realized millions on the original investment, and the property has been producing steadily ever since Campion found the ore in 1893. After securing the greater part of his fortune from the fabulous strikes repeatedly made in the Little Jonny, he undertook mining ventures in every corner of Lake County. Many of them proved unsuccessful, while others added to his great wealth.

With a large fortune and a desire for a quiet life, Campion moved to Denver, where he built a magnificent residence and entered into the business and financial circles of the capital. At the time of his death, he was vice-president of the Denver National Bank, director of the Carbonate National Bank of Leadville, general manager of the Ibex Mining Co., president of the Colorado Society of Natural History, a large owner in the Moffat road and in coal lands in Moffat and Routt Counties, and a cattleman. He gave liberally to charity.

John F. Campion was born on Prince Edward Island in 1849. He is survived by his widow and four children.

Copper-Smelting Conditions in the Pacific Northwest

Seattle Correspondence

In the last few years, and especially since the Kennecott and other rich Alaska mines have started producing on a large scale, the tonnage of copper produced by Pacific Coast smelteries has increased amazingly. The smeltery at Tacoma, now a subsidiary of the American Smelting and Refining Co., produced both lead and copper up to four or five years ago, at which time its lead plant was torn out and the plant has since been devoted to copper production alone.

A year ago the plant had two blast furnaces and a converter capacity of 6,000 to 7,000 tons of copper per month and an electrolytic refinery with a capacity of something over 2,000 tons a month. During the last year there has been installed a large oil-fired reverberatory furnace, together with a battery of Herreshoff roasters to smelt the fine ores and a largely increased converter capacity in the form of Smith-Pierce converters. A new refinery, with a capacity of over 3,000 tons of copper per month, has been added, a new power plant built and a Cottrell dust-precipitation apparatus installed. A number of incidental improvements have also been made, including a Bleichert tramway for stockpiling excess ore.

In addition to the British Columbia and Alaska ores that have hitherto been the sources of supply, shipments of copper concentrates from Chosen began to be received at the Tacoma smelter. A considerable tonnage of oxidized ore from South America was also received. The shortage of ocean tonnage and the high freight rates have combined to keep shipments from these sources down, but the reported recent purchase of three freighters, said to be for use in the South America ore trade, would seem to indicate that ores from this source will continue in importance at this plant. The average copper content of the ores received ranges from 15 to 20%, while the high-grade ore received from the Kennecott mine in Alaska averages 70% copper. A 60% matte is produced.

In spite of the smelteries greatly enlarged capacity, ore shipments have increased to a greater extent, so that the smeltery management has had to discourage larger production from existing producers, but still seeking not to discourage small present or prospective shippers. This has been very fully brought out by a recent announcement of the manager, H. Y. Walker, as follows:

> We are so flooded with ore from our regular customers that we would prefer not to receive any new shipments for several months. However, we realize that there are some properties, or prospects, that want to open up, that may be able to ship ore in later years, when copper is around 14c., therefore we do not want to do anything to stop the development of legitimate mining enterprises.
>
> In view of the above-outlined conditions, we have worked out the following schedule, which is practically another way of lending money to legitimate mining enterprises. If you wish to ship ore on this schedule we will be glad to take care of you:
>
> Gold—Pay for 95% of the gold at $20 per oz. No pay for gold under 0.03 oz. per ton.
>
> Silver—Pay for 95% of the silver contents at New York quotation. No pay for silver unless 1 oz. per ton or over.
>
> Copper—Pay for 100% of the copper on the wet assay, less a deduction of 1.3 units at the "Engineering and Mining Journal" wirebar price, less a deduction of 3c. per pound.
>
> Treatment Charge—$1.50 per ton flat when copper is 14c. per lb. or less. When copper is over 14c. per lb., our treatment charge is increased ¼c. per lb. for each cent increase in the quotation over 14c. to a maximum of $3 per ton.
>
> Settlement—Preliminary settlement will be made immediately upon the sampling and assaying of the ore, on a basis of 14c. copper, 55c. silver and $1.50 treatment. Final settlement will be made, however, 90 days after date we commence to reclaim the ore. The copper quotation to be used will be the average quotation for the six days published in the "Engineering and Mining Journal" of the calendar week previous to the ninetieth day after reclaiming the ore. Silver quotation will be the New York quotation on date final settlement is due.
>
> To explain this feature will say that any miscellaneous ores that we buy now, outside of our contracts, will have to go on the dump to be reclaimed when business lets up a little or we complete the installation of additional facilities that we are now putting in, and the quotation will be figured from the date we begin to pick up the ore from the dump. The exact date we do not know, but we hope it will be some time this fall when we can commence to pick the ore up.
>
> Zinc—Limit 8%. Thirty cents a unit charged for any excess.
>
> The above schedule applies on any size lot down to five tons. On anything under five tons, we add to the above rate a flat sampling charge of $10 on each lot.
>
> All schedules on ore not under contract for a definite period of time are subject to change without notice. However, should a shipment be en route at a time when we make a change in our schedule, that one shipment will be settled for on the price as herein quoted.
>
> Treatment rates apply on the ore delivered at our plant.
>
> On the above schedule where the word "ton" is used, it is understood to be a ton of 2,000 lb. avoirdupois; where the word "ounce" is used, as referring to gold and silver, it is understood to mean the Troy ounce, and where the word "unit" is used, it is understod to mean a unit of 1%, or 20 lb. avoirdupois.
>
> In case of umpires, the following rule will be observed. The result obtained by the umpire shall be accepted by both parties, provided it is between the results obtained by both contestants. If the result obtained by the umpire is above or below the results obtained by both contestants, the assay of the contestant nearest the assay of the umpire shall be accepted in settlement, and the party whose results are farthest from the umpire's result shall pay for the cost of the umpire.

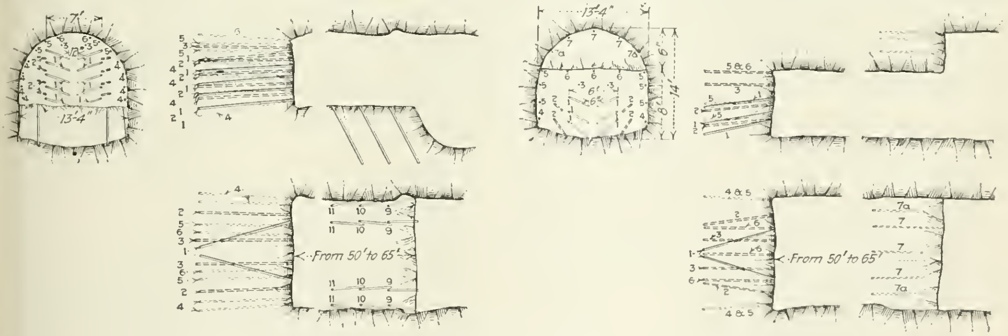
Concrete Water Tunnel Lining at Chicago

SYNOPSIS—In driving an 8-mi. tunnel for water supply, the top-heading system was found to be most economical. The use of waste rock in the concrete lining reduced hoisting and concreting costs. Total cost per foot was $61.48.

The Wilson Ave. intake tunnel of the Chicago water-supply will be about 8 mi. long and 12x12 ft. in section, with vertical sides, semicircular roof and invert floor. To keep the entire tunnel in solid rock, it was placed at a depth of 160 ft. Access to the tunnel was through shafts at five points on its alignment. The following description is prepared from a paper read by Henry W. Clausen, Engineer of Water-Works Construction, at a meeting of the Western Society of Engineers, at Chicago. Union labor is employed at the union scale of wages, which is higher than for tunnel work in other parts of the country. The lowest pay is $1.40 per day, for muckers. Drillers and miners get $5, skilled mechanics, $6, with overtime.

TOP HEADING MOST ECONOMICAL

In general the top-heading and bench method is the most economical, operated on the two-shift basis. If there is any quantity of water, it can escape freely instead of being blocked by the breakdown shot of the top heading. The second and most important reason is that on the two-shift basis a certain task can be given to the gang, which must be completed before they leave the work. It is the duty of the miners to set up columns, drill and load their holes, and shoot their rounds before going home. Likewise it is the duty of the muckers to muck out all the rock from the previous shift. It is understood that the time of the shift ends whenever these tasks are completed.



ALTERNATIVE METHODS OF DRIVING THE TUNNEL ON THE TOP HEADING SYSTEM

With a well-organized crew, for a 10- to 12-ft. round, the muckers will complete their work in from 6½ to 7 hr. and the miners in from 7 to 7½ hr. If the gang is not up to standard, it may take from 9 to 10 hr., for which they only receive one day's pay. The fact that a shift can be held responsible for a definite amount of work spurs each man to do his part.

In the three-shift method, the gang works 8 hr. and quits, the succeeding shift taking up the work where the previous shift left off. If the previous gang neglected its work, it is very much harder to place this responsibility without argument and question. This is of extreme importance when (as in this case) the work is under the civil-service system, because absolute evidence must be forthcoming before a man can be discharged. The total daily progress was no greater by the three-shift method, although a greater number of men were employed.

The concrete for lining is mixed and placed by the MacMichael pneumatic process. The mixing is done in the tunnel itself. The plant includes a conveyor traveler and a concreting traveler, both built of steel (Fig. 5). The former has an inclined track up which the car loaded with rock is hauled by a cable and 10-hp. electric hoist. The car is dumped at a screen plate having 4-in. circular holes, and the rock passing through falls upon a belt conveyor which delivers it directly to the mixer hopper. The conveyor is driven by a 3-hp. motor and runs at about 150 ft. per min.

The concreting traveler carries the pneumatic mixer and two reserve air tanks of 11 cu.ft. capacity; these are to prevent sudden drops of pressure in the air-supply line due to the large volume of air required for each discharge of the mixer. An 8-in. pipe leads to the forms.

The plant, comprising the two travelers, is moved 700 ft. every 12 days. As the forms approach the mixer, the 8-in. pipe is shortened until another shifting of the plant becomes necessary.

The method usually employed by contractors in tunnels of this size has been to complete the drift before starting the lining of the tunnel, bringing all material to the surface. After the mining was completed, the excavated rock stored on the surface was crushed and screened and made into concrete, which was brought into the tunnel and placed by hand behind forms of steel or wood. From 30 to 35 ft. per day was lined in this way. When the drift was long, the concrete sometimes had its initial set before arriving at the forms. By a radical departure from this method, the Wilson Ave. tunnel secures a great gain of economy.

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*"Engineering News," May 25, 1916.

It was noticed that the muck or excavated rock contained considerable fine material and would make good concrete. Various compressor foundations and other miscellaneous concrete work on top were built with this material. Test cubes also showed satisfactory strength. It thus developed that the rock could be used for concrete without previous crushing.

Realizing the possibility of saving time and also of saving the expense of hauling back and forth the material required for the lining, as well as the cost of purchasing crushed stone and sand for the concrete, a method was devised for carrying on both mining and lining simultaneously. For this purpose the screening and mixing machine was installed in the tunnel. It handles all the rock coming from the heading and delivers all rock under 4 in. to the pneumatic mixer. The oversize is rejected and loaded by hand into a car.

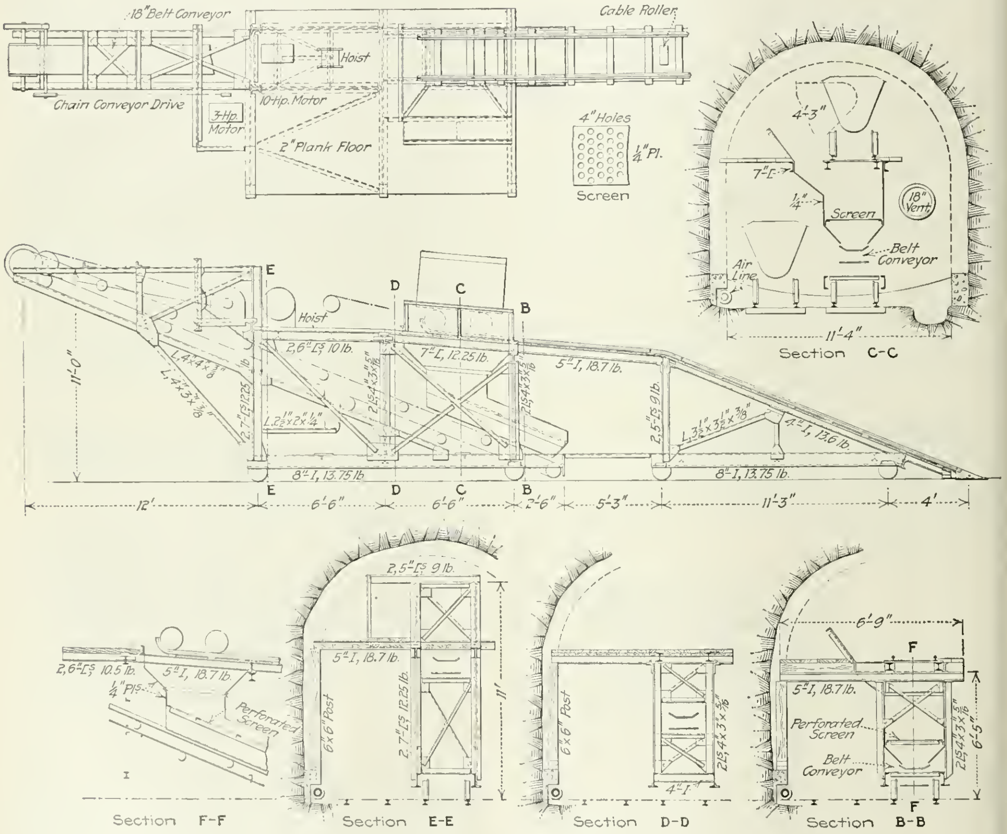

FIG. 5. TRAVELING CONVEYOR FOR DELIVERING ROCK TO THE PNEUMATIC MIXER

The pneumatic mixer delivers the concrete through an 8-in. pipe placed behind the steel forms at a distance of as much as 800 ft. The screening machine and the concrete mixer operate on one track and within the clearance of the final tunnel dimensions.

The forms are made of the traveling type. As the mining and lining had to be carried on at the same time, room had to be provided through the forms for transportation of muck to the shaft, with sufficient clearance for the locomotives. These are Blaw forms, constructed of structural shapes and steel plates in 30-ft. sections, and are mounted on roller-bearing wheels running on 70-lb. rails.

By means of this system of working, approximately 60 ft. is lined in two shifts. The net results are that 20 to 22 ft. a day is mined and approximately 60 ft. of tunnel is lined with the excavated material on each working day in each drift.

In advance of the steel forms, concrete guide walls are constructed by hand. Wood forms are used for these, set to true line and grade from the engineer's center line and grade plugs. These concrete walls guide the steel forms so that the finished lining is absolutely true to line and grade. Mr. Clausen states that this is something it was difficult to get a contractor to do, his policy being rather to fit the hole as blasted as near as possible and thus avoid trimming. This would sometimes result in the tunnel being a series of short tangents varying 2 to 6 in. from a straight line.

At the Lawndale shaft the rock is of a different texture, 50% breaking over 4-in. size. As at this shaft the total excavation was required for concrete, it was decided to put in a crusher. Accordingly, a concreting machine is placed in each drift, and the oversize from the east machine (at the face) is put through the crusher and sent to the west machine in the completed drift.

The crusher was mounted on timbering in an enlarged chamber at the bottom of the shaft. Above it and at one side was a track on which rock cars were run from the shaft cage and dumped directly into the crusher. Beneath was another track for cars to receive the rock.

The average daily tunnel excavation is about 20 ft.; on many days as high as 22 and 23 ft. is made. The maximum has been about 26 ft. One reason for the remarkably rapid advance is the rapid clearing of smoke by the ventilation system. On similar work done by contract, the best daily average was 8 ft. A record progress of 15 ft. on one contract left so much trimming to be done afterward that the average daily rate was lower.

When excavating rock at 20 ft. per day, a round trip of the cage is made every 56 sec., 7 sec. being used each at top and bottom for loading a car. The descent would be made in 10 sec. At the bottom of the Lincoln Ave. shaft, in order to facilitate this operation, there is a spare track on one side of the cage to handle empties.

The cost of excavation of 12-ft. tunnel (labor and material) averages $32.94 per ft. The lining was estimated at $15, but is costing less. For all work in 1915, including depreciation of plant, engineering, inspection, excavation, lining and cleaning, the average cost was $61.48 per ft. The cost by contract was estimated at $75 per ft., and on the basis of the lowest bid it would have been $68.20.

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Gold Production in Australia

The gold production of the Australian continent which has been declining for several years, again showed a loss in the first half of 1916. The decrease, as compared with last year was 15.4%, a heavier ratio than for several years, the causes being briefly indicated below. As these causes are still in operation, it is hardly to be expected that the second half of the year will show much improvement.

The gold production of Australia for the half year is reported as follows, comparisons being made with the first half of 1915; the figures are in five ounces:

	1915	1916	Changes
Western Australia	626,930	525,035	D. 101,895
Victoria	164,101	135,000	D. 29,101
Queensland	128,635	116,893	D. 11,742
New South Wales.......	71,942	61,000	D. 10,942
South Australia	2,800	2,975	I. 175
Tasmania	9 500	8,750	D. 750
Northern Territory	1,275	1,075	D. 200
Total, ounces	1,005,183	850,728	D. 154,455
Total, value	$20,777,133	$17,584,548	D. $3,192,585

The production of South Australia and the Northern Territory is partly estimated.

The larger mines of Western Australia have continued to produce lower grade ores, and no new developments have been made. In the other states the main reason for the decrease this year has been the shortage of mine labor, which is in large part due to the war and the heavy contribution of men which Australia has made. No new mines or districts have been opened this year. In fact prospecting has been at a standstill, with the exception of a little in South Australia.

New Zealand has made no monthly reports this year; but is reported that there has been a considerable decrease in production.

Bauxite in the Guianas

A report from United States Consul George E. Chamberlin at Georgetown in British Guiana says that activity in exploring for bauxite in British and Dutch Guiana has been marked in the last two years. Bodies of this mineral have been found in both colonies, and the prospects of those engaged in the industry are believed to be highly satisfactory. A syndicate which establishes a working agreement has been formed, from 13,000 to 14,000 acres of land have been purchased, mining rights over 6,000 acres secured, and application made to the government of British Guiana for the lease of three tracts of Crown land of 500 acres each. All these tracts are on or near the Demerara River, in the vicinity of Wismar, Christinburg and Three Friends, from 65 to 80 mi. above Georgetown. Other deposits are known to the local government, and application has been made for particulars as to the location.

Active operations have been commenced in Dutch Guiana, but on account of the fact that the leases for Crown lands required in British Guiana have not yet been approved by the British government, to which they were referred, no active development has been undertaken in this colony.

The extent of the deposits of bauxite in Dutch Guiana is not known, but they are believed to be fully as extensive as those of the British colony. Some of the known deposits are located as follows: At Oncribo, Para Creek, Surinam River; at Rena Reu Creek, Portorico, on the Surinam River; on the Cotteca River; on the Marechals branch of the Surinam River.

American citizens are not prevented by the laws of either colony from acquiring prospecting and mining rights for minerals, but in British Guiana only British subjects can acquire rights for mineral oil.

Mining concessions or leases of Crown lands in British Guiana, for 99 years or under, may be obtained for any area on payment of $10 with the application and an annual rental of 20c. per acre, payable in advance on Apr. 1 of each year. The concessions are suitable in cases where the work to be carried is of a permanent nature and necessitates the expenditure of large capital, as they are not open to automatic revocation for nonpayment of rental nor are they liable to be jumped, as an ordinary claim license is liable every June.

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Employee's Right to Lien Against Mine

By A. L. H. Street*

Like several other states, Oklahoma has a statute giving a lien to miners and other employees engaged in developing mines, for labor performed in and about the mines. The Supreme Court of that state was recently called upon to apply this law in a case where an employee of a zinc-mining company claimed a lien for services as a watchman over an abandoned mine and for collecting accounts due the mining company. (Hunt vs. Stribling, 157 Pacific Reporter, 711.) In denying that there was any right of lien for such services, the court said: "The purpose of the act was to give those who are engaged in the development and opening up of a mine a lien upon the property for their services."

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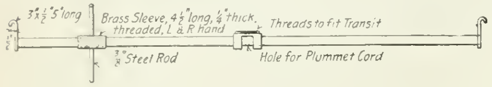
*Attorney at law, 829 Security Building, Minneapolis, Minn.

Details of Practical Mining

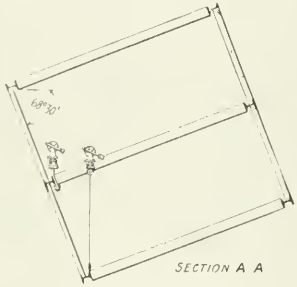
Supports for Transits

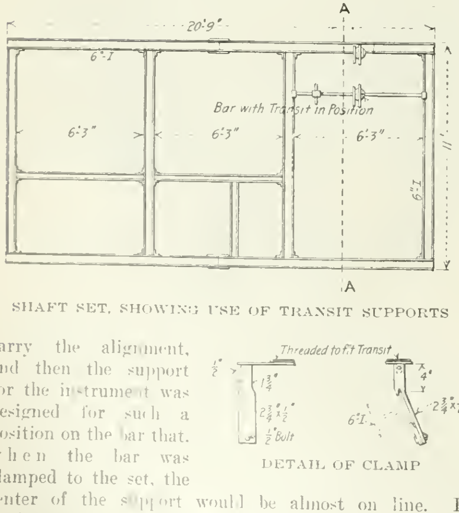
By John F. Spedding*

The accompanying illustrations show two supports used for setting up a transit in a shaft that was being sunk at a steep angle and lined with steel of 6-in. H-section. Before the bar was made, it was decided which would be the most convenient part of the shaft through which to carry the alignment, and then the support for the instrument was designed for such a position on the bar that, when the bar was clamped to the set, the center of the support would be almost on line. In setting up with the bar, the latter is placed on the shaft set and tightened by means of the handle, which turns the threaded brass sleeve, thus forcing the two ends of the bar tight against the end piece and divider. The instrument is then screwed on and will require only about ¼ in. of movement to bring it on line, and once set, there is no danger of slip.

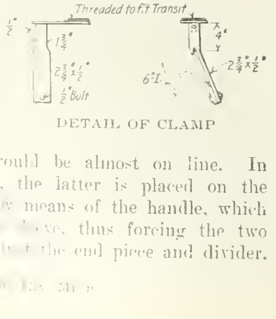


DETAIL OF BAR





SHAFT SET, SHOWING USE OF TRANSIT SUPPORTS



DETAIL OF CLAMP

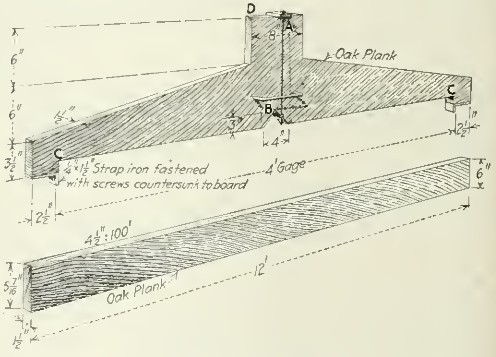
In some cases it was found that it would be much more convenient to have the transit closer to the foot of the shaft, and so the arm was made. This also admits of rapid and accurate setting up, and takes up less room than the bar. About 1,200 ft. of shaft has been lined in with the transit, using either the bar or the arm, and much time has been saved and good results obtained.

※

Gage and Level Boards for Track Laying

There are various devices used by the miner in laying track in the level or drift that he is driving, and those shown in the sketches seem to be as good as any.

The gage board shown in Fig. 1 is used in laying track; and before the second rail is spiked to the ties the miner should try his board on both rails to make sure that the gage just fits over the rails at the offsets *CC*. These offsets are reinforced with strap iron so that constant wear at these points will not alter the gage.



FIGS. 1 AND 2. SIMPLE AND PRACTICAL DEVICES FOR LAYING TRACK IN MINES

From *A* to *B* a straight line is marked in the exact center of the board and at right angles to the line *CC*. A cord with a plumb-bob attached is suspended at *A* so that the plumb will swing freely in the notch cut at *B*. In turning curves in the mine roads it is desirous to elevate the outside rail, and if the gage board is placed on the rails and a combination spirit level on which can be read the elevation per foot is placed on the plane surface at *D*, the miner can readily raise his rail.

These combination rules and spirit levels are universally used for all kinds of work in and around the mines and can be obtained at almost any hardware store for $2.

The level board used by the miner for carrying his grade is shown in Fig. 2. The large end of the board is placed on the track with the small end pointing in the direction of the grade. The road is then raised or lowered until the bubble in the spirit level, on top of the board, comes to rest in the center of the rule.

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*Mining engineer, Box [illegible]

It is extremely important that the miner should carry a good road, for many transportation delays, such as a wet road caused by poor drainage, and much expense and labor are avoided by it. If the miner uses these devices intelligently and his work is checked up occasionally by the mine foreman or his assistant there is no reason why he cannot lay track as well as the tracklayer. —*Coal Age*, Aug. 5 1916.

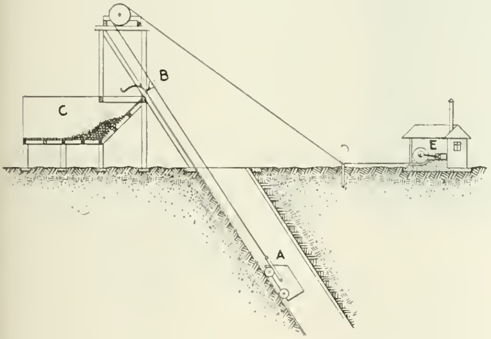
⁂

Headframe for Inclined Shaft

By Frederick W. Foote

A mine recently reopened in Virginia was entered by an old inclined shaft dipping at an angle of 55°. It was decided to put the hoisting plant on the hanging-wall side of the shaft rather than in the usual position on the foot wall. This was deemed necessary on account of the situation of the mill and waste pile.

A headframe was built of native timber, as shown in the accompanying illustration. Its diagonal legs rested on the shaft collar set, which was a monolithic concrete block, while the posts were set on concrete piers set in the foot wall. The legs were given the same slope as the shaft and carried the track. The skip *A*, which was a wooden affair built on the property, ran up to the point *B*, where it dumped into an ore bin *C*, which was made an integral part of the headframe. An idler *D* kept the hoisting cable down so that it entered the drum of the hoisting engine *E* horizontally. The headframe was successful in operation.



HEADFRAME WITH HOIST ON OPPOSITE SIDE OF SHAFT

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Development Work Data

Some ideas on the relative advantages of development work by company forces and by contract may be derived from the following data. During a month's operations 568 ft. of development work was accomplished, consisting of raises, crosscuts and drifts. The total actual cost of labor, explosives and timber was $3,959.90, or $6.94 per ft. Some of this work was done on force account and some on contracts ranging from $7.50 to $9 per ft.

The following instance shows the contractor's gain on a raise 32 ft. high: The price on this was $9 per ft. The contractors received $288, paid out $50 for supplies and did 310 hr. work. Their profits were at the rate of $0.76 per hr., while the current wage scale was $0.45 per hr. This is a gain of 68%. In another case of cross-cutting 45 ft. was acomplished under contract at $7.50 per ft., or a total of $337.50. Supplies cost $86.95 for this period. Profits were $250.55 and 726 hr. labor was performed. This compensation was at the rate of $0.34 per hr., or a loss of 24% to the contractors.

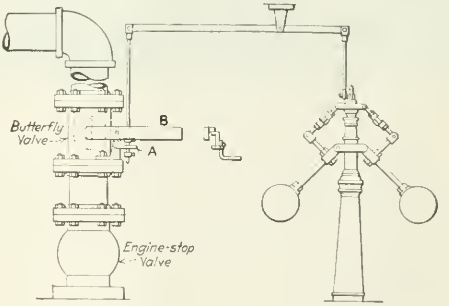
The monthly results were as follows: On 568 ft. of development the contractors received $1,279.50 for 528 ft., while 40 ft. was done on the force account. The total supplies cost $1,459.20, so that the contractors received $2,820.30 clear for 5,550 hr. work. This is at the rate of $0.50 per hr., or an average increase of 11%. Expressed in a different manner, contractors made as high as 68% increase and lost as much as 24% and averaged 11% gain over daily wages. The company paid 11% more than if the work had been done entirely on the force account, but doubtless saved more than this in fixed charges, air, superintendence, etc.

⁂

A Home-Made Engine Stop

A home-made engine stop made entirely from material from the scrap heap—except the butterfly valve—is described in the April *Locomotive*, by J. Simpson.

The device as installed consisted of a butterfly valve placed directly above the engine throttle. The disk of the butterfly valve was arranged to be moved by a heavy lever *B* keyed to its stem in such a way that its weight was sufficient to close the valve. The closing lever was supported in a horizontal position, which corresponded to the open position of the valve, by a projection on the side of the lever which caught on the top of a forked bell-crank lever *A*. This little lever *A* was pivoted, as shown, to a small forged bracket fastened to the valve body by one of the flange bolts A rod was attached to the top of the governor and extended upward to connect with the horizontal lever pivoted to a point on the ceiling. The other end of the lever carried a rod which dropped down and hung between the forks of the bell-crank lever *A*. This latter rod was provided with two collars which could be set to trip the bell crank and release the valve-closing lever whenever the governor reached either the top or bottom of its travel. Thus the device would serve to either stop the engine upon the failure of the driving belt so that the governor would stop revolving and fall to the extreme bottom of its travel, or it would also act in the event of



A HOME-MADE ENGINE STOP

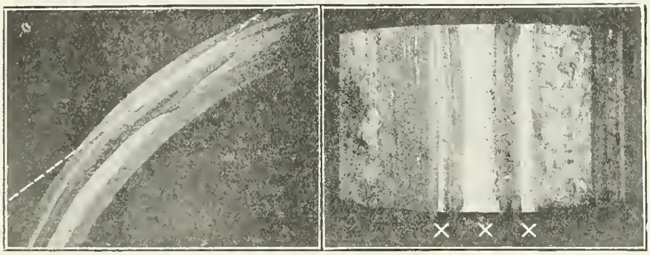
an increase in speed sufficient to send the governor to the extreme top of its range.

The arrangement proved entirely satisfactory and was retained and reinstalled when the engine was erected in a new place.

Detection of Steel in Wrought-Iron Pipe

An etching test possessing many advantages has been recommended as an aid in detecting the presence of steel in wrought-iron pipe. This test may be used in discovering steel in any of the commercial shapes of wrought iron. The detection of steel by means of picric-acid etching and a microscopic examination requires the preparation of a metallographic specimen and is a tedious operation involving considerable time and great care. Even when the wrought iron contains a large percentage of steel, the steel contents will often be missed, as there is nothing to indicate where the metallographic specimen should be prepared for microscopic examination.

The etching test has been recommended because it eliminates this uncertainty and insures success in discovering any steel that might be mixed with the iron. It is not in itself a conclusive test of the presence of steel, but it does show up the areas most likely to contain it, thereby obviating the necessity for further search and enabling the investigator to proceed at once with the more elaborate preparation of the specimen for microscopic examination.



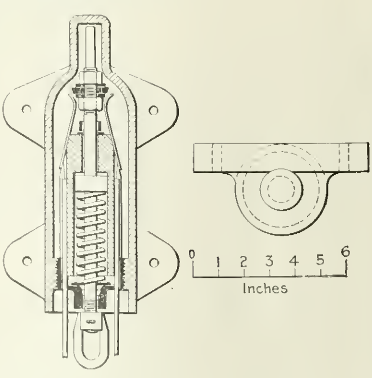
SHOWING METHOD OF FILING PIPE, AND THE BENDS DEVELOPED BY ETCHING

In making the test three or four sample rings 2 or 3 in. long are cut, preferably from different pieces of pipe or from different points on the same length of pipe. The rings are submerged one at a time in a solution consisting (by volume) of 25% c.p. HCl, 1.19 sp. gr.; 25% c.p. H_2SO_4, 1.84 sp.gr. and 50% water. After leaving in solution about one minute, the samples are rinsed in cold water and then with alcohol. Both ends of each sample should then be examined to discover bright streaks, which are an indication of steel. An examination of the surface of the metal will not, as a rule, show steel, as steel scrap usually occurs in the middle layers of the fagot. If no suspicious-looking streaks are found in the first ring etched, try additional rings. Three or four rings will usually reveal the steel scrap, especially if rings cut from different pieces of pipe are available.

A flat should now be filed on the outside of the ring suspected of containing steel, as shown by white line in Fig. 1, where the steel, according to the end indications, is most likely to be found. Stop filing when the suspected steel band or bands are half filed away or when their maximum surface is exposed. It is not necessary to polish the surface to be examined. The flat should now be etched, proceeding in the same manner as mentioned for the etching of the ends, keeping the sample in solution one minute or as much longer as is necessary to bring out the steel bands in strongest relief, as shown in Fig. 2. If it is desired to keep the etched surface from fading, it should be covered with white shellac or some other suitable nonacid coating. If any doubt exists as to whether the bright streaks shown on the etched surface are steel, the surface should be polished to the highest possible mirror finish, free from scratches, etched with a 5% solution of picric acid and alcohol, and examined by means of the microscope. The test has been recommended by the A. M. Byers Co.

Switch for Mine Signal System*

At the Santa Gertrudis mine, Pachuca, Hidalgo, Mexico, signals from cage or skip tender to hoist engineer are by electric bells, the same system being used by persons calling at any level. The bells are the Holtzer Cabot polarized loud-ringing type, 300 ohms resistance, operating on 50- or 60-cycle 110-volt a.c. Current is taken from 1,000-volt power circuit through transformer to 110 volts. The three-wire system is used for the bells of each shaft compartment. Where telephones are also installed, both bell and telephone wires are in one wire-wrapped, lead-covered cable containing several reserve wires for emergency use. No. 18 wires are used. The accompanying illustration shows the waterproof pull switch which is used in signaling and which has given satisfactory service.



WATER-PROOF SWITCH FOR CALL-BELL SYSTEM

One of these is placed at each level and provided with a rope to operate it. This permits its placement out of reach of meddlers.

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*Excerpt from article by Hugh Rose in August, 1916, Bulletin, A. I. M. E.

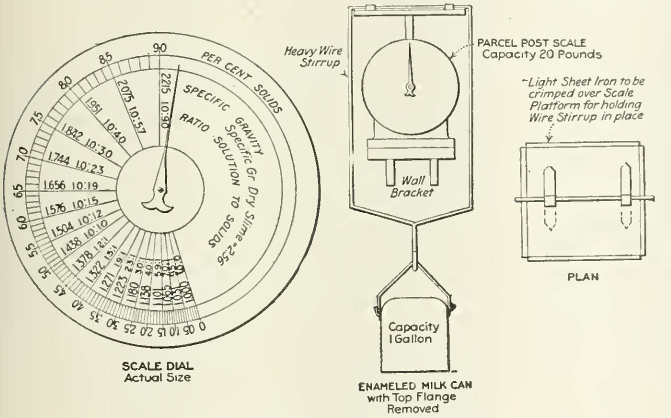
Details of Milling and Smelting

Specific Gravity Apparatus

By C. R. Olson*

One having had experience with the specific gravity apparatus in general use about cyanide plants will at once see the advantage of direct readings and the particular kind of apparatus shown in the illustration. The accuracy is well within the limits possible in sampling mill pulps. In this instance a parcel-post scale was used.

I thought it advisable for our purpose to improve on the apparatus described by J. M. Lilligren[1] by having the readings direct in percentage of solids, and in addition to the specific gravity, the ratio of solids to solution are shown also. A piece of drafting paper may be cut to the circle of the dial, graduated and pasted thereon or, better still, a piece of tracing cloth can be cut to the circle of the dial and held there while the points for the graduations are laid off on it. The transparency of the cloth will facilitate the drafting. It can then be removed and the calibrations inked-in over the points. From this blueprints can be made for any number of scales around a plant.


SCALE DIAL
Actual Size

ENAMELED MILK CAN
with Top Flange
Removed

PLAN

THE SPECIFIC-GRAVITY APPARATUS

Laying off the graduations for any particular ore, where factors of five in the percentage-of-solids group are desired, may be accomplished either by the aid of a set of specific gravity tables or with the following formula:

$$\textit{Per cent. of solids} = \frac{S(a-1)100}{a(S-1)}$$

where S = sp. gr. of dry slime and a = sp. gr. of wet pulp, S to be determined beforehand in the usual way. The percentage-of-solids figures are assumed to be 5, 10, 15, 20, . . . 90 and the equation solved for a by substituting the percentage-of-solids in each case and the specific gravity of the dry slime. Having previously decided on the size of sample to be taken in practice, the type and capacity of scale and the kind of container best suited to accurate work, the procedure would be as follows:

Assuming a 1-gal. sample and a scale of 20 lb. capacity and an enameled milk can, the starting point on the dial would be 8 lb. 5 oz. (1 gal. water weighs 8.33 lb. at 60° F.). This point on the dial corresponds to sp. gr. = 1 or 0% solids on the tracing cloth. Substituting 5% and solving for a we get 1.031. Then 1.031 × 8.33 = 8.58 lb. = 8 lb. 9 oz., which is the second point on the new dial. Similarly 10% solids is equivalent to sp. gr. 1.065, and 1.065 × 8.33 = 8.87 lb. = 8 lb. 11 oz., or the third point on the new dial. After laying off the points on the new dial from 5%, 10%, 15%, . . . 90% and drawing radial lines through them, the intermediate points, as between 0 and 5, 5 and 10, 10 and 15, etc., may be obtained by dividing the respective spaces into 5 equal parts without seriously affecting the accuracy of those points for routine mill work. If it seems desirable that the neck be left on the can and the capacity is greater than one gallon, it is only necessary to adjust the scale to read zero with the empty can suspended from the hook. After filling the can to overflowing with water, the weight may be noted and substituted for 8.33 lb. in the calculations. After the new dial is pasted in place, the can should be filled with water while suspended from the hook and adjustments made on the thumb-nut to bring the pointer over sp. gr. 1 and 0% solids. The scale is then ready for use.

It should be kept in mind that the percentage-of-solids group of figures applies for pulps in which the dry slime is of a fairly constant specific gravity. This, of course, is true for specific-gravity tables as well. Obviously, dry ore-slime from different localities and having different specific gravities would require a calibration in percentage of solids for each particular ore. Whenever a lime coating collects on the can, dilute hydrochloric acid will remove it without injury to the can, providing the enamel has not been cracked. Or the scales can be adjusted by means of the thumb-nut so that the pointer will read 0% solids or sp. gr. 1 when the can is full of water, the reduction in the cubical contents due to the lime coating being negligible when the coating is not abnormal. The cans we buy hold one gallon with the top flange or neck removed which facilitates mill determinations because the can is simply filled to overflowing. Credit is due H. J. Wason, our assayer, for working up data on slimes and providing dials for mill scales.

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*Mill superintendent, Pittsburg-Dolores Mining Co., Yerington, Nev.

[1] "Min. and Sci. Press," Feb. 13, 1915.

The Golden Reward Roaster*

The Golden Reward roaster was built in 1913 to roast the so-called "blue ores" encountered in the mines owned by the Golden Reward in the Bald Mountain district, South Dakota. Previous to this the blue ores were shipped to Denver or Omaha smelteries if they contained value enough to stand the high freight and smelter charges. The blue ores are not amenable to cyanidation in the raw state without preliminary treatment, the extraction of the gold values by cyanidation in the raw state varying from 10 to 30%. Chemical oxidizers or modifications of a straight cyanide treatment do not increase the extraction of the precious metals to make such a treatment commercially successful. The sulphur content of the hard blue ores averages 3% sulphur, while the sulphur in the soft blue or sulphide ore extracted from the Astoria shaft will average 11% sulphur.

Experimental runs of several hundred tons each at different roasting temperatures ranging from 800° F. to 1,600° F. have confirmed the results obtained in laboratory roasts as regards the proper roasting temperature to obtain the highest extraction of the precious metal values most economically. For the soft blue ores this temperature is 800° F. and for the hard blue ores a temperature of 1,100 to 1,200° F. The temperature control in the furnace is maintained by base metal thermocouples and two galvanometers, one of which is a recording instrument. Sweet roasts with either ore prove detrimental to the extraction of the precious metal values and varying percentages of salt added to these ores during roasting causes gold losses as high as 30% of the original value of the ore with a decreased extraction by cyanidation compared to an oxidizing roast. The sulphur content of the roasted product varies from 0.5 to 0.9%, total sulphur, depending on the character of the raw ore and the calcium and magnesium content, the sulphur in the roasted product being present as sulphates or basic sulphates of calcium, magnesium, iron and aluminum. Occasionally sulphides can be detected qualitatively, but not generally.

The roasted hard blue ores can be cyanided direct without preliminary treatment, with a low cyanide consumption and no solution trouble, but the roasted soft blue or sulphide ore must have a water wash previous to cyanidation or a high cyanide and lime consumption, fouled solution, poor precipitation of the dissolved precious metal values and a lowered extraction will result as both the soft blue raw ore and roasted product contain large quantities of cyanicides which can be removed by a water wash. The roasted soft blue ores require but a few hours treatment with cyanide solution to dissolve the contained gold values with a high extraction, but the hard blue ores when roasted require a much longer treatment. A gyratory crusher and two sets of rolls are used to crush the ores, the only change made in the mill between the hard and soft blue ores being in the size of crushing before roasting. The hard blue ores are crushed to pass a Ton Cap screen, having an opening 0.1 in. wide, the screen used giving approximately a six-mesh product, and for the soft blue ores a screen having a square opening of ¼ in. is used. The seven hearth, 22½ ft. in diameter, Wedge mechanical furnace roasts 65 tons of the blue ore per 24 hr., but any increase above this tonnage causes a decreased extraction at the mill and an increased sulphur content in the roasted product.

The feed to the furnace contains 5% moisture and is fed on top of the furnace at the outer circumference. The rabble blades or plows rake the ore across the top of this dryer hearth toward the center shaft, where it drops through drop-holes to the next lower hearth at the inner circumference, is raked across this hearth to the drop holes at the outer circumference and dropped to the next hearth, preceding to each hearth in a similar manner until discharged from the bottom hearth at the outer circumference, taking about 5 hr. to pass through the furnace, the arms of which make 18.6 revolutions per hr. Each hearth has two arms with the exception of the lower or cooling hearth, which has four. The arms are fastened to the central shaft from the inside, making it possible to change arms should it be necessary in a hot furnace. After the arm is in place it can be spotted at one of the doors on the exterior of the furnace and the blade holders slipped over the arm. When a blade holder or blade warps or breaks the furnace is shut down and in a few minutes another blade holder or blade can be put on to replace the old one, and unless the arm needs an entire new dressing the burners seldom need be entirely shut off. The arms are water cooled, each arm having a separate feed and discharge pipe, all feed pipes being connected to a water pan on top of the furnace. The furnace and two coolers require about 90 gal. of water per min.

Six high-pressure crude-oil burners are fired on the second hearth from the bottom of the furnace, being placed equidistant apart around the outside of the furnace and using air at 60 lb. pressure per sq.in. to atomize the oil. The gases are taken off the top hearth, no gas escaping out of the top of the furnace. The feed arrangement on the dryer hearth makes a gas-tight joint unless the feed to the furnace should be shut off and no feed enters the feed slots. The crude oil consumption averages approximately 11 gal. per ton of hard blue ore roasted, and only half as much with the soft blue ore.

The gases leave the furnace at a temperature of 200 to 250° and enter the stack at a temperature of 150 to 200° F. when the depth of the ore bed on the hearths is five inches. The range of temperature from hearth to hearth approaches very closely to the following temperatures: Fire hearth, 1,200° F.; 900° F.; 750° F.; 550° F.; 350° F.; 200° F.; 200° to 250° F. The horsepower demand of the crushing mill and roaster is 135 hp. the roaster, and coolers taking less than 15 hp. Electric motors are used throughout the plant, power being furnished by the Consolidated Light and Power Co.'s plant at Pluma.

The Golden Reward ore is said to be somewhat similar to that formerly mined at the Gold Reef, Fergus County, Mont., and similarly roasted.

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*Excerpt from an article by C. G. Willard in the South Dakota School of Mines Publication, June, 1916

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Investigations for the Government Nitrate Plant provided for by the Army Appropriation Bill are being made by Colonel Newcomer and Major Kelly, of the Corps of Engineers, so far as all questions regarding the proposed site of the plant and its construction are concerned. A committee representing the Nashville Section of the Engineering Association of the South is to urge the selection of the Muscle Shoals site on the Tennessee River. John Howe Peyton, President of the Nashville, Chattanooga & St. Louis R.R., is chairman of the Committee and Prof. W. G. Waldo, of Vanderbilt University, is the Secretary.

The Assayer and Chemist

Determination of Copper in Low-Grade Ores

By F. O. Hawley*

It is generally conceded that the determination of the copper content of ores containing only moderate amounts of iron and practically no bismuth, antimony, arsenic, molybdenum, selenium or tellurium can be most accurately and satisfactorily obtained by the electrolytic method. Unfortunately the chemist often has to assay more difficult ores, some of which have a low copper and high iron content together with more or less of the impurities mentioned. The quick and accurate determination of copper in them presents many difficulties.

The ordinary electrolytic separation in an acid solution is very unsatisfactory in the presence of any metal of the copper or antimony group. The use of rotating anodes gives the deposited copper a better appearance than when stationary ones are used, but the results are little if any more accurate. If the current is too strong or used too long, the results are not so good as with the stationary electrodes. When small amounts of bismuth, antimony and arsenic precipitate with the copper on stationary electrodes, the deposit has a darkened appearance that would never be mistaken for pure copper; on the other hand, when the same amount precipitates with rotating electrodes, the deposit has a much better appearance, except that it has a lighter color than it should have and looks as if it had been dusted with a thin coating of flour.

The colorimetric and cyanide methods are quick, but the results are usually far from satisfactory. Accurate results may be obtained by first separating the copper from the iron and other metals and then determining the amount by the electrolytic, iodide or other standard method, but it is a long and troublesome process, especially with slags, if the gelatinous silica is first dehydrated.

The writer has evolved a method which he recommends to anyone having the necessary apparatus and which is particularly adapted to slags. It is rapid, simple, requires little attention on the part of the chemist and, when properly performed, is very accurate. Antimony, arsenic, bismuth, molybdenum and tellurium, even when present in considerable amounts, have no injurious effect on the assay; large amounts of iron may be present without causing any of the ill effects so often noticed with the ordinary electrolytic determination.

The procedure for slag analysis is as follows: Weigh one gram of the sample into a 200-c.c. tall beaker, add a few drops of water, shake around and add 5 c.c. of an acid mixture made of equal parts of nitric acid, sulphuric acid and water. Shake again and quickly add 20-25 drops of hydrofluoric acid to volatilize most of the silica, put on the hot plate and boil until the red fumes have disappeared; continue boiling about a minute longer to expel most of the silicon fluoride. Add 10 c.c. more of the acid mixture and heat a little longer, remove from the hot plate and add about 70 c.c. of water. Neutralize with ammonia and add 10 c.c. excess. Heat from 60-65° C. (about 150° F.) and add slowly and with constant stirring enough potassium cyanide to combine with most of the copper present. To obtain good results, at least 75% or more of the copper should be combined with cyanide, but an excess is not desirable.

Electrolyze the alkaline solution for about 10 min. with a current of 0.25 amp., using rotating anodes, then increase the current to 0.5 amp. and run for 10 min. longer. Turn off the current and as quickly as possible remove the beaker containing the alkaline solution. Without removing the electrodes rinse off the small amount of solution adhering to them, into a beaker of water. Replace this with a 150 c.c. tall beaker containing cool or slightly warm water acidified with about 7 c.c. of the acid mixture mentioned before. Reverse the current and as soon as the copper is dissolved, which only takes about a minute, change the current again and redeposit the copper from the acid solution, using a current of 0.6-1 amp. This second precipitation takes about 30-40 min., but may be hastened by using a stronger current. The cathodes are removed from the solution, rinsed with water, then with alcohol, ignited and weighed.

In the application of this method to ores instead of slag, some slight modifications are made. The ore is decomposed by nitric acid and potassium chlorate, using hydrochloric also if necessary, and then 8 c.c. sulphuric acid added and evaporated to dense fumes. Three cubic centimeters of nitric acid and about 100 c.c. of water are added, then ammonia and cyanide as before. A little more time may be required for the electrolysis, depending on the amount of copper present. A 1-gram sample of 8% ore requires about 1½ hr. for complete precipitation from the alkaline solution and about 45 min. for precipitation from the acid solution.

The reason for rinsing the alkaline solution from the electrodes before beginning the acid electrolysis is to remove all trace of cyanide, for it is found that a very small amount in an acid solution has a tendency to cause a mossy deposit similar to that formed when chlorides are present. In the case of low-grade slags to which little cyanide has been added, the rinsing may not be necessary.

The precipitate from an alkaline solution of an ore containing much copper has a tendency to be deposited in a somewhat spongy condition. Unless considerable care is taken, there is some possibility of a mechanical loss. For this reason and also because of the increased length of time necessary to precipitate, dissolve and reprecipitate the larger amount of copper, it is generally not advisable to use this method on ores higher than 8%, although by having the proper conditions higher ores may be run.

The copper deposits much better and faster if the alkaline solution is warm. Usually, the heat generated by the reaction between the acids and ammonia is sufficient to heat the solution to about the right temperature. On the other hand, the acid solution may be cool, although the deposition is a little better and faster if it is slightly warm. The same solution may be used for three or four determinations until most of the nitric acid is decomposed by electrolysis. There is some advantage in having the beaker containing the alkaline solution covered with a split watch-glass or some similar contrivance, not so much to prevent a loss of copper as to prevent the solution cooling by evaporation.

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*Chief chemist, International Smelting Co., Miami, Ariz.

The quantity of acid used in dissolving the sample is purposely made rather large in order to provide a large amount of ammonium salts, which have a beneficial influence on the deposition. Much free ammonia is to be avoided as it has a tendency to cause the deposit to be granular. On adding the potassium cyanide, care should be taken not to add much more than the required amount, as an excess delays the precipitation. Some of the excess cyanide also will combine with the iron hydroxide, forming ferrocyanide, which is objectionable. A convenient method of adding the cyanide is to take a burrettefull of the ordinary solution used for titrating copper and let it run in slowly, with constant stirring, until the solution is almost colorless. For slags it is generally satisfactory to add the amount thought necessary without trying to see when the exact end point has been reached.

COPPER IN THE PRECIPITATE

One of the first thoughts that suggest themselves in connection with the alkaline precipitation is whether the iron and aluminum hydroxides do not retain copper and prevent its being precipitated on the cathode. It can be stated positively that when cyanide is used, practically no copper is precipitated with the hydroxides, and even when no cyanide is used, it is found that as the copper is withdrawn from the solution by being precipitated on the platinum, the equilibrium is disturbed and the copper held by the hydroxides goes into solution and soon all is precipitated on the cathode. This is well illustrated by the following experiment: A 1-gram sample of slag, high in iron and containing 0.70% Cu, was dissolved in the usual manner and an excess of ammonia added, but no cyanide. The sample was filtered and well washed with hot water. The filtrate was electrolyzed, and 0.61% Cu was obtained. After the copper had been removed from the solution, the precipitated iron hydroxide was added to the same alkaline solution and again electrolyzed, this time with a new cathode. An additional 0.09% Cu was recovered making the total 0.70% as before. This experiment was repeated several times with similar results, showing the safety of the procedure.

Copper deposited from an alkaline solution is seldom in a suitable condition for weighing, although the appearance is fairly good. It is free from Sb, As, Bi, Te and Mo, but when the sample contains zinc, a little of that metal is usually precipitated. In fact, under some conditions enough zinc precipitates with the copper to form a beautiful yellow brass. A high current density, little free ammonia and a fairly cool solution favor the precipitation of zinc. Of course any zinc precipitated from the alkaline solution will not affect the final result, as it all remains in solution during the acid electrolysis. Indeed, for ores containing over 2-3% Cu, there is some advantage in having the copper precipitated as brass, as the deposit is denser and smoother than when copper alone comes down. A small amount of zinc may be conveniently added with the cyanide, a good proportion being 1 part of zinc oxide to 6 parts of cyanide.

Many experiments were made to test the accuracy of the method in the presence of some of the metals that have injurious effects on the ordinary electrolytic method. Inasmuch as most of the results were similar, only two typical groups of experiments will be given here. These were made on a reverberatory slag and a low-grade ore containing about 60% pyrite. Both ore and slag were practically free from interfering elements.

The following table shows the accuracy of the method for ore and slag in the presence of impurities:

Sample	% Cu Content
1 gram slag	0.66, 0.66, 0.64
1 gram slag + 10 milligrams Sb	0.64, 0.65
1 gram slag + 50 milligrams Sb	0.65
1 gram slag + 50 milligrams As	0.66, 0.63
1 gram slag + 20 milligrams Bi	0.65, 0.64, 0.64
1 gram slag + 50 milligrams MoO_3	0.65, 0.66
1 gram ore	2.06, 2.06, 2.05
1 gram ore + 10 milligrams Sb	2.06, 2.06
1 gram ore + 50 milligrams Sb	2.05, 2.04
1 gram ore + 50 milligrams As	2.04, 2.03
1 gram ore + 50 milligrams Bi	2.05, 2.06
1 gram ore + 50 milligrams MoO_3	2.06, 2.06
1 gram ore + 10 milligrams Se	2.09, 2.09
1 gram ore + 10 milligrams Te	2.06, 2.07
1 gram ore (by iodide method)	2.04, 2.04, 2.07
1 gram ore (by permanganate method)	2.06, 2.08

Of all the metals added, it will be seen that selenium alone interfered, and that to only a slight extent. Selenium and tellurium, when electrolyzed in either an acid or alkaline solution with pure copper, are precipitated with it, and probably the only reason they do not precipitate in this case is that they are combined with the precipitated ferric hydroxide and so are removed from the influence of the electric current.

A great many tests were made to determine what effect, if any, this method would have on the platinum electrodes. These tests show that with the temperature and amount of current recommended the electrodes lose weight a very little faster than they do in ordinary acid electrolysis. Of course this is a disadvantage, but as the loss is only about 0.0001 gram in four to six determinations it is a very slight one. With higher current densities or warmer solutions the loss may be slightly higher but is never excessive. Some attempts were made to use this method with stationary electrodes, but the precipitated hydroxides hindered a free circulation of the liquid and the results were not very satisfactory.

I think that anyone who gives this method a fair trial and follows directions closely will have no difficulty in getting very good results on any slags or low-grade ores, no matter how impure they may be.

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Chlorate Explosions in the Laboratory

An explosion of potassium chlorate was recently traced by Floyd E. Rowland, of the University of Illinois, to the use of sulphur for sealing in wooden handles to porcelain pestles (*Journ. Ind. Eng. Chem.*, June, 1916). A little of the chlorate worked in between the wood and porcelain while grinding chlorate and violently exploded when the pestle was again put into service. The particular pestle was of German make, but whether this is a common method of sealing in that country is not known.

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That Colloidal Platinum Cannot Be Detected in ores was disproved by J. Loevy, "Chem. Ztg.," p. 287, 1915, who added colloidal gold and platinum to ores and then assayed them, recovering from 98 to 99.6% of the two metals. This seems to dispose of the choicest argument of the "green gold" Adirondack-mine promoters.

Estimating Metallic Aluminum in Aluminum Dust

By J. E. Clennell*

SYNOPSIS—Details, in addition to those previously published, about the methods of testing aluminum dust. Possible sources of error are considered and the means of correcting them when necessary.

In reference to my article on "Estimating Metallic Aluminum in Aluminum Dust," that appeared in the *Journal* of May 6, 1916, I wish to point out certain additional particulars concerning the two methods described. At the same time I desire to correct an error in one of the figures given at the foot of page 813, column 2, where it is stated that 1 c.c. H at standard temperature and pressure = 0.09004 mg. H = 0.8099 mg. Al. Taking 1 c.c. H at standard temperature and pressure as = 0.0896 mg. (the figure usually accepted), it follows that 1 c.c. of H under standard conditions = 0.80296 mg. Al. In our calculations we adopt the figure 0.803 for simplicity, this being as close an approximation as can be obtained in actual work.

Study of the Gasometric Method

The gasometric method has been made the subject of further study in our laboratory, mainly for the purpose of establishing a standard method of testing that would be applicable to all samples, whether containing coarse particles or not. It was not intended to use the method for ordinary routine work, as it is too complex and the necessary calculations would be an objection. Certain points noted here were overlooked in the original description.

The following factors are involved in all determinations: Temperature of gas measured; pressure of gas measured; tension of aqueous vapor in collected gas; volume of air expelled with the hydrogen; variations in volume of generating and receiving vessels and solubility of gases in water displaced.

The first three factors are allowed for in the formula

$$V_o = \frac{V(B - T)}{\lrcorner}$$

With regard to the fourth point, the volume of air expelled, it must be noted that even when the same flask and same volume of liquid are used in all tests, the amount of air expelled is not a constant, but a variable depending on the initial temperature and pressure. We determine the original volumes of generating and receiving flasks by filling with water to the mark reached by the stopper in each case and measuring this water in graduated columns or burettes. These vessels record the correct volume only at some definite temperature (in our instrument this is 17.5° C.), and a correction has to be made at all other temperatures, depending on the difference between the coefficients of expansion of glass and water (see table in "Sutton's Volumtric Analysis," 8th ed., p. 26). Table 1 shows the extremes of variation for the measurements involved in our tests.

At the end of the operation, when water is allowed to flow back into the generating flask a bubble of gas of about 3 c.c. always remains; this must not be ignored, but by transferring receiver and generator to a body of water sufficiently deep, the bubble may easily be passed through a funnel to the receiving flask and added to the main volume of gas therein.

TABLE 1. EXTREMES OF VARIATION IN TESTS

Temperature, Deg. C.	Air Space in Generating Flask, c.c.	Total Volume of Receiving Flask, c.c.
12.0	164.9	519.2
17.5	165 0	519.6
25 0	165.2	520 4

We have as yet devised no new means of estimating the error due to solubility of gases in water, but our results clearly indicate that it is trifling in amount and falls far short of the theoretical maximum calculated from data given by T. E. Thorpe ("Manual of Inorganic Chemistry," Vol. I). This authority gives the number of cubic centimeters dissolved by 100 c.c. of water as follows: Oxygen, 3; hydrogen, 1.93; nitrogen, 1.5. If these amounts had been dissolved, our recorded percentage of Al would have been less than the truth by 6 or 7%, but actual tests have in several cases recorded over 99% of Al, showing that the actual error must certainly be less than 1%.

Measurement of the final volume of gas is best made indirectly, by noting the residual volume of water, after equalizing pressure as described in the article of May 6. This water is measured by pouring into a burette and its amount deducted from the corrected volume of water filling the entire receiving flask at the final temperature, up to the mark on neck reached by cork of leading tube.

Possibly the most accurate method would be to add the necessary amount of oxygen and explode the hydrogen in a eudiometer, thus eliminating the correction for air in the generating flask, but this might be inconvenient as the volume to be dealt with is rather large. If the amount of hydrogen were much reduced, as by taking less Al dust for the test, the errors of measurement and observation would become too serious.

TABLE 2. POSSIBLE ERRORS IN DETERMINATION

Condition	Variation in Condition	Variation in Per Cent. Al
Temperature	±0.5° C.	±0.35
Pressure	±1 m.m.	±0 20
Final volume	±1 c.c.	±0.36

In our determinations, taking in all cases 200 mg. of Al dust for a test, the possible errors may be stated as in Table 2.

Gasometric Method with Sodium Hydrate

Since metallic iron dissolves in hydrochloric acid with evolution of hydrogen, it was thought that this source of error could be eliminated by utilizing the reaction,

$$Al + NaOH + H_2O = NaAlO_2 + 3\,H$$

The theoretical amount of hydrogen obtainable by dissolving a given weight of Al is the same as with HCl, but metallic iron is insoluble in caustic soda. Using 50 c.c. of a 2% solution of NaOH for 200 mg. of the dust, the reaction starts almost instantaneously in the cold, and proceeds for some time without artificial heat. A precipitate, apparently consisting of ferric hydroxide, hydrated silica and perhaps alumina, remains in the generating flask when the latter fills with water and entangles the residual gas in small bubbles, but this can generally be remedied after transfer to the receiver, by corking the latter and agitating briskly.

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*Metallurgical chemist, Oakland, Calif.

Contrary to the supposition, the results with NaOH were generally slightly higher than with HCl, as will be seen in Table 3.

TABLE 3. RESULTS OF GASOMETRIC TESTS

Sample No.	Description	Metallic Aluminum (Mean Result) By HCl Al%	By NaOH Al%
1	Pure aluminum granules....	99.6	99.6
2	Standard bronze powder..	90.4	90.3
3	High-grade aluminum dust	91.6	92.6
4	Low-grade aluminum dust	76.4	77.2
5	Medium aluminum dust...	88.5	90.7

Samples 3, 4 and 5 represent products obtained in Charles Butters & Co.'s Oakland plant.

The volumetric method with ferric sulphate and permanganate described in the previous article remains the only one rapid and simple enough for routine testing. It has been simplified and improved by adopting a standard solution of acid ferric sulphate, consisting of 100 grams pure ferric sulphate to which distilled water is added and then 250 c.c. of concentrated sulphuric acid. This mixture is heated to boiling until the ferric sulphate has completely dissolved, then cooled and finally made up to a liter with distilled water. For each test on 100 mg. of dust, 50 c.c. of this standard solution is used. More uniform results are obtained than when the dry salt is added before acidulating.

I may add that attempts to check the accuracy of the other processes by gravimetric methods were not altogether satisfactory. In the phosphate method a portion always passed through the filter and further boiling of the filtrate was required for its recovery; nevertheless, the final results were generally too high, and the method proved tedious and troublesome.

In the oxide method the final precipitate could not be accurately weighed except in a closed vessel, as it increases in weight rapidly on the balance; it seems to be hygroscopic, perhaps owing to persistent retention of traces of sodium chloride.

⁂

Chronology of Mining for July, 1916

July 1—Time limit for purchase of Tamarack by Calumet & Hecla expired; deal was blocked by litigation.

July 3—Supreme Court of Nevada affirmed decision of lower court in the apex suit in favor of West End company, of Tonopah; suit was brought by the Jim Butler.—Yuba No. 15 dredge at Hammonton, Calif., started digging.

July 6—Earthquake in Sicily did much damage to sulphur mines near Caltanissetta; about 100 miners said to have been buried.

July 7—Bethlehem Steel Corporation officially announced absorption of Pennsylvania Steel and Maryland Steel companies.

July 10—Revenue Bill, containing clause taxing copper companies, passed by the House of Representatives.

July 13—American Zinc, Lead and Smelting Co. declared initial dividend on its preferred stock.

July 14—Mass Consolidated Copper Co. declared initial dividend of $1.

July 15—Calumet & Hecla Mining Co. celebrated its semicentennial.

July 18—Fluorspar mines in Illinois closed on account of strike initiated by Western Federation of Miners.

July 19—Announcement that Hayden, Stone & Co. had acquired a predominant interest in the American Zinc, Lead and Smelting Co.

July 20—Engels Copper Co., of California, paid initial dividend.

July 24—Utah Metal and Tunnel Co. declared initial dividend of 50c.

July 25—United States Steel Corporation reported earnings for second quarter of 1916 to be greater than any similar period; declared extra dividend of 1% on common stock.—Fire at Mammoth copper mine, California, destroyed boarding house, warehouse and aerial tramway terminal.

July 26—First National Copper Co. declared initial dividend of 25c.

⁂

Alvin Robert Kenner

Alvin Robert Kenner was drowned on July 4 while bathing in a small lake in a public park near Nevada City, Calif., to which place he had recently gone to inspect the Big Murchie mine preliminary to its acquisition by his New York company, the Rio Plata Mining Co.

Mr. Kenner was born in 1885, and was graduated from the Colorado School of Mines in 1907, after a preliminary training at the Armour Institute of Technology, Chicago. Later at Chloride, Ariz., he will be remembered by the many friends that he made while superintendent of a mine there.

During the early days of the first Villa revolution in Mexico he was superintendent of a large mine at Parral, in the State of Chihuahua, where he remained until the Mexicans destroyed the railroad over which the mine shipped its ore to the smelter, and the property closed. The management of the Rio Plata silver mine southwest of the City of Chihuahua called Mr. Kenner to that property, and the shipments of silver bullion made under his superintendency are evidences of his ability. Other properties of great value were purchased under the direction of Mr. Kenner in Mexico by his company.

He was a frequent contributor to the *Journal* and by his death the mining fraternity loses one who had a bright future and would have gone far in his chosen profession.

⁂

California Nickel Discovery

In view of the public interest in metals entering into war supplies, a concise report on the discovery of nickel in San Diego County, Calif., published by the United States Geological Survey, is timely. The author of the report is F. C. Calkins, who describes the deposit and makes suggestions for further prospecting.

The nickel deposit is an irregular body in a dark igneous rock (gabbro) and is shown by Mr. Calkins to have an origin similar to that attributed by most geologists to the famous deposits at Sudbury, Ont. The nickel occurs in an iron-nickel sulphide (probably polydymite), and assays of more than 4% of nickel have been obtained. Copper is also present in quantities ranging from a trace to 2.4%, and conditions are favorable for the presence of platinum.

Another report by the same author describes a deposit of molybdenite, also in San Diego County. The molybdenum prospect is located in a dike of fine-grained granite (aplite) containing an average of much less than 1% of the mineral molybdenite (molybdenum sulphide). Only one prospect has been located thus far, but the surrounding country is favorable for the discovery of others.

These reports are published together as Bulletin 640-D, which may be obtained free on application to the Director, United States Geological Survey, Washington, D. C.

Wood Oils Suitable for Flotation*

In taking up this work, which had for its object the finding of oils best adapted to accomplish certain things, the Forest Products Laboratory of the Department of Agriculture, which is interested in finding uses for by-products from wood distillation, was represented by R. A. Palmer. The Bureau of Mines, which is interested in finding supplies of suitable flotation oils, was represented by O. C. Ralston, and the Department of Metallurgical Research of the University of Utah, which is doing coöperative work with the Bureau of Mines, was represented by G. L. Allen. The testing of flotation oils has occupied a large part of the time of the testing departments of various companies using the flotation process in the treatment of their ores. The great differences in ores and in oils have made such work necessary, as it has not been possible to select the oil best suited for the purpose without trial of many kinds. In fact, individual shipments of flotation oils from the same manufacturer will often differ so radically that the millmen have been forced to test every lot of flotation oil before its use in the mills.

Further, although almost every imaginable product of the distillation of wood, from alcohol to pitch, has been tested in a more or less perfunctory manner by various people, few companies have allowed the results of their tests to be made public. This work was undertaken for the purpose of obtaining reliable data regarding the value as flotation agents of a number of products that are obtained from the distillation of wood by different methods, and incidentally to determine whether some of the products not used at present could be used. It was thought that if such products can be used as flotation agents, then their use would serve to increase the number of oils and other products available for flotation purposes. It was also hoped that it might be possible to discover a substitute for some of the most effective but comparatively high-priced oils which are now used for flotation purposes.

THREE TYPES OF ORES TREATED

Three ores were chosen for tests of the series of oil samples herein described. Ore A was from the mine of the Arthur Zinc Mining Co., near Ruby Valley, Nev. It was chosen on account of its simplicity. It consisted mainly of galena, sphalerite and quartz minerals, which were crystallized in such a way that they could be broken away from each other by crushing to the size necessary for flotation. Ground quartz was mixed with it to make it sufficiently low grade. Any marked tendency of one mineral to float in preference to another could be observed with such a "free" ore. Consequently, the value of the oil for differential flotation of mixtures of galena and sphalerite could be observed; also the conditions which allowed the best extraction or the cleanest concentrate of any of these minerals with any given oil.

Ore B was the heavier sulphide ore from Cripple Creek, Colo. This siliceous ore contains some pyrite, some gold and silver as the tellurides, sylvanite and calaverite, and other tellurium minerals. The tests on this ore would allow observations on the flotation of pyrite as well as of the famous Cripple Creek gold telluride minerals. Wherever the pyrite contains gold it would be desirable to float it, while barren pyrite ought to be kept with the gangue. Hence the tests should be carried on with an ore containing both types of minerals, as was done in this case. This sample was furnished by the Golden Cycle Mining and Milling Co.

The ore C was the Utah Copper Co.'s milling ore from the mine at Bingham. A great many copper minerals are present in this ore—chalcopyrite, cupriferous pyrite, etc. The gangue is siliceous, and the ore is well known. It is a hard ore to treat by flotation, and nearly any oil that will treat it is almost sure of success with most other copper ores. One peculiarity of the Utah Copper ore is that it is much easier to float in an alkaline solution.

Each of the ores was tested with three different tests—an acid test, an alkaline test and a test run in neutral water. The water used in all the flotation tests was the Salt Lake City water. It contains a small amount of lime, so that the water used in the "neutral" tests was in fact slightly alkaline. This method of testing was adopted for the reason that it is known that some oils will refuse to work at all in neutral solution, although they do good work in acid solution. Others are more successful in alkaline solutions.

A flotation testing man must be an opportunist and seize on the best conditions for flotation as he is able to see them in his machine when varying the conditions, such as amount of agitation, depth of pulp in machine, amount of oil, amount of acid or alkali, temperature, etc.

A Janney test machine was used for all this work. Our reason for using this machine is that it permits of quick work and is so designed that practically every particle of flotation concentrate and tailing can be recovered and weighed, while many other machines have inaccessible corners where some of the material escapes.

The extractions were calculated by the following well-known formula, which does not require weights of the products involved:

$$Extraction = \frac{100\,(h - t)c}{h(c - t)}$$

where the analyses of the head, or original ore, tailing and concentrate are represented by the letters in the equation. This formula assumed that any middling produced can be separated into concentrate and tailing. Each test was "roughed" and "cleaned." The rough tail was final, but the concentrate was poured back into the machine with more water and a clean concentrate and middling produced.

The oils tested in these experiments were furnished by the Forest Products Laboratory, Madison, Wis. Most of them were either commercial samples or where produced in the laboratory in semi-commercial apparatus under conditions entirely comparable with plant practice.

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*Excerpt from an article by R. C. Palmer, G. L. Allen and O. C. Ralston to be presented at the Arizona meeting September, 1916, of the A. I. M. E., by permission of the director, United States Bureau of Mines.

The following is a somewhat detailed description of the different oils which are most interesting on account of being immediately available at low prices and because they can be used in small amounts with success.

No. 11 was a commercial wood oil produced in the destructive distillation of hardwood, the particular species in this case being maple and birch. The specific gravity of the oil was 0.934 at 21° C. The chemical composition of this oil is unknown, but it is practically a waste product and is burned for fuel in most plants. It is an excellent solvent, and a small amount is sold for that purpose. A cord of hardwood gives on an average about 2 gal. of this oil, and the production in all the hardwood distillation plants is probably close to 2,500,000 gal. annually. It could probably be bought for $0.10 to $0.15 per gal. f.o.b. plant, as this is the price usually paid for it in the crude condition for a solvent.

No. 18 was a crude hardwood tar just as it settled out of the pyroligneous acid. On distillation the sample gave 12% pyroligneous acid, 8% wood oil, 42% wood creosote oil and 38% wood pitch. The specific gravity of the combined wood oil and wood creosote was 1.067 at 21° C. Excluding the wood oil, about 15 gal. of this tar is produced per cord of hardwood, making available per year over 20,000,000 gal. of this crude tar. This tar with the wood oil and pyroligneous acid removed is generally used for fuel at the distillation plant, where it is worth about $0.03 per gal. for this purpose, in comparison with the normal prices for other kinds of fuel. It could probably be bought for $0.05 to $0.06 per gal. f.o.b. plant.

No. 15 was an entirely different tar product produced in the distillation of hardwood. After the pyroligneous acid has been allowed to stand to settle out the oily tar, it contains a tar-like substance dissolved in it which has to be removed before the liquor can be worked up into alcohol and acetic acid. The yield of this "dissolved tar" or "residual tar" or "acid water tar" or "copper still tar," which are the various names given to it in the plants, is from 6 to 8 gal. per cord, making a total production in the United States of about 9,000,000 gal. per year. It is strictly a waste product at present, although worth about $0.025 per gal. as fuel. It could probably be obtained for $0.04 to $0.05 per gal. at the plant.

No. 16 is a 15% water solution of the water-soluble portion of No. 15, just described. The specific gravity of the solution was 1.061 at 21° C. This sample was prepared to determine the value of the water-soluble portion as compared to the whole tar.

The results of the flotation of these three ores with the above set of oil samples are contained in Tables 1 to 3. In Table 1 the analyses of the concentrate and tailing for each test are given. In the other two tables only the analyses of the concentrate samples are given. Accompanying the analyses of the concentrate samples in each case are the percentages of extraction obtained. The test in neutral, acid and alkaline solutions for each oil is given.

It can be seen that many of the oils give fully as satisfactory results as pine oil for practically all the minerals tested. For all-round work, No. 18 seems to have given good extractions of all the metals tested, together with fair grades of concentrate. It will be remembered that this is the crude hardwood tar which has settled out of the pyroligneous acid. It is a pleasant surprise to find that No. 16, the 15% solution of No. 15 in water, is so efficient in comparison with No. 15. Here is something which is really not an oil, because it is completely soluble in water. It is satisfactory for all the minerals except the copper minerals of ore C.

Preliminary Results Encouraging

The extractions of the gold in the Cripple Creek ore and the grades of concentrate are surprisingly good. Oils 18, 15 and 16 seem to be capable of producing the highest-grade concentrates. By further treatment of the tailing it should be possible to get even higher extractions, although the grade of the total concentrate would be cut down. No attempts to run tests in this manner were made. The relatively high grade of the heads in the tests on the Cripple Creek ore leaves tailing in all these tests too high to compare favorably with roasting and cyaniding. Hence, further work in adaptation of these oils to give higher extractions would have to be done. This is a question of mechanical manipulation with which every flotation experimenter is familiar. The extractions of the iron in the Cripple Creek ore are very poor with all the tests. As the ore was ground dry in a

TABLE I. TESTS ON ORE A IN NEUTRAL, ACID AND ALKALINE SOLUTIONS WITH DIFFERENT OILS

Analysis Head: Tests on Pb, 3.4%; Zn, 4.74%

Oil No.	Remarks Character of Oil	Total Time, Min.	Total Oil, Lb. per Ton	Total Acid, Lb. per Ton	Total Alkali Lb. per Ton	Lead		Zinc	
						%	% Extraction	%	% Extraction
11	Hardwood "wood oil"	17	1 11	. .	...	57.2	92 6	20.4	58 2
		10	0 18		...	0 3		2 3	.
		16	0 94	3.68	.	37 9	88 7	34.2	72 6
		15	0.17	3.68	.	0.4		1.4	
		15	1 29	....	4 0	48 0	97 2	32 0	64 8
		5	. ..	....	...	0 1	.	1.8	. .
18	Crude hardwood "settled tar"	17	1 35	....	. .	48 6	97 2	28 0	68 4
		3	.		...	0.1		1 7	
		19	1 24	3 68	.	37 7	98 2	33 4	76.5
		6		....	...	0 1		1 2	.
		20	1 70	....	2 0	48 7	98 0	27.9	63 4
		4		....	...	0.1		1.9	.
15	"Dissolved hardwood tar"	20	1 44	....	...	59 2	79 4	16 2	30.2
		7		.	...	0.7		3.5	
		15	1 44	5 52	...	32 8	88 7	13.0	69.8
		10	0 72	3 68	.	0 4	.	1 9	.
		20	1 44	....	4.0	66 7	73 0	38 1	30.3
		8	..	....	...	1.0	. ..	3 4	
16	Water solution of No. 15	13	1 80	...	. .	55 1	90 2	22 0	43 7
		5		.	...	0.4		2.9	
		19	1 80	7.36	. .	30.3	92.2	40 5	77 2
		4		....	...	0 3	..	1.2	.
		19	1 80	....	4.0	53 7	77 4	23 3	44 7
		4		....	..	0 8		2.9	.

TABLE 2. TESTS ON ORE B IN NEUTRAL, ACID AND ALKALINE SOLUTIONS WITH DIFFERENT OILS

Analysis Head: Gold, 0 608 Oz. per Ton; Iron, 5 2%

Oil No.	Total Time, Min.	Total Oil, Lb. per Ton	Total Acid, Lb. per Ton	Total Alkali, Lb. per Ton	Gold		Iron	
					Oz. per Ton	% Extraction	%	% Extraction
11	24	1 11	0 00	0 0	4 72	82.5	8 5	31.9
	22	1 11	3.68	0 0	6.12	75.8	17 2	41 1
	23	1 11	0 00	4.0	5.64	82.3	13.4	14 8
18	22	1 8	0.00	0 0	10.34	78.2	13 2	17.7
	21	1 5	3.68	0.0	11.52	78.0	14.3	19.6
	22	1 5	0 00	1 0	11.60	81.2	13 1	6 2
15	23	2 88	0 00	0 0	5.06	82 3	5.7	0 0
	21	2 88	3 68	0 0	13 80	74 8	9 6	11 8
	21	2 88	0 00	1 0	5 80	76.0	7 4	6 2
16	21	2 4	0 00	0 0	10 10	81.3	8.6	31 5
	21	2 4	3 68	0 0	12 60	81.2	..	0 0
	21	2 4	0 00	1 0	7 88	78.7	11.7	27.3

TABLE 3. TESTS ON ORE C IN NEUTRAL, ACID AND ALKALINE SOLUTIONS WITH DIFFERENT OILS

Heads: Copper, 1.58%

Oil No.	Total Time Min.	Total Oil, Lb. per Ton	Total Acid, Lb. per Ton	Total Alkali, Lb. per Ton	Copper	
					%	% Extraction
11	20	0 92	0 00	0	15 95	29.3
	21	1.48	7 36	0		
	21	1 29	0.00	6	16.15	32 6
18	20	1 8	0 00	0	16.45	51.2
	20	1 5	7.36	0	2.48	
	20	1 2	0 00	4	22.27	68 2
15	21	1.44	0.00	0	5 84	4.3
	21	1.44	7.36	0	2.77	
	23	1.44	0.00	4	18 17	23.1
16	17	2 1	0.00	0	4.50	33 6
	18	2 7	7.36	0	1 72	5 6
	23	2 4	0.00	8	7 94	3.9

laboratory sample pulverizer, this is not surprising, for pyrite is peculiarly sensitive to oxidation during such grinding and will not float well. Not being an important mineral in this case, the method of preparation of the sample did not matter. It is interesting to note that No. 11, the "wood oil," was the oil that gave best extractions of the iron. As was expected, the Utah Copper ore usually floated best in alkaline solutions, oils 11 and 15 doing the best work.

*

1916 Tungsten Production

All records for tungsten production by any country for 12 months have been broken by the output of the United States for the past six months. This production is estimated by Frank L. Hess at 3,290 short tons, carrying 60% WO_3, valued at $9,113,000, says a bulletin of the United States Geological Survey.

The domestic demand for tungsten was not satisfied by this enormously increased output over former years, however, as is shown by the importation of 1,520 tons of foreign ores valued at $3,449,311 during the first five months of the year. While most of this imported ore came from Peru, Bolivia and Argentina, some came from Mexico and Japan.

Imports of tungsten metal and ferrotungsten totaled 10 tons valued at $36,885, while exports for the first five months totaled only 4,906 lb. valued at $10,571.

By adding the domestic production and imports, estimating the imports for June, the American consumption amounted to roughly 5,100 tons of 60% concentrates valued at $13,278,000. Allowing a 20% loss in steel making, it seems probable that between 11,000 and 12,000 tons of new high-speed steel were made in using this tungsten supply.

Of the domestic production of 3,290 tons of WO_3 concentrates the various ores constituting this total were as follows: Ferberite, 1,495 tons valued at $3,590,000; scheelite, 1,404 tons valued at $4,322,000; wolframite, 201 tons valued at $613,000; and hübnerite, 185 tons valued at $587,000.

Colorado has regained its lead in tungsten production, having marketed between Jan. 1 and June 30 a total of 1,505 tons valued at $3,638,000, of which the Boulder district produced 1,494 tons. California sold 984 tons valued at $3,005,000, its higher-grade concentrates bringing higher prices. Nevada produced 461 tons valued at $1,432,000; Arizona shipped 175 tons valued at $565,000, while smaller quantities came from Alaska, Connecticut, Idaho, Missouri, New Mexico, South Dakota, Utah and Washington.

In the tungsten mining camps the excitement following the greatly increased prices was similar to that caused by important gold discoveries. Nederland, Colo., suddenly sprang from a hamlet of a few dozen homes to a town of more than 3,000 population, while east of Nederland two other settlements of several hundred souls came into existence. Atolia, Calif., jumped from a town of less than a hundred to several thousand population.

During the last six months 40 concentrating plants of various types and sizes were in operation on tungsten ores, and at the end of June there were 14 new mills under construction.

In the Boulder district 10 mills were put in operation, of which six were new, and at the end of June five old mills were being overhauled and three new ones were in course of construction.

At Atolia, Calif., the mill of the Atolia Mining Co. was burned, but rebuilt with enlarged capacity. Two mills were reported under construction near Goffs and one near Nipton. A smaller mill of the Atolia company was operated at Johannesburg. Many kinds of machines, largely of the dry-concentrator type, were used to extract scheelite from desert débris, between Randsburg and Atolia. Two mills, of 30 and 100 tons' daily capacity respectively, were erected near Bishop, Calif., to concentrate scheelite ores from contact-metamorphic deposits. The mill owners claim they can operate profitably on prices equal to those prevailing before the war.

In Nevada a mill was constructed near Toy, Humboldt County, and four more mills were erected in the Snake Range, in which tungsten deposits were found throughout a length of 50 mi. or more. The United States Tungsten Corporation operated an old mill at Tungsten, 12 mi. south of Osceola, and a small mill was also working on the east side of the range.

In Washington a mill was constructed on Tungsten Mountain, 35 mi. northwest of Oroville.

The prophecy made by the Geological Survey several years ago that the production of tungsten ores would probably be greatly increased with an increase in price, and that new deposits equal to those known might be found, has now received abundant confirmation.

*

Foreign Trade in Copper

Exports of copper from the United States in June and the six months ended June 30 are reported by the Department of Commerce as below, in pounds:

	June	Six Months
Ore and concentrates, contents.......	298,199	1,909,706
Blister and black copper..............	672,938	3,687,953
Refined—ingots, bars, etc.............	77,176,722	356,058,839
Plates and sheets.....................	642,526	7,395,129
Wire	1,512,749	11,242,867
Old and scrap.........................	124,296	160,224
Total copper, lb.....................	80,427,430	380,454,718
Copper manufactures, value..........	$2,895,546	$9,276,841

The weight of ore exported in June was 9,364 tons; of concentrates, 588 tons.

Imports of copper into the United States in June and the six months ended June 30 are reported by the Department of Commerce as below, in pounds:

	June	Six Months
Ore and concentrates, contents.......	18,161,173	80,267,710
Matte, contents	2,116,389	11,793,950
Unrefined—blister copper, etc.........	23,723,976	141,647,879
Refined—bars, plates, etc.............	112,000	2,618,392
Composition, copper chief value......	47,717	446,758
Old and scrap.........................	571,304	5,064,128
Total copper, lb.....................	44,732,559	241,238,817
Copper manufactures, value..........	$8,102	$26,067

Actual tonnage of copper-bearing material imported in June was 59,779 tons ore, 8,448 tons concentrates and 2,366 tons matte.

*

Robert Safford Towne

Robert Safford Towne, a mining engineer long active in the development of Mexico, died on Aug. 3 in his apartment at the Engineers' Club, New York City. He was in his fifty-eighth year, having been born at Portsmouth, Ohio, a son of the late Henry A. Towne and Mrs. Harriet Nye Towne. Mr. Towne received his education at grade schools and at the Ohio State University, from which later institution he was graduated in 1879, receiving his degree of mining engineer a year later.

Mr. Towne was an officer in many Mexican corporations, most of which he was instrumental in organizing and over all of which he exercised active management. One of the largest interests was the Compañia Metalurgica Mexicana, operating the large lead-smelting works at San Luis Potosi, Mexico. In this company he occupied the position of president and treasurer, and was also a director. The company obtained supplies for its smelting plant from the mines of the San Pedro district, near San Luis Potosi, with which mines the company had long-time contracts and some of which it operated with its own men. The smeltery at San Luis Potosi is connected with the San Pedro mines by the Potosi & Rio Verde Ry., of which company Mr. Towne was also president and director.

Another large and important interest that Mr. Towne instituted is the Tezuitlan Copper Co., at Tezuitlan, Vera Cruz. This plant had been extremely active before the Mexican revolution and is one of the important copper-smelting centers in Mexico. Mr. Towne was president and director of the Mexican Northern Railway Co., and he was also president and director of the Alvarez Land and Timber Co., the Fresnillo Mining Co., the Mexican Lead Co., the Montezuma Lead Co. and the Soubrette Mining Co. He was also president of the Minerals Extractor Corporation and vice-president of the Metallurgical Engineering and Process Corporation.

Mr. Towne was a member of the American Institute of Mining Engineers, the Ohio Society and the New York Yacht, Engineers', New York, and Lawyers' clubs.

New South Wales Mineral Production in 1915

The report of the New South Wales Department of Mines for 1915 has just been issued, and gives the figures of production shown in the accompanying table.

NEW SOUTH WALES MINERAL PRODUCTION, 1914 AND 1915

Substance	Unit	1914	1915
Alunite	tons	3,040	1,420
Antimony (metal and ore)	tons	36	636
Bismuth (metal and ore)	tons	15	18
Coal	tons	10,390,622	9,449,008
Coke	tons	304,800	417,753
Copper (ingots, matte and ore)	tons	6,607	6,793
Diamonds	carats	1,580	839
Gold	oz.	124,507	132,498
Iron	tons	75,150	76,318
Iron, "oxide"	tons	3,144	2,294
Lead (pig, etc.)	tons	25,989	30,305
Lime	tons	36,207	33,010
Limestone flux	tons	51,852	71,720
Molybdenite	tons	61	31
Platinum	oz.	244	56
Silver (ingots and matte)	oz.	2,871,559	3,237,432
Silver-lead, ore, concentrates, etc.	tons	337,019	282,776
Shale (oil)	tons	50,049	15,474
Scheelite	tons	57	33
Tin (ingots and ore)	tons	2,317	2,188
Wolfram	tons	130	50
Zinc (spelter and concentrates)	tons	359,319	190,916

In addition to the foregoing, marble valued at £4,187, opal, £6,403; portland cement, £115,000; building stone, £657, and sundry minerals and ores valued at £7,756 were produced in 1915.

The total value of the mineral yield in 1915 was £10,064,569, a decrease of £435,161 from that of the previous year. However, considering the disabilities under which the mining industry has labored during the continuance of the war, the production must be regarded as very satisfactory.

The number of persons employed in mining in 1915 is estimated at 31,111, a decrease of 6,059 from figures of the previous year.

Appointments in the Engineer Officers' Reserve

The Officers' Reserve Corps is authorized by sections 37-40, 49 and 51-53 of the National Defense Act approved June 3, 1916. The regulations prescribed by the President to carry it into effect are published in general order No. 32, War Department, July 28, 1916, which also quotes in full the above-mentioned sections of the National Defense Act.

The following extracts from the above general order give the principal requirements of the regulations that apply to the Engineer Officers' Reserve Corps. A copy of the complete regulations will be furnished on request, which should be addressed to the Chief of Engineers, U. S. Army, Washington, D. C.

Applicants commissioned in the Officers' Reserve Corps will rank in the various sections according to grades and to length of service in their grades. Commissions will be issued for periods of five years. No age limits apply to the Engineer Officers' Reserve Corps.

Except as otherwise herein provided, a member of the Officers' Reserve Corps shall not be subject to call for service in time of peace, and whenever called upon for service shall not, without his consent, be so called in a lower grade than that held by him in said reserve corps. In time of actual or threatened hostilities the President may order members of the Officers' Reserve Corps, subject to physical examination, to temporary duty with the Regular Army, or as officers in volunteer or other organizations that may be authorized by law, or as officers at recruit rendezvous and depots or on other duty. They may be promoted to vacancies in volunteer organizations or to temporary vacancies in the Regular Army, as prescribed in the act. While reserve officers are on such service they shall be entitled to the pay and allowances of the corresponding grades in the Regular Army.

Department commanders and the Chief of Engineers, when authorized by the Secretary of War, may order reserve officers of their departments or corps to duty with troops in the field or at field exercises or for instruction for periods not to exceed 15 days in any one calendar year. While so serving such officers shall receive the pay and allowances of their respective grades in the Regular Army. These periods will not be extended except with the consent of the reserve officers concerned.

Enlisted men of the Regular Army and of the National Guard, both active and retired, if citizens of the United States, are eligible for examination for commissions in the Engineer Officers' Reserve Corps. No applicant will be examined who is an officer of the Regular Army on the active list or of the National Guard or who is not a citizen of the United States.

The examining board will ordinarily be composed of one officer of the Corps of Engineers, one member of the Engineer Officers' Reserve Corps, and one officer of the Medical Corps or the Medical Officers' Reserve Corps.

The mental examination of no applicant will be undertaken who, in the judgment of the board, is not physically qualified to discharge in active service all the duties of an officer of the grade in which the applicant seeks a commission in the Officers' Reserve Corps; nor of anyone who has any mental infirmity or deformity of body, or whose moral fitness has not been duly established.

No person shall be examined for appointment in the Engineer Officers' Reserve Corps unless he has a letter from the Chief of Engineers authorizing his examination. Such a letter to an applicant will be the acknowledgment of the receipt of his application.

If an applicant has served in the Regular Army of the United States, or in any of the volunteer forces of the United States, or in the organized militia of any state or territory or the District of Columbia, he shall submit his discharge papers for each term of service; if still in service of any of the organizations named, he shall submit recommendations of his immediate and higher commanders.

If an applicant has attended or pursued a regular course of instruction in any military school or college of the United States, or has graduated from any educational institution to which an officer of the army or navy has been detailed as superintendent or professor pursuant to law, he shall, if a graduate, be required to present a diploma or certificate of graduation from such military school, college, or educational institution, or, if not a graduate, a certificate showing the amount and character of training, theoretical or practical, satisfactorily completed thereat.

Every applicant will be subjected to a rigid physical examination, which shall include the ordinary analysis of the urine, and if there be found to exist any cause of disqualification which might in the future impair his efficiency as an officer, he will be rejected. Defects of vision resulting from errors of refraction which are not excessive, and which may be entirely corrected by glasss, do not disqualify unless they are due to or are accompanied by organic disease.

Candidates for appointment in the Engineer Officers' Reserve Corps will be examined either (a) for duty with combatant engineer troops or other duties in the service of the front, or (b) for special service on the lines of communications or other points in rear, including engineer work in connection with seacoast defenses, as hereinafter indicated. Officers appointed under (b) will not ordinarily be assigned to combatant duties but will be subject to such assignment whenever needed The examinations shall be especially directed to ascertaining the practical capacity of the applicant, and the record of previous service and training of the applicant shall be considered as a part of the examination.

Military experience or training in the regular army, volunteers, or National Guard, or at training camps or educational institutions will be noted and reported by the board and considered in making the recommendations.

Qualifications for Reserve Officers, Service of the Front

1. For First and Second Lieutenants:

(a) The applicant must be an engineer in the active practice of his profession or some business immediately connected with, or concerned in, engineering matters.

(b) He must either hold or have qualified for the grade of junior engineer, civil, electrical, or mechanical or higher grade in the civil service, or he must be a graduate from an approved engineering college, or have been in the active practice of engineering for at least two years.

2. For Captains:

(a) The applicant must be an engineer in the active practice of his profession or some business immediately connected with, or concerned in, engineering matters.

(b) He must either hold or be eligible fc - the grade of assistant engineer in the engineer department at large, or a corresponding engineer grade in the civil service in another department of the Government service, or have held a commission in the Corps of Engineers of the Regular Army, or shall be a professional engineer not less than 28 years of age, who shall have been in the active practice of his profession for at least 8 years and have had responsible charge of work as principal or assistant for at least 2 years. The graduation from a school of engineering of recognized reputation shall be considered as equivalent to two years' active practice.

(c) Knowledge of the principles of military organization and operations, as illustrated in Infantry Drill Regulations, Parts I (to include School of the Company) and II, and Field Service Regulations, Part I and Part II (Articles I, II, IV, VI); and of the general principles of field fortifications, as illustrated in the Engineer Field Manual, Chapter V.

3. For Majors:

(a) The applicant must be an engineer in the active practice of his profession or some business immediately connected with, or concerned in, engineering matters.

(b) He must hold the grade of assistant engineer in the ngineer department at large, or corresponding engineer grade in the civil service in another department, or have held a commission in the Corps of Engineers of the Regular Army not more than two grades below that for which he desires to be listed, or shall be a professional engineer not less than 35 years of age, and shall have been in the active practice of his profession for 15 years, who shall have had responsible charge of work for at least 5 years, and shall be qualified to design as well as to direct engineering work. Graduation from a school of engineering of recognized reputation shall be considered as equivalent to two years of active practice.

(c) In addition to fulfilling the qualifications given in paragraph 3 (a) and (b), the candidate will be required to pass n examination on the following subjects:

Drill Regulations—Parts I (School of the Company and Battalion only), II, III, Infantry Drill Regulations.

Field Service Regulations, entire text.

Duties of Engineer Officers and troops in war, as illustrated in the Engineer Field Manual and Bulletin No. 4, Vol. I, of the office of the Chief of Staff.

Coöperation between the various arms of the service, as illustrated in "Technique of Modern Tactics" (Bond and McDonough) Chapters VIII, IX, XI and XII.

All examinations will be oral.

Qualifications for Reserve Officers, Special Services

Candidates desiring appointment in special services must e qualified for at least one of the duties assigned to the Corps f Engineers by the following extracts from Army Regulations:

"1493. The duties of the Corps of Engineers comprise reconnoitering and surveying for military purposes, including the laying out of camps; selection of sites and formation of plans nd estimates for military defenses; construction and repair f fortifications and their accessories; . . . the installation f electric power plants and electric power cahle connected ith seacoast batteries; . . . construction and repair of military roads, railroads and bridges; military demolitions; . . . In time of war within the theater of operations it as charge of the location, design and construction of wharves, iers, landings, storehouses, hospitals and other structures f general interest, and of the construction, maintenance and repair of roads, ferries, bridges and incidental structures, nd of the construction, maintenance and operation of railroads under military control, including the construction and operation of armored trains."

No oral or professional examinations will be required, but recommendations of boards will be required in lieu of such xaminations. Candidates will submit evidence of their actual nployment in corresponding or higher positions in civil life nd references to persons under whom they have been or re employed.

Reserve officers from the following civilian occupations will e required for the special services of the Corps of Engineers: ridge engineers; constructing engineers (earth and concrete); onstructing engineers (wharves, piers and buildings); electrical engineers (for small plants and power lines); highway ngineers; mining engineers (skilled in tunneling and use f explosives); railroad engineers (construction and maintenance); railroad operating officials; sanitary engineers; topographical engineers.

War Department, Office of the Chief of Engineers,
Washington, Aug. 1, 1916.

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American Mining Congress Call

The nineteenth annual convention of the American Mining Congress will be held in Chicago, Ill., from Nov. 3 to 16 inclusive, with the La Salle Hotel as headarters.

Coöperation between capital and labor is the declared ynote of the convention. A better understanding between employers and employees is one of the most important subjects for consideration, and the truth of the issues involved is to be told plainly but without giving offense. Coöperation is declared the greatest need of the mining industry. The great purpose of the convention will be to inaugurate plans by which all branches of the mining industry may work together for the solution of common problems.

In order that delegates may attend the discussion of only such questions as are of direct interest to them, the afternoon and evening sessions of each day will be divided into sections, each giving consideration to its special problems. A general meeting of the congress will be held on the morning of each day of the convention at which only subjects of general interest will be considered. These subjects will be grouped under the heads of safety, efficiency and conservation.

The entertainment committee will provide functions for time not occupied by the serious work of the convention, including trips to points of interest and a smoker and banquet. The management of the La Salle Hotel will make special rates to members of the convention who make reservations in advance.

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Exports of Sheet Zinc

We recently drew the attention of the Bureau of Statistics of the Department of Commerce and Labor to the probability that its statistics of the exportation of sheet zinc from the United States during the last year was seriously in error. The Bureau insituted an investigation of the matter with the result that a few days ago the following circular was issued:

Correspondence with collectors of customs has resulted in certain corrections of the export figures published in the successive issues of the "Monthly Summary of Foreign Commerce" for the period from July 1, 1915, to May 31, 1916. The changes represent transfers from the class entitled "Zinc plates and sheets" to that entitled "Zinc pigs, bars, etc., produced from domestic ore." The amended figures for those classes are as follows:

Month of—	Zinc Pigs, Bars, Etc., Produced From Domestic Ore		Zinc Plates and Sheets	
	Pounds	Dollars	Pounds	Dollars
1915—July	9,563,906	1,514,440	3,419,536	510,829
August	10,358,383	1,700,021	4,189,474	716,889
September	11,987,071	1,908,495	5,320,428	871,939
October	17,509,317	2,769,390	6,676,174	1,103,728
November	18,034,229	3,042,816	2,004,081	361,089
December	16,250,983	2,871,662	3,156,531	539,087
Six months total	83,703,889	13,806,824	24,766,224	4,103,561
1916—January	17,509,686	2,974,223	3,457,116	636,747
February	18,428,050	3,136,523	2,227,345	435,929
March	14,852,831	2,598,389	1,489,655	304,083
April	16,608,797	2,943,719	1,657,134	408,139
May	16,226,961	2,893,519	939,121	207,133

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Greenland Cryolite Mining

Cryolite has been found in commercial quantities at Ivigtut, an Eskimo hamlet on the southern coast of Greenland. The cryolite deposit is reported to be a solid mass, having surface dimensions of about 200 ft. by 600 ft., and it has been worked as an open cut to a depth of about 150 ft. The deposit widens with depth, and the depth is unknown.—*The Chemical Trade Journal and Chemical Engineer.*

⁂

Shattuck Arizona Copper Co.'s production for June, 1916, was 1,446,080 lb. copper, 61,889 lb. lead, 24,636 oz. silver and 367.02 oz. gold.

Editorials

The Situation in the Metals

About three months ago there was a cessation in the feverish activity that previously had prevailed in the metal market for a long time, and in all cases there were recessions in price, which in some cases were very severe. The last was true especially of zinc, antimony, and tungsten. The prices for copper, lead, and iron and steel declined, but in nothing like the same proportion as the other metals. However, with the feelings of pessimism over financial and commercial prospects that began to develop, there was an expectation in many quarters that copper, lead, and iron and steel would meet with more or less the same fate as the other metals. There were to be no more war orders. The clock was considered to have struck twelve six months or more ago, and some financial danger signals were believed to be flying. This pessimism was about at the deepest just at the mid-year.

As July wore on, there appeared to be a change of sentiment and a growing appreciation that what had been happening was only a natural readjustment of conditions that were still sound and excellent. In Great Britain there are two views among economists. The optimistic, whereof Sir George Paish is the great exponent, minimizes the destruction of wealth by the continuance of the war. The other, the pessimistic school, whereof Francis W. Hirst, who recently retired from the editorship of the *Economist,* is the chief exponent, prophesies that a prosecution of the war for only a few months more will result in catastrophe for the whole world. The minds of a good many people in this country were probably unduly colored by the latter view. If we may rely upon so excellent a practical authority as the National City Bank, which in its last circular called attention to the very slight extent of the diminution of the gold reserves of the European nations during the last year, there is good reasons for adhering to the opinion of the optimistic school of economists.

Anyway, people began to feel better during July. The advance in money rates proved to be but temporary. Other danger signals did not appear to be so positive as previously they were regarded. Even then came some further ammunition orders, rather to the surprise of everybody. This improvement in feeling was reflected in the metal markets, which is the subject of our present discussion.

Let us start out with the premise that any great rise in the value of a commodity automatically brings about the corrective thereof through the stimulation of new production, and sooner or later there must be a recession from every high price. That is going to happen with copper and steel, just as it has already happened with zinc and antimony, but by virtue of natural conditions it may not happen for a long time. In other words, there are at present some fundamental differences in the positions of copper and zinc, and there are some special factors that are playing a part in the lead market.

The position of copper is still phenomenally strong. The production of the miners and smelters has increased a good deal, but that of the refiners has not increased in the same proportion and lately has been checked considerably by the diminished output of labor. The refiners have no stocks and are finding it difficult to keep up with the deliveries that they have contracted to make. Were it not that copper manufacturers are to a considerable extent in the same fix there would be serious trouble. The principal producers have without exception sold all of their expected output up to about Oct. 1. There has been no large buying since about the first of May. Even the French and British governmental contracts do not run generally beyond the end of this year. There is reason to anticipate that large buying of copper will soon have to take place. The expected demand will come in a market that is already firm. The situation is well reflected in the sharp rally in copper that occurred in the latter part of July. A precisely similar rally happened in the market for iron and steel products.

With zinc the situation is quite different. The high price for that metal was a direct invitation to Tom, Dick and Harry to produce it. The conditions of the zinc business permit of a rapid increase in plant for the purpose of production—such a rapid increase as would be impossible in copper and steel. The statistics of spelter production in the first half of 1916, just issued by the U. S. Geological Survey, throw light on this. The output in the first half of 1916 was 316,255 tons compared with 272,987 tons in the second half of 1915. [We use the Washington figures for the latter in order to have an accurate comparison. These figures represent only the spelter derived from ores, and do not include what the smelters get from dross and other waste products.]

The increase in production in the first half of 1916 was less than what everybody was prophesying early in the year. We find the probable explanation in the knowledge that both the shortage and increasing inefficiency of labor have been restrictive factors. One large new plant that was expected to be running at full capacity early in 1916 is not yet up to 75% of its capacity, owing to inability to secure the requisite number of smelters. On the other hand, numerous plants that used to make 85 to 90% extraction are now getting much less, while some of the small new plants are simply butchering their ores.

However, although the production in the last semester was not as large as expected, it is manifest that it was larger than necessary, for stocks on hand increased from about 14,000 tons at the beginning of 1916 to 24,000 tons at the mid-year. It is obvious, therefore, that the market in declining reflected correctly the conditions.

In lead, the statistical position appears to be almost as good as is that of copper. Early in 1916 there was an acute position in lead to which the diversion of the output of an important Coeur d'Alene producer was a contributory factor. That producer, having decided to smelt its ore on its own account, was obliged to deprive the market of a large supply while it was stocking up its bins and saturating its smelting and refining system. That having been done, the lead from that producer began lately to come on the market again in large quantities, and in order to effect a disposition of it a very sharp competition was instituted, which produced a general nervousness and something like a temporary demoralization. At all events this competition was the direct cause of the recent reduction in the price of lead.

The prices for antimony and tungsten have declined to relatively low levels. Instead of being from five to ten times above normal, they are now only one and a half to two times above it. The high prices were a direct invitation to everybody to produce all they could, and the plants required for the production of these metals being relatively easy to provide the corrective conditions came quickly into operation.

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A Clearing House for Myths

There ought to be a clearing house for pet theories, alias myths, so as to settle those that are directly in conflict, as is frequently the case. This refers especially to ideas about market conditions, that many people cherish when things happen that they do not like.

Thus when spelter went up to dizzy heights, our friends in Britain said, and probably believed, that it was due to a German or German-American plot to mulct them. When spelter went down, American producers averred with equal assurance that it was a result of a British conspiracy to skin them.

Copper has been purchased lately for the British and French governments by a great American banking house. The price rose to a high figure and then receded somewhat. In Great Britain there has been criticism of the purchasing of copper through that banking house owing to its own important interests in copper production. At the same time American producers have been intimating that the abstention of the aforesaid banking house from the market for several months was a part of a wily scheme to depress the market in the interest of its foreign clients.

Some people say that copper declined in nothing but a nominal way. Others say that it declined on resales by the foreign governments who sought thus to depress the market in order to pave the way for further purchases.

So it goes. The only people who get any amusement out of it are those of a humorous cast of mind.

⁂

The Proposed Tax on Munitions

The more the proposed tax on munitions is examined the more unreasonable and unfair does it appear to be. Take the tax on explosives—8% proposed—and the first thought is that this will fall chiefly on the Du Pont and Hercules companies, which have been making a mint of money and can well afford it. But on second thought the idea occurs to us that explosives are extensively used in the mining industry and perhaps the manufacturers will be able to spread the tax among the consumers.

There is another thought. Two years ago the cotton planters were in a desperate condition. Clubs were organized to help them and "Buy a Bale of Cotton" became a national slogan. Then the Du Pont company got a war order and bought several bales wherewith to make gun cotton. Before long it purchased approximately 1,000,000 bales and the cotton planter was saved. Indeed, the price for short-fiber cotton advanced from 2c. to 8c. per lb. This was proportionately far more than the advance in copper. Why should the copper producer and the explosive manufacturer be taxed and the cotton planter go scot free?

Incidentally the Du Pont company reckons that its tax will be $21,000,000 for 1916, or $38 per share, which is more than the net profits of the company in the three years 1912-14.

The Senate appears to be paying some attention to arguments like the above, for this week the Finance Committee struck out the varying rates provided in the House bill for munitions of war, explosives, copper, etc., and substituted a uniform rate on all of those things. Moreover it decided to add to the list steel billets, ingots and blooms, zinc, lead, denatured alcohol, cotton linters, and chemicals actually used in the manufacture of munitions. It is not explained why the list should be cut short with them and should not be extended so as to comprise canned meats, army rations of various kinds, antimony, quicksilver, tungsten, shoes, stockings, harness, saddles, blankets, barbed wire, kerosene, gasoline, locomotives, and a great variety of other articles that went to make up the military exports of more than $3,000,000,000 during the last two years.

However, it is evident that the excise bill is being completely made over in the Senate and what it will be when completed nobody yet can say.

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Labor Conditions

The National City Bank in its last circular on business conditions calls attention to the alarming increase in the inefficiency of labor, referring to this matter in the following very moderate words:

> It is a deplorable fact that there are circumstantial and authentic reports going to show that labor, in some instances, instead of being inspired by higher pay to greater productiveness, is becoming less efficient. In one instance under our observation, a large employer, whose attitude toward labor is that of sympathetic consideration, reports that after raising wages three times within a year the output per man is in serious degree less than before. The superintendents in immediate charge of operations attribute these results to indifference, loss of discipline, and the fact that other jobs can be easily had. It is needless to say that this development is disappointing to all who are sincerely interested in seeing the standard of wages and of living advanced, but it illustrates the fact that normal progress is by gradual rather than revolutionary processes.

The independence of labor is the natural result of scarcity. The demand for it has increased, while the supply has been diminished both by the cessation of immigration and the return of workers to Europe. With this independence has come about an inefficiency that is due to ignorance.

The attitude of labor is one of the disturbing features of the present situation. Its blighting effects are being experienced in copper smelting, zinc smelting, and other metallurgical industries, as well as in manufacturing industries in general. It is discouraging to see the discountenancing of efficiency obtaining the sanction of the American people collectively through acts of Congress, one of which proposes to make it illegal to institute time studies in governmental work. We imagine that the movement for the abolition of efficiency systems does not come from the men themselves so much as it does from the walking delegates who foresee a curtailment of their power, activity and income. The workmen unfortunately do not, in their ignorance, appreciate what is good for them. However, there is the underlying desire of human nature to throw thrift to the winds, to live from hand to mouth, and to have a good time while the going is good. Therefore, if with present circumstances a man can earn as much in five days as he used to in six, and the income is sufficient, why work any more than five days?

BY THE WAY

The *Boston News Bureau* notes that Gen. Luis Herrera has posted in Parral a decree to the effect that Carranza currency must be accepted at rate of 20c. silver on dollar throughout district, and that any merchant, foreign or native, refusing to accept money at this rate will be shot. Testimony of one witness is all that is necessary to convict.

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There was a rumor in metal circles, said the New York *Sun*, which, however, lacked confirmation, that the concern which furnished the largest part of the consignment of metal supposed to have gone to Germany on the giant submersible the "Deutschland" was sold to Germany by the American Smelting and Refining Co. Metal men were hugely delighted at this report, pointing out that there was little chance of that company getting on the British blacklist for this trading with the enemy, owing to the fact that Great Britain and her allies are themselves forced to buy from this concern the copper and other metals which they find so necessary to carry on their warfare against Germany.

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A correspondent whose veracity in small matters has hitherto remained unquestioned writes the following from one of the mushroom camps of the desert: "The other night Chuckawaller Pete's thirst emporium caught fire. The joint was a mass of flames when the camp volunteer fire department arrived. Prompt measures were necessary to avoid a total loss, but the mine bookkeeper held up the extinguishment of the blaze. He set out to figure which was the cheapest—to let the shack, constructed of lumber costing $150 per thousand, burn down, or put it out with water hauled 15 miles and costing $8 per barrel. While he was figuring, the shack burned down and we never did hear which way the figures pointed."

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Senator Penrose really ought to know better, for he has traveled much in the West and both he and his brothers are extensively interested in mines. There was an exchange of partisan musketry in the Senate on Aug. 2. Senator Penrose cited as an example of Democratic extravagance the passage of a bill in the House appropriating $325,000 for a public building at Tucson, Ariz., a town of 20,000. Senator Penrose pronounced it "Tukson."

"The Senator criticizes and he does not even know how to pronounce the name of the town," shouted Senator Mark Smith, of Arizona, who is urging on Congress the improvement of Tucson. "Does the Senator from Pennsylvania know the amount of public business to be carried on in this building?" demanded Mr. Smith.

"I was there a few years ago," replied Mr. Penrose, "and I have a distinct recollection that there were more coyotes than voters."

"There are more gray wolves—timber wolves—in Pennsylvania than voters," shouted back the Senator from Arizona, red with anger.

After some further senatorial amenities attention was redirected to the affairs of the nation.

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Now is the time of terrific summer heat in Arizona mining camps, and mine managers may possibly be excused for economy of effort in penciling a note. Two neighboring mining companies of a certain camp are in the habit of exchanging courtesies. One day when the local phone was temporarily out of order, Manager W. in an exasperated hurry wrote the following note: "Tell Manager C. offer him 15 bones for roll mill hose f.o.b. warehouse, R. S. V. P." In an hour back came the reply by messenger, and great was the indignation of W. when he read: "C. says W. can g. t. h."

About this time the phone trouble was remedied and W. called up C. forthwith. "I never said any such thing," came the laughing reply over the wire. "I told the bookkeeper you could 'get the hose,' and he merely copied your style of abbreviated writing in his answer."

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Some of the visissitudes of military control of industries were related at the recent meeting of the Magadi Soda Co., Ltd., in London, on June 20. This company has a 99-year lease of a natural soda deposit about 30 mi. square, known as Lake Magadi, in British East Africa, and has built a branch line connecting with the Uganda Ry., to reach the port of Kilindini. The foreman reported that operations had been suspended at the lake, owing to the war. The nearly completed works at Irlam were offered to the munitions department of the government when its directors heard that they were in need of a factory of this type, and offered to put the factory at the disposal of the government on behalf of the shareholders, the government paying 5% interest on the capital and amortization for the period the factory was used, and, of course, the government was expected to make good any damages done. Accordingly, the directors learned that the munitions department had commandeered the works and were later appalled to find that it was not the government's intention to use the works as they were, but to dismantle them and to remove the machinery to the works of one of the company's competitors. The directors entered a protest against this action, but without result. Owing to the commandeering of the company's railroad no shipments could be made, although orders had been received for the product. The company entered claim for the price of the material and buildings. The directors offered to let the government have the whole of the material and buildings in the works at the price that it would cost the company to replace. This, however, was refused, and the ministry of munitions referred the directors for compensation to the governing committee. The directors also entered a claim for compensation for use of the railways and water supply and buildings, but no decision has been reached. There are many uncompensated injuries to noncombatants in time of war, but sending one's equipment to a rival would seem to be an unnecessary and rather irritating one.

PERSONALS

George Watkin Evans, of Seattle, is East on a business trip.

Russell P. Lelbee has gone from Patagonia, Ariz., to Kingston, Penn.

Bond Coleman has gone from Douglas, Ariz., to Esqueda, Sonora, Mexico.

D. F. Hewett, of the United States Geological Survey, is in Peru, South America.

A. E. Hall is superintendent at the mine and mill of the Sable River Copper Co., at Massey, Ont.

P. Kirkegaard has been examining the property and mill of the Sable River Copper Co. at Massey, Ont.

Pope Yeatman will resume his independent practice as consulting mining engineer, beginning Sept. 1.

Ralph Arnold, of New York, is in Venezuela, where he will conduct some investigations in the petroleum dsitricts.

Douglas Walker, salesman for the Snyder Electric Furnace Co., in charge of the Chicago district, has been appointed sales manager.

B. A. Robinson, assistant secretary of the American Institute of Mining Engineers, is attending the military training camp at Plattsburg, N. Y.

Ernest Marquardt has joined the petroleum division of the staff of the Associated Geological Engineers, and will be detailed to service in Oklahoma.

Nathan O. Lawton will be engaged for the next two months at the mine of the Vermont Copper Co., South Strafford, Vt., looking after the reopening of the mine and the development of the property.

David F. Baker, who has been connected with the blast-furnace department of the Broken Hill Proprietary Co. at Newcastle, N. S. W., is now in the United States and will take up permanent work here.

Robert Bryce, of Cobalt, Ont., has been making some examination at Whiskey Lake and Sudbury districts. He made an examination of the Sable River mine where flotation is being used on the chalcopyrite ores.

James F. Callbreath, secretary of the American Mining Congress, is spending a good deal of time in Chicago looking after the preliminary arrangement for the annual convention, which will be held in that city in November.

OBITUARY

Thomas Francis, a mining engineer of Missouri, died at Bevier, Mo., on July 24,, aged 75 years.

Louis Rosenfeld, one of the owners of the Eagle-Shawmut mine in Tuolumne County, Calif., was found dead in Golden Gate Park, San Francisco, early in the morning of July 20.

W. Vaughn Pettit, a mining engineer of Philadelphia, Penn., was killed in action in France during the latter part of June, while serving with the British Royal Engineers. Mr. Pettit was 41 years old and a bachelor. He was a graduate of Lehigh University. Mr. Pettit enlisted in the British army about a year ago.

Reuben Kay Edwards, a well known furnace operator and contractor, of Birmingham, Ala., died on July 29. He was formerly superintendent of the old Mary Pratt furnace, long since torn down, and later was connected in the same capacity with the Sloss-Sheffield company. In the past five years he had been in the contracting business. He leaves a widow and two sisters.

J. J. Abbott, a pioneer mining engineer of Colorado and prominent throughout Denver and the mountains, died at Auburn, Me., on July 31. He had been in ill health, which obliged him to give up his professional work about a year ago. He went to California in the spring of 1915 to seek relief from a breakdown caused by high blood pressure. He returned to Denver last February and later went to Maine, where two sons and two daughters reside. The funeral will be held there.

Mr. Abbott was born at Uxbridge, Mass., in 1850. He was a graduate of Yale and of the Sheffield Scientific School. In 1876 he went to Colorado and settled at Lake City.

He removed to Denver in 1898 and followed his profession until ill health forced him to retire.

INDUSTRIAL NEWS

Rix Compressed Air and Drill Co., of San Francisco, Calif. has moved to 505 Howard St., San Francisco.

Encinitas Cash Store, Encinitas, San Diego Co., Calif., is supplying California grinding pebbles in all sizes from 1 to 6 in. in diameter.

Norton Company, Worcester, Mass., has issued its catalog for 1916, showing a comprehensive line of Alundum refractories for laboratories and industrial works.

The Asbestos Protected Metal Co., of Pittsburgh, announces the appointment on Aug. 1 of Melbert W. Taber, manager of its Detroit office, in the Penobscot Building.

The Cement-Gun Construction Co., 900 South Michigan Ave., Chicago, reports it is waterproofing a coal mine for the Cottonwood Coal Co., Lehigh, Mont.; and waterproofing a coal mine for the Alden Coal Co. at Farmington, Ill.

The Morse Bros. Machinery and Supply Co., of Denver, has purchased the steam-power plant of the A. V. plant of the American Smelting and Refining Co. at Leadville and is removing it to their Denver warehouse for resale.

Colorado Iron Works Co., Denver, announces that L. G. E. Bignall has joined its sales organization. Mr. Bignall's wide experience gained during several years' service as sales engineer for the Mine and Smelter Supply Co., at El Paso, Tex., and sales manager for the Denver Engineering Works Co. well equips him for this work.

The distinction of furnishing the United States Navy with its first kite balloon has fallen to the **Goodyear Tire and Rubber Co.,** Akron, Ohio. Kite balloons are so called because of the method of rigging, which is similar to that of a boy's kite. They are also known as captive balloons from the practice of holding them captive at any height desired by means of a wire cable attached to balloon rigging. The balloon which has just been delivered to the Navy was designed by Goodyear aëronautical engineers and made entirely in the Goodyear factory. It has been placed in commission at the U. S. Navy aëronautic station at Pensacola, Fla., and is 81 ft. in length while its largest diameter is 22 ft. Hydrogen gas is used in inflating the big sausage-shaped bag. This gas is produced by a simplified process by the use of a hydrogen generator.

NEW PATENTS

United States patent specifications listed below may be obtained from "The Engineering and Mining Journal" at 25c. each. British patents are supplied at 40c. each.

ALUMINA—Crystalline Fused Alumina and the Manufacture Thereof. Frank J. Tone, Niagara Falls, N. Y., assignor to The Carborundum Co., Niagara Falls, N. Y. (U. S. No. 1,192,709; July 25, 1916.)

ALUMINATE—Producing Aluminate from Alunite. Paul R. Hershman, Chicago, Ill. (U. S. Nos. 1,191,104; 1,191,105 and 1,191,106; July 11, 1916.)

AMALGAMATOR. Albert E. Vandercook, Alameda, Calif., assignor to California Macvan Co. (U. S. No. 1,192,478; July 25, 1916.)

BLAST-FURNACE DISCHARGE ARRESTER. Edwin E. Slick and Edgar W. Clarke, Westmont Borough, Penn. (U. S. No. 1,191,541; July 18, 1916.)

CLASSIFIER — Ore-Classifying Machine. Selden Irwin Clawson, Salt Lake City, Utah. (U. S. No. 1,191,280; July 18, 1916.)

CONCENTRATOR—Ore Concentrator. Jacob Lampert, Rapid City, S. D. (U. S. No. 1,192,534; July 25, 1916.)

CRUSHER. James W. Boileau, Chicago, Ill. (U. S. No. 1,191,494; July 18, 1916.)

CRUSHER—Rock and Ore Breaker. Thomas W. Capen, Milwaukee, Wis., assignor, by mesne assignments, to Allis-Chalmers Manufacturing Co. (U. S. No. 1,191,564; July 18, 1916.)

CRUSHING—Stamp Mill. Henry L. Doherty, New York, N. Y. (U. S. No. 1,192,997; Aug. 1, 1916.)

DREDGING—Apparatus for Separating Materials of Different Specific Gravities. Charles Schifferle, San Francisco, Calif., assignor to The Yuba Construction Co., San Francisco, Calif. (U. S. No. 1,190,466; July 11, 1916.)

DRILL—Rock Drill. William August Smith, Denver, Colo., assignor of one-half to William W. Hassell, Colorado Springs, Colo. (U. S. No. 1,191,842; July 18, 1916.)

SINTERING—Cover for Sintering Pans. Frank D. Carney and Richard V. McKay, Steelton, Penn. (U. S. No. 1,190,513; July 11, 1916.)

ZINC—Metallurgy. Henry Swift Kimball, St. Louis, Mo., assignor to American Zinc, Lead and Smelting Co., Boston, Mass. (U. S. No. 1,189,830; July 4, 1916.)

Editorial Correspondence

SAN FRANCISCO—Aug. 2

Mine-Tax Assessments in Tuolumne County have been reduced by the board of equalization in application to a large number of mining properties, including the Rawhide, App, Heslop, Jumper, Golden Rule, Tarantula and others. The reductions apply to the mines and equipment and total a large amount; the separate reductions run from $500 up to more than $25,000. A total reduction of $73,700 was made to the Central Land Co. in favor of the Rawhide, App and Heslop, which includes surface equipment. The Rawhide is being developed by the Pittsburgh Silver Peak Mining Co. and the App and Heslop are in the holdings being operated by W. J. Loring and associates. The encouragement thus given to investors and operators in Tuolumne County will not be confined to men who are able to work on a large scale, but will apply to a number of smaller owners who might not be able to work at all under a continued system of high taxation.

Oxygen May Be Explosive, when made by the electrolytic process, through contained hydrogen. This is the conclusion of the California Industrial Accident Commission, resulting from investigation of accidents due to the explosion of oxyacetylene-welding apparatus at the Mountain Copper Co. shops, Hercules Powder Co. and the California Artistic Metal and Iron Co. These accidents all occurred in the first half of July and resulted in a total of seven deaths. All of the apparatus was furnished by one company, and as the accidents were similar, the apparent cause of the explosion was more easily determined. However, the commission has not made any public statement as to its determination in that respect; but has merely issued a warning to all persons using oxyacetylene-welding apparatus that it is unsafe to use oxygen for this purpose without first determining that it does not contain hydrogen or other gases which with oxygen would form an explosive mixture. Experiments are being made to determine definitely the explosive limits of such mixtures. Users are advised to reject oxygen containing 2% hydrogen.

Conditions at the North-End Comstock Mines in the last half of July were particularly encouraging to the operators since the meeting of the United Comstock Pumping Association, held on July 21, decided to reduce the water level from the 2,700-ft. to the 2,900-ft. point. This has been in contemplation for several weeks and Superintendent Whitman Symmes, engineer in charge, was previously in San Francisco getting estimates upon costs of necessary electrical equipment. The result of the investigation was satisfactory to the Pumping Association and the work of unwatering will proceed as soon as the necessary installations are made. The pumps and other machinery used in unwatering from the 2,500 to the 2,700 levels are available, but additional equipment is necessary. The estimate for unwatering to the 2,700 level is said to have been $25,000, but the actual cost was $17,000. Mr. Symmes reports that the additional 200 ft. will be unwatered at a still smaller cost. It is known that the orebodies extend to the lower levels but no exploration was done by the early-day operators. The production of the north-end mines in the past two or three months has been encouraging, the Union showing large amounts of high-grade ore, while improvement in the Mexican, Ophir, Con. Virginia and other properties also adds to the encouragement. The Mexican mill is being operated on large tonnage from the Union and the mill sheet for June showed that Sierra Nevada shipped 262 tons that netted $2,254. The Comstock Leasing Co. which will operate the Chollar and Potosi is hurrying installation of mill and tramway, expecting to be operating early in August.

BUTTE—Aug. 5

Monument to Mark First Gold Discovery in Montana, the gift of Mrs. Mary E. Morony, of Deerlodge, to the Montana Society of Pioneers, is now being prepared in New Hampshire and will be erected this fall in Powell County on a bar between the Northern Pacific and the Milwaukee tracks at Gold Creek, the spot where gold was first discovered in Montana. The monument will be an 18-ft. granite shaft. Former Senator W. A. Clark has been invited to deliver principal address at the dedication ceremonies.

Anaconda Copper Production for July shows an increase of 100,000 lb. over the reported production for June, the total for July being 28,200,000, representing the output of the Washoe and Great Falls smelteries, this may be compared with 22,100,000 lb. for July, 1915. The company's production by months for the first seven months of 1916 follows: January, 23,200,000 lb.; February, 23,300,000; March, 26,600,000; April, 23,300,000; May, 30,000,000; June, 28,100,000; July, 28,200,000; a total of 192,700,000 lb., an average of 27,528,000 lb. per month. The rate of production is 330,000,000 lb. for the year. John D. Ryan, president of the Anaconda company, is in Montana on his annual visit and tour of inspection, expecting to remain in the state about a month. He is quoted as saying in an interview: "The copper business has had two months of dullness, succeeding a big business. As comparatively little copper has been traded in the past two months prices have dropped 5 or 6c. per lb., but the market is recovering and a good buying movement is starting. I am expecting higher prices than have prevailed since June 1. In the first few days in August quotations again ranged above 25c. per lb., and I have no doubt that the average during the month of August will be above that figure and that miners wages will again advance under scale regulated by the price of copper. The mines of the company in Butte look better than they have done in years, and production is being maintained at a satisfactory rate. The zinc plant at Great Falls is nearly completed and will be ready to start operations in two weeks. The zinc concentrator at Anaconda will be ready then to furnish product for the electrolytic plant to treat. These plants were begun last September and have been completed before the time promised by the engineers in charge of the construction."

DENVER—Aug. 3

Purchase of the Cresson Mine—the mine of vug fame—is announced from Cripple Creek as accomplished, the price named being $4,200,000 or at the rate of $3.50 per share. The new officers of the company will be: President, A. E. Carlton; vice-president, Claude K. Boettcher; secretary, A. J. Zang; treasurer, E. P. Shove; general manager, Richard Roelofs. Other directors are T. B. Burbridge, Charles M. MacNeill, Spencer Penrose, Irving T. Snyder, Adolph Zang and L. G. Carlton.

The Lead in Tungsten Production has been regained by Colorado, according to the statement of the U. S. Geological Survey. The output is estimated for the first six months of the year as having a gross value of $3,638,000. Fred Carroll, state commissioner of mines, says that the state's production of gold and silver for 1916 will range around $30,000,000 and that the total production of gold, silver, lead, zinc, copper and tungsten will probably have a value of about $100,000,000.

Leadville's Two Great Unwatering Operations have been attended by unforeseen misfortune. After water had been lowered to the bottoms of both the Penrose and the Harvard shafts, heavy flows developed and have persistently prevented the prosecution of development at depth. No satisfactory explanation has been advanced to account for the flow in the Penrose, which appears to issue from the floor of the bottom level, but Manager H. S. Lee, of the U. S. Smelting, Refining and Exploration Co., believes the Harvard is taking water from Evans gulch and he is accordingly constructing a great flume to carry the creek past the property. Both enterprises will be carried through despite these obstacles, as they were both formerly operated-at present depths and are known to contain good reserves of valuable ores.

SALT LAKE CITY—Aug. 4

Utah Ore Sampling Co., owning and operating sampling mills at Park City, Murray and Silver City, will increase its capitalization from $200,000 to $300,000, by issuing another 100,000 shares of stock. The company has handled an unusually large tonnage during past months and is planning the erection of a fourth sampler, to be built at Murray. The Tintic sampler is at present working one shift, handling a somewhat reduced tonnage (400 tons daily) owing to less lower grade ore being produced there.

Grading for the New Leaching Plant of the Utah Copper Co., near the Arthur mill at Garfield, has been practically completed. Work of installing the equipment will depend on when supplies, building material, steel, etc., can be delivered. The capacity will probably be 3,000 to 5,000 tons per day at the beginning, with provisions for handling a larger tonnage. Concrete leaching tanks, lined with acidproof asphaltum material, are to be used. D. C. Jackling and engineers of the company are in Salt Lake City going over the plans. The company has set aside $2,500,000 for the undertaking. The capacity of the Arthur and Magna mills is being gradually increased, by additions and through improvements in handling the ore. Additional flotation equipment is also being installed. During June the copper production amounted to 17,877,432 lb. as compared with 15,950,215 lb. in May. The July production is expected to be greater than that for June, and the output for the year will be about 180,000,000 lb. There was recently handled in one day 44,000 tons of ore.

JOPLIN, MO.—Aug. 5

Another Slump in Ore Prices on both zinc and lead during the last week in this district tended to check development work and caused several more mines to close. The turn in for the week amounted to less than 4,000 tons, and it is expected yet smaller shipments will be made if the price does not improve. Several mines in the west Joplin camp were closed down the latter part of the week, on account of lack of water and it is becoming increasingly difficult to get sufficient water for milling.

Three Ambitious Prospecting Campaigns have just been launched in the Kansas portion of the district. These campaigns will cover the prospecting of over 6,000 acres of virgin territory and should add materially to the known resources of the field. Of these three campaigns, the largest is that of a group of interests said to be associated with Boston zinc companies and involves the development of over 4,000 acres immediately north of the Oklahoma line and west of Baxter Springs, Kan. There have been a number of drill holes put down already and some strikes reported and a number of drill rigs are being sought to place at work upon the land. The second largest undertaking is that of a group of men already interested at Picher and Cardin. The development of 1,200 acres near Columbus, Kan., has just been announced as a part of their activities during the remainder of the summer and fall. This acreage is south of Columbus where there have been rumors of strikes during the last two years, but which have never been developed. The third campaign is that announced by the Delaware Zinc Co., which holds leases upon 1,000 acres north and south of Picher, Okla., about half of the acreage only being in Kansas. The latter work is in charge of Haywood Scott, of Joplin, and he has placed about 10 drill rigs at work during the last fortnight. It appears to be the ambition of all of these concerns to develop large acreages and the undertakings are being aided by the farmers by the granting of low rates of royalty and advantageous terms of working the ground. With the steady growth of the Miami and Commerce camps northward it is the belief of those interested in that field that the mineralized zone will extend far into Kansas. It would bring into the zone a large area of prospective mineral-bearing ground beyond Spring River, which has hitherto been considered as limiting the west side of the Joplin district.

DULUTH—Aug. 5

July Iron-Ore Shipments were 9,750,517 tons, the greatest for a single month in the Lake Superior district. Total shipments to Aug. 1 are slightly over 29,300,000 tons. Should the same ratio of increase prevail throughout the season, the 1916 tonnage would pass the 60,000,000 mark, or five to ten million tons in excess of the rosiest expectations. Last year but 44,000,000 tons were shipped down the Lakes, while the record season of 1913 showed but 49,000,000 tons. The new Steel Corporation steamer "Wm. A. McGonagle" recently took on her maiden trip a cargo of 12,677 tons of iron ore.

Prevailing Wages in the Chisholm District were under discussion when the Mesabi Range strike started. Recently, Supt. A. Y. Peterson, in charge of the Oliver Iron Mining Co.'s operations in the Chisholm district, permitted press representatives to examine the company's pay rolls to ascertain the truth or falsity of the I. W. W. statements regarding the rate of wage paid to miners in the district. The examination disclosed the fact that 544 men per day were employed on contract work during May and 540 men during June. During May these men worked 14,147.25 shifts with net earnings of $48,067.86, an average rate per day of $3.397. During June they worked 10,318.75 shifts, net earnings $36,482.94, or an average of $3.535 per day. A tabulation of the average rates of wage of contract miners in the district showed the following for the two months stated:

Less than $2.50........	0.1%	$3.26 to $3.50..........	16.3%
$2.51 to $2.75..........	0.6%	$3.51 to $3.75..........	13.2%
$2.76 to $3.............	23.4%	$3.76 to $4.............	7.6%
$3.01 to $3.25..........	20.0%	Over $4.01	18.8%

The lowest average rate paid at any one mine of the group during June was $3.34 per day, and the highest $3.897.

Strike Situation Remains Unchanged on the Mesabi Range. No mines were started up during the last week and the men who are now holding out seem determined to remain away from work until some agreement is made with the companies. However, this will not take place as long as the Industrial Workers of the World are looking after the interests of the men. The two Federal investigators are going ahead with their work and have been in attendance at most of the meetings that the strikers have held during the last week. There was some picketing by women the early part of the week and the officers did not interfere with them until one deputy was severely wounded by being struck on the head by a rock, after which the sheriff issued orders to stop picketing by both men and women. Since that time there has not been a disturbance on the range. One of the mining companies that was hit hard by having almost every one of its mines closed down has been compelled to enter the open market to get enough ore to keep its furnaces going. This company owns mostly underground properties; few underground mines east of Keewatin are operating. Shipments, however, are being maintained at a steady rate. There was some talk that the boat men were going on a strike, but the vessel owners took quick action in Detroit and granted an increase in pay of $10 a month to all men not licensed officers; the officers get their increases in the form of bonuses at the close of the shipping season. Although the I. W. W. has made attempts to start trouble on some of the other iron ranges, their efforts have been without results and it is not believed that they can accomplish anything. Wages are higher than they have been in years, in spite of the statements of the I. W. W. leaders to the contrary. The I. W. W. has no funds to support the strike and it is surprising that the miners are holding out when they are not receiving the strike benefits promised them. The Federal report on strike conditions, as made by Investigator George P. West, to the Committee on Industrial Relations, has come in for much criticism on the part of local and state authorities. The report was made public at Washington on Aug. 2, and anti-administration papers claim it to be largely political clap-trap.

TORONTO—Aug. 5

The Nickel Controversy seems in a fair way of being settled by the incorporation of a new company, known as the International Nickel Co. of Canada, which will have a capital of $5,000,000. This company will build a refinery at Port Colborne, on Lake Erie, in Ontario. It will be built in units and is expected to have a capacity sufficient to supply the needs of the British Empire. The cost of the new works is put at about $4,000,000. A number of towns in northern Ontario made strenuous efforts to have the refinery placed in their localities, but the present site was decided upon on account of the proximity to the market for raw materials, the greater part of which have to be imported from the States. It requires about four tons of raw materials to refine one ton of nickel matte.

Destructive Forest Fires, the worst in the history of the country, occurred during the last week in northern Ontario. It will be impossible for some time to come to estimate correctly the loss of lives, but it is believed that up to the present the loss will be over 400. From Raynor to Monteith there is not a settlement left along the railroad and from Monteith to Porquois Junction the same conditions prevail. The fire was so intense that absolutely nothing is left and the sight of the blackened and devastated country is depressing in the extreme. The largest number of fatalities was around Matheson, where there is a considerable number of farmers, but in the mining section of Munro, which is a few miles from Matheson, the loss was also heavy. There is nothing left of the surface plant of the Croesus mine and several of the miners perished, but the exact number is not yet known. A number of prospectors were in the bush around this district and some of these are supposed to have perished. At the Croesus before the mine was abandoned about $75,000 in ore and bullion was put down the shaft and a short time after this the shaft timbers caught on fire. The Alexo nickel mine was completely surrounded by fires, but fortunately they did not approach the mine. At one time it was thought that the Porcupine camp might go too, and the danger was considered sufficiently real, that in some of the mines the men were brought up from underground in order that they might escape. Contrary to what might ordinarily be thought, a mine is an extremely unsafe place to be in a forest fire of the kind that visited the country this week and in 1911. The fire draws all the oxygen out of the workings and the poor unfortunates are left to smother. Fortunately a change in the direction of the wind saved parts of Porcupine this week. All the danger, to this as well as other parts of the country, is not yet over. A heavy rain last Sunday dampened but did not entirely put out the fires, and since then the warm dry weather has continued. Around about one can see the ominous smoke haze, but it is generally believed that the danger is largely over—for this time. Prospectors are already going into the burned areas where the fire has helped to expose the rocks, and it is possible that new mineral discoveries may help with the resettlement of the country which has received a great setback.

The Mining News

ALASKA

P. F. CUMMINGS of Seward is installing hydraulicking plant at placer properties on Bear Creek, at northern end of Kenai Peninsula. Formerly operated by Herron, Cassidy & Sullivan.

KENAI ALASKA GOLD (Seward)—James Drennan and associates, lessees, are operating 5-stamp mill on Falls Creek, 26 mi. north, on ore taken out during winter.

ALASKA GASTINEAU (Juneau)—Milled in July 150,403 tons; heads, $1.24; tails, $0.24; extraction, 80.64%, mill closed July 4 and 5. June results were: 164,800 tons milled; heads, $1.06; tails, $0.22; extraction, 79.25%.

ARIZONA

Cochise County

SHATTUCK-ARIZONA (Bisbee)—July copper production 1,397,445 lb.; seven months 10,277,009 lb.

Gila County

FIRE IN MEXICAN CANON, MIAMI, July 26, destroyed most of Mexican part of town.

MIAMI (Miami)—July production 4,305,000 lb. copper.

INSPIRATION CONSOLIDATED (Miami)—July production 11,300,000 lb. copper, about 800,000 lb. more than in June.

VAN DYKE COPPER (Miami)—New organization of L. D. Van Dyke, Edwin Tuft and C. B. Loomis, all of Miami. Capitalization $5,000,000; shares 50c. each.

OLD DOMINION (Globe)—Hoisting 1,100 tons daily; mine now making only 6,000,000 gal. water as compared with 11,000,000 last winter; spare centrifugal pump being added.

Greenlee County

SHANNON (Clifton)—July production about 968,000 lb.

GOLD BUTTE MINING (Duncan)—Supersedes Twin Peaks Mining Co.; machinery on ground for mill; 1,500 tons ore on dump.

Maricopa County

DRAGON MINING AND DEVELOPMENT (Wickenburg)—This gold-silver-vanadium property, on western slope of San Domingo Peak, is being equipped with gasoline hoist, air drills, etc., to sink on 42-in. vein opened at 100 ft. from surface. J. F. Newman, superintendent.

Mohave County

OATMAN GOLD (Oatman)—Reports $8 ore in west drift, 500 level.

AOTMAN PIONEER (Oatman)—On 200 level, following a 2-ft. vein of high-grade ore.

OATMAN CRESCENT (Oatman)—In July, drove adit 281 ft. at cost of $11.12 per ft.; face now nearing objective, adit being in a total distance of 425 ft.

Pima County

MINE EXPERIMENT STATION will be established at Tuscon by U. S. Bureau of Mines in connection with the University of Arizona.

GOULD (Tucson)—Trustees for defunct Pioneer Smelting Co. will auction 10 unpatented claims comprising Gould mine, 18 mi. west Tucson, Aug. 10; has well equipped 360-ft. main shaft.

SWEET BYE-AND-BYE (Helvetia)—This copper group is being operated by W. B. Akers, late of Pachuca, Mexico, and Robert Farmer, of Tucson. Two to three cars shipped each week to El Paso smeltery.

NEW CORNELIA (Ajo)—Employing 750 men; carpenter shop, machine shop, warehouse, electric plant, tank house and foundations for tanks completed; work progressing on 10,000-ton coarse-crushing storage plant, power plant and smoke stack; solution storage one-third completed; 10 Mexican and 8 American houses in process of erection.

Yavapai County

BIG LEDGE DEVELOPMENT (Mayer) — Purchased old Treadwell smeltery and will treat ores from Henrietta, Butternut, Gopher and Hackberry mines.

HULL COPPER (Jerome)—Stockholders filed suit asking receivership and return of 5,000,000 shares of stock to treasury, following sale to United Verde by George W. Hull, of his holdings.

UNITED ARIZONA COPPER (Jerome)—President Charles Dunlap and other officers recently visited this property, 32 mi. southeast of Jerome; will continue sinking, and crosscut at 200- and 600-ft. levels.

DUNDEE-ARIZONA (Jerome)—Heavy hoist, compressor and other equipment ordered; electricity will take place of gasoline. Station at 300-ft. level finished; west drift at 65-ft. point in 25 ft. carbonate ore.

GRAND ISLAND MINING (Jerome)—Reorganized by James M. Layman and other local business men, who put 20% of their stock in the treasury and pooled the rest; contains 13 unpatented claims adjoining the Copper Chief and Shea; working shaft 200 ft. deep.

Yuma County

DESERT (Wenden)—Sulphide ore struck on 250-ft. level; hoist and compressor being installed.

BLACK REEF (Wenden)—New headframe and hoist being installed; freight truck purchased; shaft down 130 ft. is in ore.

COBRITA MINES CO. (Salome)—New organization of the Greggs, Los Angeles promoters, acquired this property from Arthur Neil.

MARIQUETTA (Plomosa)—Lloyd L. Miller, of Los Angeles, as heir of Julia Traves, has secured annulment of sale of mine to Benjamin Goodrich by administrator of the estate.

CALIFORNIA

Amador County

ALLEN COPPER (Ione)—Copper-gold ore reported in this old mine formerly owned by Alvinza Hayward; now operated by Allen Estate Co.

KEYSTONE (Sutter Creek)—Semi-annual report shows 40-stamp mill in constant operation since Jan. 1 except 2 days for repairs and cleanup, crushed 41,084 tons, yielding in bullion and concentrates after deducting smelting charges $81,366 or $1.98 per ton. Low yield reported due to development rock which necessarily went through mill. Total cost, including franchise tax and overhead expenses, about $77,000. C. R. Downs, manager.

Butte County

SPRINGER (Magalia)—Harry M. Thompson and associates, prospecting this old mine with steam shovel, will exercise option. Have also bonded the Eureka mine, adjoining Mineral Slide and Lucky John mines.

LUCKY JOHN (Paradise)—Has reached channel through the 1,000-ft. adit and a 96-ft. raise; will commence washing gravel soon. Adit cut three quartz veins that warrant prospecting. John D. Hubbard, manager.

BIG BLUE LEAD (Oroville)—This gravel property near Bangor reported sold to F. F. Ford and C. G. Fowler, of San Francisco and Alaska who will expend $20,000 in development when water is available in the autumn. Former development includes 2,500-ft. tunnel.

MINERAL SLIDE (Magalia)—This old drift mine has been bonded by John Cowan and associates of Salt Lake City, Utah. A 1,500-ft. tunnel will be run on a sluice grade and it is expected that low-grade gravel left by former operators, can be worked at a profit. Mucking machines will be used. C. E. Hand, of Los Angeles, will be engineer in charge.

Eldorado County

BADGER HILL (Placerville)—The 300-ft. tunnel to be advanced to 650-ft. point, to form connection with main shaft.

WAGNER (Placerville)—Good ore reported at depth of 60 ft. Shaft will be deepened. A 4-stamp mill, compressor and gas engine installed.

GEORGIA SLIDE (Georgetown)—Development in progress, some ore being produced and mine may again come into regular producing class. Under management of Robert Cranston, of San Francisco, on a purchase bond.

Humboldt County

HUMBOLDT COPPER MINING CO. (Eureka)—Exploring with drills to develop ore of better grade than that previously opened. W. L. Perrott, secretary.

Mono County

CLIFF (Oasis)—This old silver group in White Mountains optioned by E. J. King and J. C. King, of San Francisco. Good road will be constructed and ore will be hauled by motor trucks to Coaldale, Nev., about 75 mi. from the mine. Reduction plant will be built if development warrants.

Placer County

GLOBE MINING (Auburn) — This company in Ophir district has leased following claims: Mowitza, Good Friday, Green, Enterprise, West Friday and Cornucopia. Sinking on the Mowitza (Old Copper Point) is in progress. At 300-ft. point will crosscut to the Friday. Electric-power line installed; also air compressor, machine drills and Cameron pumps.

San Bernardino County

OSDICK (Atolia)—"Highgraders" robbed ore bins of about 1,000 lb. of high-grade ore on July 20. First big steal of tungsten in several months.

Shasta County

ORO FINO (Redding)—High-grade ore disclosed by Peter Sorensen who is working this property for Charles H. Behrens.

GOLD DREDGE owned by L. Gardella at Lincoln, Placer County, will be removed to Clear Creek within the year, after having worked out its present ground. Additional dredges may be erected.

Sierra County

SHADY FLAT (Downieville)—Bonded to Thomas Wilson, of Manhattan, Calif. Engine and pump being installed. Two shifts sinking shaft in back channel.

MONITOR (Gibsonville)—Bonded to Monitor Mining Co. Contains extension of Bellevue channel. Drain tunnel being run to unwater 125-ft. shaft now in rich gravel.

BALD MOUNTAIN (Forest City)—Bonded to Copeland & Alling. New tunnel being run to prospect quartz vein encountered during drift operations many years ago. Perry Bixby in charge.

Trinity County

VALDOR DREDGING CO. (437 Holbrook Bldg., San Francisco)—The new 7-cu.ft. dredge being erected near Junction City is expected to be ready in September.

GLOBE (Dedrick)—Reported that title has reverted to original owner H. M. Hall. Company took mine four years ago, installed 20-stamp mill and cyanide plant. Not sufficiently profitable.

SIXTYFIVE (Ruth)—This placer mine on Trinity River sold to Frederick Hosking, of Placerville. Has been worked by hand methods. New owner will install 12-in. pipe line and No. 2 giant.

Yuba County

SOLANO WONDER (Brownsville)—Modern 10-stamp mill and cyanide plant completed. Developing underground with 16 men.

COLORADO

Boulder County

BOULDER COUNTY (Cardinal)—Preparing to reopen this mine.

LIVINGSTONE (Boulder)—High-grade gold ore opened in Nyanza winze.

GILLAND (Nederland)—Lessees have opened body of high-grade tungsten ore; shipments will begin at once.

PACKARD (Boulder)—Gold quartz vein, 2 ft. wide, opened in this Beaver Creek mine. Other gold discoveries made in search for tungsten ores, are reported from west of Nederland.

Custer County

BASSICK (Westcliffe)—This old mine near Querida may be reopened.

BUFFALO HUNTER (Westcliffe)—Lessees opened ore assaying 20 to 30 oz. silver in old workings. Much milling ore developed.

Gilpin County

FRANKLIN (Rollinsville)—This 100-ton tungsten mill has started.

AMERICAN METALS CO. (Blackhawk)—Plant No. 1 started; zinc-lead ore being concentrated.

Lake County

ALLEGHENY (Leadville)—Retimbering will be followed by extensive development.

WOLFTONE (Leadville)—Shaft drained to 980-ft. level. McCormick and Greenback mines, connecting, are also drained.

TARSUS (Leadville)—M. A. Nicholson and J. P. Hepburn reopening this old mine on Yankee Hill struck vein of silver-copper ore.

IBEX (Leadville)—The Little Jonny continues to furnish "jewelry ore." In sampling 1-ton lot from Connors lease, the coarse screens caught 112.5 oz. of nugget gold.

HARVARD (Leadville)—New 1,200-cu.ft. compressor will be installed; also 500-gal. station pump at shaft sump. Shaft sinking will not be resumed until water problem has been completely solved.

GAMBETTA (Leadville)—Being developed through Pousardin shaft. Body of galena discovered after lower levels were drained. High-grade zinc-carbonate shipments being made from upper levels.

Ouray County

PLACER MINING NEAR RIDGWAY started. Work done on small scale with good results. Larger sluice will be installed.

ROCK OF AGES (Ouray) — Lessees opening good-grade copper ore.

WANAKAH (Ouray)—Development resumed; 30 or 40 men employed. Smelting plant below town expected to be "blown in" soon by Ouray Smelting and Refining Co.

SOUTH DAKOTA (Ironton)—Surface buildings completed; machinery enroute. Development to begin soon. Power line being built from Gladstone.

Summit County

MOZART (Montezuma)—Mill will be put in operation in near future.

PHILADELPHIA MINES (Montezuma)—Toledo tunnel equipped with large air compressor. Auto trucks hauling 50 tons daily from Jumbo mine to mill.

COLORADO ORE SEPARATING CO. (Breckenridge)—Smith 500-ton mill purchased recently; contracts being made for low-grade ore that cannot be sold for shipment.

FRENCH GULCH DREDGING CO. (Breckenridge)—Shipment of $15,000 in gold from 10-days' run made recently to Denver mint. Dredge handles 2,100 cu.yd. per 24 hr.; pay streak now 400 ft. wide.

DUNKIN (Breckenridge)—Shipment assaying 40% lead, 18 to 25 oz. silver and considerable gold, made recently. Free gold in this ore is coarse, sometimes in large flakes and crystals. Mine operated by lessees.

MONTEZUMA MINES (Montezuma)—Regular shipments to milling plant made from Silver Wave, Chautauqua and Princess mines; treating by flotation 65 tons per day. Site for new mill at base of Teller Mountain cleared. All mines will be connected to plant by aërial trams.

Teller County

MARGIE M. GOLDING MINING CO. (Cripple Creek)—Organized to operate Little Daisy mine on Bull Hill.

VINDICATOR CONSOLIDATED (Cripple Creek) — During second quarter, development of middle vein system carried on. Oreshoot of better than average grade opened between 12th and 18th levels. Flotation plant below Golden Cycle ore house will be completed Sept. 1. Results of flotation work may make change in policy of handling low-grade ore now used for stope filling.

IDAHO

Idaho County

CONCORD GOLD CORPORATION (Elk City) — This company recently formed by Edward Everett Rowe and others of Salt Lake to develop 380 acres. About 1,500 ft. of tunnel development. Frank Steckner in charge.

MICHIGAN

Iron

MUNRO (Iron River)—Property is to be stripped. Contract awarded to Hoose & Person. Pit will be 500 ft. long by 175 ft. wide.

CLEVELAND-CLIFFS (Ishpeming)—Contracts have been awarded for a change house at the Holmes and a new office at the Cliffs mine.

MARY CHARLOTTE (Negaunee)—Two shifts now being worked instead of three. Same force of men employed. One of the last Lake Superior mines to change from the old eight-hour system to two eight-hour shifts.

OLIVER (Ironwood)—All of this company's mines on the Gogebic range are to be electrified. An order for 10 electric hoists was given to Wellman-Seaver-Morgan Co. Sullivan Machinery Co. will build two large compressors and supply motors for same. General Electric Co. awarded contract for motors for the hoists, generators and a large turbine. These orders will amount to over $400,000.

MINNESOTA

Cuyuna Range

CUYUNA RANGE TONNAGES with 16 shipping mines now operating, are expected this season to amount to 1,700,000 tons of iron ore and 300,000 tons of manganiferous material.

HOCH (Manganese)—Will ship upward of 35,000 tons of manganiferous iron ore this season.

ROWE (Riverton)—Stated that Pittsburgh Steel Ore Co. will add another unit to the 500-ton concentrating plant at this mine. Mine will ship 300,000 to 400,000 tons this season.

Vermilion Range

SAVOY (Ely)—In two weeks the last ore from this property will be extracted by the Oliver company, lessee, and the mine will then be abandoned. Property has for many years been one of the principal producers of the Vermilion Range.

MISSOURI-ARKANSAS

Joplin District

BONNIE BELLE (Joplin)—Has broken into rich ore in new shaft.

FIGHTING WOLF (Zincite)—Operations resumed after several months shutdown on account of excessive water.

ETTA MAY (Joplin)—New mill to be operated steadily as soon as ground is better opened. Face approximately 45 ft. in height.

AURORA UNION (Aurora)—Sinking shaft from 200- to 300-ft. level. Deep for Aurora camp but drills blocked out good ore at this depth.

BETSY JANE (Zincite)—New mill near completion on lease of Brooks land. Will work disseminated formation at 110 ft. Two shafts opened.

KING JACK (Commerce)—Lost compressor and two boilers in cave-in. Bessemer gas engine saved by cables. Mine owned by Commerce Mining and Royalty Co.

GRAY (Webb City)—New 500-ton mill well underway on tract adjoining D. C. & E. mine, in Oronogo bottoms, north of Webb City; Philip Gray and Eastern associates, owners.

ST. REGIS (Duenweg)—Completed Number 2 mill at Chitwood; capacity 300 tons per shift. Mining disseminated formation at 180 ft.; sheet-ground formation underneath, which will be worked later.

Northern Arkansas

MANY PRODUCERS in this field holding their ore, but shipments for month of July amounted to 75 cars. Of this number, 30 came from Rush, 15 from the upper and lower Buffalo camps, 18 from Searcy and Newton Counties, and 7 from Zinc.

MONTANA

Beaverhead County

BOSTON & MONTANA DEVELOPMENT CO. (35 Congress St., Boston, Mass.)—To facilitate shipments from company's Spain mines, in French Gulch, to Washoe smeltery, a spur is being built from B. A. & P. tracks at Mill Creek near the smeltery to a loading station to which motor trucks will bring ore from mines 12 mi. The trucks will haul four trailers carrying 4 tons each. Similar haulage is to be carried on from the company's Elkhorn mines at the head of Wise River in Jefferson County.

Silver Bow County

ANACONDA (Butte)—Cave-in. Aug. 4 at Tramway mine, 2,000-ft. level, extended upward 150 ft.; one man killed.

BUTTE-BALLAKLAVA (Butte)—Developing orebodies on 2,600 level; drifted 75 ft. on vein. About 100 tons of 3% ore being hoisted daily.

EAST BUTTE EXTENSION (Butte)—Company's Westlake and Rose O'Malley mines being successfully worked under lease. Recently shipped 58 tons of $27 ore from the Westlake. Company receives 25% royalty on proceeds of operations.

BUTTE-DETROIT (Butte)—Operating old Ophir mine in southern part of district; preparing mill for resumption and arranging for sinking 1,000-ft. shaft to 2,000 ft. Zinc ores previously encountered on 500 level were not given attention at the time, as there was no market for them.

NORTH BUTTE (Butte)—During quarter ended June 30, shipped 146,190 wet tons of ore, as against 131,070 tons in first quarter. Principal new ore development during quarter was opening of North Berlin vein north of present workings and cutting of vein below the 3,500 level in Granite Mountain shaft, 500 ft. below present deepest workings.

BUTTE & SUPERIOR (Butte)—July production showed slight falling off from that of June. Total ore hoisted was 51,710 tons from which 14,005 tons of zinc concentrates were secured. Concentrates averaged 53.53 per cent. zinc or about 15,000,000 lb. New main shaft is completed and timbered to 1,500-ft. level. Will be carried to 1,900 level later.

NEVADA

Elko County

OIL-SHALE BEDS about 1 mi. south of Elko are being actively developed. R. M. Catlin, of New York, Franklin Furnace, N. J., is interested and a 20-ton experimental plant is to be erected.

NORTH STAR (Jarbidge)—This mine and mill purchased by John Creighton.

LONG HIKE (Jarbidge)—John E. Newsom and others engaged in making examination of this mine.

SEATTLE-CONTACT COPPER (Contact)—Working 40 men at the Delano mine. Shipping to Garfield, Utah, 400 to 500 tons of 11% ore monthly. Lower grade ore being stockpiled.

Esmeralda County

FLORENCE (Goldfield)—Additional crushing and other equipment placed and plant now running at increased capacity.

GREAT BEND (Goldfield)—Connections made with old lease workings on the 235-ft. level. East drift being run on 6-ft. vein showing seams of excellent ore on both walls.

SPEARHEAD (Goldfield)—Company reorganized on assessable basis. Two shifts working and shaft is down about 740 ft. with latite-shale contact as objective. Drifting in progress on the 400 level.

LOS ANGELES SULPHUR CO. (Goldfield)—Erecting camp buildings and will work sulphur deposits at Cuprite about 13 mi. south of Goldfield. Initial shipments show about 75% sulphur. Company has contracts for 250 tons per month. A. W. L. Dunn, manager.

GOLDFIELD CONSOLIDATED (Goldfield)—In June treated 29,000 tons; net yield, $40,459. Operating costs, $5.22 per ton; miscellaneous earnings, 11c.; net operating cost, $5.11 per ton. On June 20, half of mill was converted to flotation process and second section expected to be converted by Aug. 15. July estimate, treated 30,000 tons, net yield $30,000.

Humboldt County

SEVEN TROUGHS COALITION (Seven Troughs)—Bird winze down 1,725 on dip of vein. The north drift on the 1,700 has encountered the oreshoot which is being stoped on the level above. High assays reported.

Nye County

TONOPAH ORE PRODUCTION for week ended July 29 was 9,217 tons valued at $191,986 compared with 10,139 tons for week previous. Producers were: Tonopah Belmont, 2,951 tons; Tonopah Extension, 2,200; Tonopah Mining, 1,650; Jim Butler, 1,150; West End, 895; Rescue-Eula, 205; Halifax, 158; miscellaneous, 8 tons.

NORTH STAR (Tonopah)—Development continues on 850-ft., 900-ft. and 1,050-ft. levels. Occasional shipments made to West End mill.

TONOPAH MINING (Tonopah)—In quarter ended May 31 net income was $118,012; of this amount $32,845 was from Tonopah Placers Co.

TONOPAH EXTENSION (Tonopah)—June profit $51,726 from 8,966 dry tons milled yielding $125,471; bullion production 1,481.48 oz. gold and 156,154 oz. silver. Repairs to Victor shaft and workings completed; development on 1,540-ft. level again under way.

Washoe County

A MINE-RESCUE CAR of U. S. Bureau of Mines will be stationed at Reno, Nev.

White Pine County

NEVADA CONSOLIDATED (McGill)—June production, 8,651,772 lb. copper.

NEW MEXICO

Socorro County

PROPOSED ROAD from Clifton, Ariz., to Mogollon again receiving consideration. It is understood the Arizona factors will construct highway to state line; Mogollon interests now running survey from the Silver City road at Cactus Flats to determine feasibility of route. Distance to railroad would be shortened 20 mi., with reduction of $5 per ton in freight charges.

UTAH

Beaver County

MOSCOW (Milford)—During June 300 tons of 9% copper ore were shipped. Zinc-carbonate ore recently developed along footwall of old lead stopes, from the surface down to the 800 level. Shipments from this ore will soon be started.

CROFF (Milford)—Eight feet of ore carrying lead, silver, and zinc has been cut at a depth of 155 ft. in the Lincoln district.

CEDAR-TALISMAN (Milford)—Plans are under consideration for milling of the zinc-lead ores. Dump contains 6,000 tons. A dry process similar to that used at Goodsprings, Nev., may be used. Shipments of lead ore and zinc ore being made. H. S. Josephs, manager.

Grand County

OIL-LAND LOCATIONS recently recorded at Moab. Claims are between Valley City and Green River. Filings made by Eastern operators.

Juab County

TINTIC SHIPMENTS for July amounted to 679 cars by 35 shippers. Chief Consolidated and Dragon Consolidated shipped the largest tonnage.

EAGLE & BLUE BELL (Eureka)—New strike in main shaft opened for 28 ft., between 1,832 and 1,860-ft. points. Not known yet whether orebody is a new one or continuation of those already opened above. The ore appears to be pitching to the west.

LOWER MAMMOTH (Mammoth)—A 25-ton leaching plant is to be built to treat the 12 to 15% zinc ore developed some time ago. Leaching with sulphuric acid and precipitation electrolytically will be done, as outlined by experiments carried on by Pierre Peugot of Western Spelter Co. of Salt Lake City.

Salt Lake County

MUCH ACTIVITY IN ALTA; prospecting and development is being done at many properties. Shipments averaging four cars a day or over. The South Hecla, Michigan-Utah, Albion, Alta Consolidated, Sells, Wasatch Mines, and others are shipping.

SOUTH HECLA (Alta)—Shipping 350 to 375 tons of ore weekly.

MICHIGAN-UTAH (Alta)—Up to three cars of ore in one day have been sent over this company's tramway to Tanner's Flat, from where ore is hauled by team to the railroad at Wasatch.

UTAH METAL AND TUNNEL (Bingham)—Suit was filed Aug. 2 against J. H. Anderson, receiver for the New England Gold and Copper Co. to quiet title to certain claims in the West Mountain Mining district. Pending trial injunction asked against operating the claims.

Summit County

PARK CITY SHIPMENTS for July amounted to 7,780 tons by 11 shippers. In June 8,714 tons of crude ore and concentrates were produced.

DALY (Park City)—Early in August ore will be raised through shaft instead of being sent out through Ontario drain tunnel. Expect to install new hoisting engine and use both compartments of shaft.

BIG FOUR EXPLORATION (Park City)—Operations started Aug. 2 at mill, which has been enlarged to treat 750 tons of tailings daily. Zinc concentrates, and lead-iron concentrates are produced. Flotation equipment to handle 75 tons per day has been added. Tailings accumulated below Park City for a number of years are to be handled by a steam shovel.

WEST VIRGINIA

UNITED ZINC SMELTING CORPORATION (Moundsville)—Has begun erection of its new zinc smelting plant here instead of at Clarksburg, as first contemplated. F. J. Eckenfels, engineer in charge.

WISCONSIN

Zinc-Lead District

CLIMAX (Platteville)—A new M. M. type Dings magnetic separator installed. Company will engage in custom roasting.

WISCONSIN ZINC (Platteville)—New 150-ton Birkbeck mill at Days Siding in operation; jig concentrates assay 52% zinc.

VINEGAR HILL (Platteville)—New Graham property at Days Siding gives promise of being best of this company's seven producers.

M. & A. (Platteville)—New 100-ton mill at Rewey completed; mine being unwatered; electric power supplied by Mineral Point Service Co.

HEFFERNAN (Platteville)—Kistler & Stephens have proved another range of zinc ore in drilling this lease west of their Blockhouse property.

CANADA

British Columbia

MOLYDENUM MINING AND REDUCTION (Alice Arm)—This company, which has a government contract, has completed its 100-ton flotation plant on Alice Arm, about 14 mi. from Anyox.

Ontario

FOLEY O'BRIEN (Porcupine)—Expected to resume operations shortly.

CONIAGAS (Cobalt)—Will install 100-ton flotation plant to treat mill slimes.

DOME EXTENSION (Porcupine)—Work in shaft and lateral development discontinued. Orebodies discovered by diamond drill at greater depth considered more worthy of further exploration than the showing on the upper levels.

CANADIAN COPPER (Copper Cliff)—New steel headframe and rockhouse at Creighton mine are nearing completion; shaft will be concreted. At Copper Cliff, fine new recreation club has been finished; nominal fee charged; employees' wives have privileges of club certain days.

MURRAY (Sudbury)—This mine being unwatered and it is expected that operation will follow. George Johns, formerly of Dome mines, is in charge. Activity assumed to be connected with proposed process of Sudbury Nickel Refineries, Ltd., of Ottawa.

QUEBEC

STRIKE OF ASBESTOS MINERS of Thetford began Aug. 3; endeavoring to extend strike to Black Lake and Robertson mines.

MEXICO

SANTA GERTRUDIS (Pachuca, Hidalgo)—In June, milled 19,775 dry short tons yielding £32,017; working expenses £28,583; operating profit £3,434. May profit £15,000. Policy of future to treat lower grade ore than milled during last few months. Profits affected by higher labor cost, increased taxation and timber shortage.

CHINA

JAPANESE INTERESTS, represented by the Sino-Japanese Development Co., have, according to the "Far East Review," secured the rights to work the Taochung iron mine at Taochung, Fanchang-Hsien, Anhui Province, China. Mine is said to contain 60,000,000 tons of 65% ore.

CHOSEN

ORIENTAL CONSOLIDATED (Unsan)—July cleanup by cable, $128,750. Final figures for June were: Milled 26,511 tons; Tabowie mill bullion, $27,321; Taracol, $22,651; Maibong, $24,688; Taracol cyanide bullion, $47,877; Maibong tube-mill bullion, $6,067; total, $128,605.

The Market Report

Metal Markets

NEW YORK—Aug. 9

There was a further improvement in copper on increasing business, although the total did not attain large proportions. A good business was done in both lead and spelter, but at a further sacrifice of prices.

Copper, Tin, Lead 'and Zinc

Copper—This market exhibited some curious features, one producer reporting no transactions, other reporting transactions on certain days, and others reporting good business right through the week. The principal producers are now in the market and are taking business on the present level of prices, although most of them are not courting business, so confident are they in the strength of the statistical position and the belief that buyers will have to come to the producers rather than will the producers have to hunt buyers. The business reported for the week was chiefly with domestic consumers, but they were consumers engaged in the manufacture of ammunition rather than of wares for peaceful purposes. The bulk of the business was for October-November delivery, for which some large transactions were made at 25½c., r.t., or about 25¼c., cash, New York. Toward the close the market was a shade higher. Our quotation for Aug. 5 reflects some special transactions on that day.

Joseph Clendenin, of the American Smelting and Refining Co., said in an interview a few days ago: "The drive at the market in July was opportunely timed. The large American consumers could not work to capacity on account of the heat, labor shortage and scarcity of crucibles for melting brass. This same condition will prevail through August and into September. As a consequence a good deal of copper was thrown on a narrow market and forced the price down to an unnatural level. Some consumers thought it was more in the line of good business to ask the producers to carry forward their engagements. The producers were glad to accommodate their customers and many millions of pounds were transferred from summer to fall delivery."

Copper Sheets rule on a base of 35½ to 37½c.

Copper Exports from Atlantic ports in July are estimated at 32,500 gross tons.

Copper Exports from Baltimore for the week included 4,759,630 lb. to Great Britain; 3,951,026 lb. to France; 88,873 lb. to Rotterdam; 208 tons brass to Italy.

Visible Stocks of Copper in Europe Aug. 1 were: Great Britain, 3,440; France, 2,525; afloat from Chile, 2,175; afloat from Australia, 3,500; total, 11,640 gross tons, or 26,073,600 lb. This is a decrease of 1,174 tons from the July 15 report.

Tin—In the early part of the week this market was dull, but subsequent to Monday a good demand developed and there was a general improvement in business.

Visible Stocks of Tin on Aug. 1, including tin afloat: London, 7,999; Holland (Banka), 1,460; United States, excluding Pacific ports; 8,945; total, 18,404 gross tons. This is a decrease of 959 tons from July 1, but an increase of 4,237 tons over Aug. 1 last year.

Banka Tin Production for the six months ended June 30, 1916, is reported at 5,793 gross tons. Shipments for the same period were 11,863 tons, large stocks held in the East having been transferred to Holland. Stocks held on June 30 by the Netherlands Trading Co. were 760 tons; by the Dutch Government, 3,388 tons, the latter including 1,023 tons afloat. The Banka production was less than in the second half of 1915 by 1,900 tons.

Imports of tin ore and concentrates in Great Britain in June were: Bolivia, 1,353; Nigeria, 611; British India, 114; Portugal, 88; Spain, 24; France, 13; Natal, 13; Brazil, 9; total, 2,223 gross tons, equivalent to about 1,334 tons tin.

Lead—Following the reduction to 6c. by the A. S. & R. Co. on Aug. 2, business was done at that price on Aug. 3, but price cutting on competition of the kind that had previously been experienced began again. In the early part of this calendar week some large business was done at 5.90c., New York, but offers of round lots at the same price on the same day failed to find buyers. Fairly large business was booked by certain producers while others consummated scarcely anything. At the close the St. Louis market appeared to be a shade stronger.

Spelter—Right from the beginning of the week there was real pressure to sell. On Friday tonnages were sold at 7¾@8c., August-September delivery. Some large business was done on Aug. 8 at the same price. There were sellers right through the week at that price. Sales at lower figures were reported

DAILY PRICES OF METALS IN NEW YORK

			Copper	Tin	Lead		Zinc
Aug.	Sterling Exchange	Silver, Cts. per Oz.	Electrolytic, Cts. per Lb.	Spot, Cts. per Lb.	New York, Cts. per Lb.	St. Louis, Cts. per Lb.	St. Louis, Cts. per Lb.
3	4.7581	64¾	25 @25½	38	6.00	5 75 @5 85	7 75 @8 25
4	4.7588	64⅞	25 @25½	37¾	5.90 @6.00	5 70 @5.80	7 75 @8 00
5	4.7581	66⅛	25¼ @26¼	37¾	5.85 @5.95	5 65 @5 75	7 75 @8.00
7	4.7588	65⅞	25¼ @25½	37¾	5 85 @5.90	5 65 @5 75	7 75 @8.00
8	4.7588	66¼	25¼ @25½	37¾	5.85 @5.90	5.65 @5 75	7 75
9	4 7588	66⅞	25¼ @25½	38	5 85 @5 90	5 70 @5 75	7 75 @8 00

The quotations herein are our appraisal of the average markets for copper, lead, spelter and tin based on wholesale contracts for the ordinary deliveries of the trade as made by producers and agencies; and represent, to the best of our judgment, the prevailing values of the metals, reduced to basis of New York, cash, except where St. Louis is given as the basing point. St. Louis and New York are normally quoted 0.17c. apart.

The quotations for electrolytic copper are for cakes, ingots and wirebars. Electrolytic copper is commonly sold at prices including delivery to the consumers and is subject to discounts, etc. The price quoted for copper on "regular terms" (r.t.) is the gross price including freight to the buyer's works and is subject to a discount for cash. The difference between the price delivered and the New York cash equivalent is at present about 0.25c. on domestic business. The price of electrolytic cathodes is 0.05 to 0.10c. below that of electrolytic. Quotations for lead represent wholesale transactions in the open market for good ordinary brands. Quotations for spelter are for ordinary Prime Western brands. Only the St. Louis price is herein quoted, St. Louis being the basing market. We quote the New York price at 17c. per 100 lb. above the St. Louis price.

Silver quotations are as reported by Handy & Harman and are in cents per troy ounce of silver bars 999 fine.

Some current freight rates on metals per 100 lb. are: St. Louis-New York 17c.; St. Louis-Chicago, 6.3c.; St. Louis-Pittsburgh, 13.1c.

LONDON

		Copper				Tin		Lead		Zinc	
		Standard		Electrolytic							
Aug.	Silver	Spot	3 Mos.	£ per Ton	Cts. per Lb.	Spot	3 Mos.	£ per Ton	Cts. per Lb.	£ per Ton	Cts. per Lb.
3	30⅞	107	104	125	26.61	168	168¼	28½	6.07	47	10.01
4	30 15/16	106	103	125	26 61	167½	168½	28½	6 07	47	10.01
5	31½	.....	....	.....	......			...	....		.
7	31 7/16	106½	103½	124	26 40	167½	168¼	28¾	6 12	44	9 37
8	31⅝	107	105	124	26 40	167¼	168	28¾	6 12	44	9 37
9	31 15/16	109	106½	124	26.40	168	169	29	6.17	47	10 01

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2,240 lb., except silver which is in pence per troy ounce of sterling silver, 0.925 fine. Copper quotations are for standard copper, spot and three months, and for electrolytic, price for the latter being subject to 3 per cent. discount. For convenience in comparison of London prices, in pounds sterling per 2,240 lb., with American prices in cents per pound the following approximate ratios are given, reckoning exchange at 4 80. £15 = 3.21c.; £20 = 4.29c.; £30 = 6.43c.; £40 = 8.57c.; £60 = 12.85c. Variations, £1 = 0.21½c.

as actually made, but there were probably some special conditions in connection with them. However, such transactions reflected the weak tone of the market. The bulk of the business was reported for August-September delivery, but there was some done for October-December, at not much difference in price.

High-grade spelter at the close was quoted at 16@20c., intermediate, at 12@14c., brass special, at 9@10c. The manner in which the price for high-grade and intermediate spelters has held up in face of the weakness in common spelter is one of the mysteries of the market. The production of these classes of spelter at the present time is very large, one estimate being at the rate of 100,000 tons per annum.

The publication of the Washington statistics on Aug. 5, showing that the stock in the hands of smelters on July 1 was about 24,000 tons, an increase of 10,000 tons from the beginning of the year, had apparently been discounted by the market.

Butte & Superior has purchased from Hayden, Stone & Co. 35,000 shares of the common stock of the American Zinc, Lead and Smelting Co.

The United Zinc Smelting Corporation is to build its new plant at Moundville, near Wheeling, W. Va.

Charles Hayden, Galen L. Stone and D. C. Jackling have been elected to the board of directors of the American Zinc, Lead and Smelting Co.

Zinc Sheets are in fair demand, both for domestic deliveries and for export. The quotations are unchanged at $15 per 100 lb. f.o.b. Peru, Ill., less 8% discount.

Other Metals

NEW YORK—Aug. 9

Aluminum—The market is quiet and does not show much change. Trading has been moderate, and has been on a basis of about 60c. per lb. for No. 1 ingots, New York.

Antimony—This metal which was quoted at 12¼c. at the end of our last week, receded further under the pressure of some holders of spot metal. We quote 10¾@11c. at the close.

Quicksilver—This market receded further on small business. At the close we quote $75, New York. San Francisco reports, by telegraph, $76.

Minor Metals—Current quotations for **Bismuth** are $3.15@3.30 per lb., New York.—**Cadmium** is quoted at $1.30@1.50 per lb.—**Cerium**, electrolytic, is sold at $8@9 per lb.—**Cobalt Metal** is quoted at $1.25 per lb.—**Magnesium** is lower, with sales at $3.50@3.75 per lb. for 99% pure.—**Selenium** is from $3 up to $5 per lb., according to size of order.

Gold, Silver and Platinum

NEW YORK—Aug. 9

Gold—A shipment of $50,000 in gold bars was received at the Assay Office in New York Aug. 4 from Shanghai for the account of the Guaranty Trust Co., coming through by registered mail from the trust company's agency in the Chinese city. The gold consisted of eight bars of exceptional fineness, each contained in a section of bamboo, with one end sealed by the joint. This was the first consignment to be received in these unusual containers in six months. The postage stamps on each bamboo section amounted to $1.80. It was said at the Assay Office that if the gold had been sent by express each package would have borne a shipping charge of close to $50. Last Autumn about $150,000 in gold arrived by mail from Shanghai in several shipments of the same sort.

Silver—The market has been firm and advancing this week on large purchases in London for coinage purposes for the English and French mints. China exchanges still continue under silver parity but silver stock is low and the failure of raising a loan with the U. S. may influence the silver situation.

The demand from India should increase based on favorable Monsoon reports. Market closes firm in London at 31 13/16 pence.

Gold and Silver Movement in the United States in May is reported by the Department of Commerce as below.

	Gold		Silver	
	1915	1916	1915	1916
Exports	$1,277,551	$11,918,597	$4,711,231	$6,211,930
Imports	31,136,311	27,321,943	2,352,242	2,724,784
Excess	I $29,858,759	I $15,403,346	E $2,388,989	E $3,487,146

The total exports of silver for the 11 months of the fiscal year from July 1, 1915, to May 31, 1916, were valued at $55,147,214, imports, $30,971,335, leaving $24,175,879 as the excess of exports.

Mexican Dollars in New York were quoted on Aug. 3 at 49¼@53c.; Aug. 4 at 49¼@53c.; Aug. 5 at 49¾54c.; Aug. 7 at 49¾@54c.; on Aug. 8 at 50¾c., and on Aug. 9 at 51@55c.

Platinum—This market was a shade weaker. Sales were reported at $57.50@58.50, which we quote as the market.

Our Russian correspondent writes from Petrograd, under date of June 16, that the demand has increased materially and that consequently prices have advanced. A little more than 100 lb. was sold at 67,500 roubles per pood, equal to $65.98 per oz. From Ekaterinburg it is reported that production has been reduced due to mobilization among the miners. Quotations at Petrograd are about 67,750 roubles per pood, $66.39 per oz., and at Ekaterinburg 17.625 roubles per zolotnik, $65.27 per oz.

Zinc and Lead Ore Markets

Joplin, Mo., Aug. 5—Quotations are as follows: Blende, high price, $72.90; per ton 60% zinc, premium ore, $70; medium, $65@50; low, $50. Calamine, per ton 40% zinc, $40@35; average selling price, all grades of zinc, $64.93 per ton.

Lead, high price, $69.80; base, $70@65 per ton 80% metal content. Average selling price, all grades of lead, $67.78 per ton. Shipments for week ended Aug. 5 were 4,550 tons blende, 232.5 tons calamine, and 1,216 tons lead ore. For year to date, 205,517 tons blende, 15,985 tons calamine and 35,790 tons lead ore. Total value, $392,960 for week and $24,590,980 for the year to date.

A further reduction of $5 per ton on blende and $10 on calamine has about forced the conclusion among producers that all hope of an improvement in prices has passed. The production has dwindled to under 5,000 tons and shipments around 4,800 to 5,200 tons per week. No new demand has arisen for ore, and with some smelters out and others quitting, there seems slight prospect for an increased demand. A general reduction of 25c. per day was made on labor for this month, based on the average price for last month, and as many mines are already idle there seems no likelihood of labor trouble from the cut in wages.

Platteville, Wis., Aug. 5—Quotations are as follows: Base price per 2,000 lb. for top grades was $60, ranging down to $52 per ton for medium grades. The base price paid this week for 80% lead ore was $65 to $68 per ton. Shipments for the week were 2,020 tons zinc ore, 227 tons lead ore and 239 tons sulphur ore. Year to date, 71,533 tons zinc ore, 2,645 tons lead ore and 16,580 tons sulphur ore. Shipped during the week to separating plants, 3,242 tons zinc ore.

OTHER ORES

Tungsten Ore—This market became rather demoralized during the week, certain holders of the ore making up their minds to take what they could get. As a result of this, sales were made at about $20, and we quote the market for the week at that price on the basis of transactions effected. At the close there were different views of the market. Some interests considered that the situation had been relieved and were asking $25@30 per unit. However, all sellers were not of that opinion.

Antimony Ore—Small quantites are reported as having been sold at $1.10@1.20 per unit.

Manganese Ore—Imports at Baltimore included 320 tons manganese ore.

Manganese Deposits in Lower California are described in a recent issue of the "Boletin Minero." These mines, which are reported to be the richest known deposits of this element in the world, are situated in the arid hills of a small peninsula, 25 mi. long and from 5 to 8 mi. wide, between the coasts of the Gulf of Lower California and Concepcion Bay. The Pilares de Gavilan mines consist of 15 claims, the outcropping veins being from 1 to 5 ft. thick, and are estimated to contain 1,733,333 tons of pure manganese. The Trinidad mines have ore veins which vary from a few inches to 16 ft. in thickness, and the Guadalupe mine has veins of this ore from 5 to 6 ft. thick. A spring of potable water exists in the vicinity of the Trinidad mines, and at Guadalupe the water stratum is from 40 to 60 ft. below the surface. Near the port of Guaymas, about 90 mi. distant, coal mines and petroleum deposits are known to exist, and in normal times provisions and other supplies are easily obtainable there, while firewood can be secured in the vicinity of the mines.

Iron Trade Review

NEW YORK—Aug. 9

The iron and steel markets show little change. Demand for steel and manufactured products is strong and domestic consumption continues steady. Pig iron and light sheets are not so active, but it is expected that there will be more buying later

The continued hot weather maintains its influence on production, but with cooler temperatures, better production is looked for. Exports from Baltimore for the week included 997 tons of scrap rails, 1,535 tons steel bars and 1,211 tons steel billets to Italy.

Pig Iron Production in July was a little below the June mark, the chief cause being hot weather and slower working of furnaces, on account of the heat and slack labor. The monthly reports of the furnaces as collected and published by the "Iron Age" show that on Aug. 1 there were 319 coke and anthracite stacks in blast having a total daily capacity of 104,400 tons, or 3,400 tons less than on July 1. Making allowance for the charcoal furnaces the total make of pig iron in the United States in July was 3,261,500 gross tons; for the seven months ended July 31 it was 22,873,300 tons. Of this total 16,126,100 tons, or 70.5%, were made by the furnaces owned or operated by the steel companies.

PITTSBURGH—Aug. 8

Following its advance of $2 a ton in steel bars reported a week ago the Carnegie Steel Co. has now made similar advances in shapes and plates, its present minimum quotations being: Bars and shapes, 2.60c.; plates, 3.00c. The independents are disposed to follow in the advance but wish first to cover regular customers on such tonnages as they will close for at once, so that prices are in a transitionary stage. Effective yesterday, the American Steel and Wire Co. advanced its prices on wire products $2 a ton and the advance was immediately followed by the independents, making plain wire 2.55c. and nails $2.60.

Thus the finished-steel market appears to have resumed the advancing tendency that practically disappeared last March. While the advances just made have some appearance of artificiality about them, seeing that they occurred when the market was far from active, they are a practical demonstration of the strength of the mill position and thus are likely to encourage buying. The tendency is to dispel the idea that the steel market had been wound up, with the amount of unfilled business on books, and that it was simply a question of how long it would take for it to run down.

To the advancing tendency in finished-steel products is added the fact that unfinished steel has grown still scarcer, and altogether the market position seems to be a very strong one, stronger than a fortnight ago, and much stronger than was expected to be developed in a dull summer.

The idea that high prices for steel products will greatly curtail consumption in certain directions has not been abandoned, but the full effect of high prices cannot be universally felt for some time to come. There is still some cheap steel being shipped, including bars and shapes at 1.15c. to 1.25c., though not as large a tonnage as formerly, and this cheap steel is helping out the consumption.

Pig Iron—The market continues very dull as to actual transactions and there is no large volume of inquiry, but there is somewhat more interest manifested in the market by consumers. There are occasional inquiries for foundry iron for the first half of 1917, a period upon which the furnaces are indisposed to quote. We quote prices unchanged: Bessemer, $21@21.50; basic, $18@18.25; foundry and malleable, $18.25@18.50; forge, $18@18.25, f.o.b. valley furnaces, 95c. higher delivered Pittsburgh.

Steel—Billets and sheet bars are almost unobtainable for any delivery, and there is much more pressure on the part of buyers, for both nearby and forward deliveries, while there is continued inquiry for all descriptions of steel for export. The buying of shell steel has continued to date, and deliveries are now running into 1917. The production of shell steel is not decreasing, and is probably increasing. Prices are quotable higher, but are practically nominal. We quote bessemer at $45 and open-hearth at $45@46, for both billets and sheet bars. Rods are stronger, but are still quotable at $55@60.

FERROALLOYS

Ferrosilicon, high grade, 50%, is quoted $84@$86 per ton, Eastern freight allowed.

Ferromanganese—The market continues quiet, with prompt at $175@$200, and contract at $175.

The estimated production of ferromanganese and spiegeleisen in the United States in July was 30,786 gross tons; for the seven months ended July 31 it was 215,220 tons.

IRON ORE

Shipments from the Lake Superior region continue very heavy. Port shipments have not yet been received but the total for July is reported by telegraph at 9,750,157 gross tons; making a total for the season from the opening of navigation to Aug. 1 of 29,365,724 tons, which compare with 18,725,303 tons for the corresponding period last year.

FOREIGN IRON

Pig-Iron Production in Canada for the half-year ended June 30 was as follows in gross tons, comparisons being made with both halves of 1916

	1915		1916
	First Half	Second Half	First Half
Basic	292,556	367,813	388,387
Bessemer	5,238	8,476	12,575
Foundry	59,646	66,123	95,602
All other	9,385	16,183	11,186
Total	366,825	458,595	507,750

Of the iron made in 1916 a total of 398,683 tons was for conversion into steel or other use by the makers, and 109,067 tons were merchant iron for sale. There were 12,154 tons made with charcoal and 495,596 tons with coke.

EXPORTS AND IMPORTS

British Imports and Exports of Metals other than iron and steel are reported as below for the six months ended June 30, in gross tons:

	Imports		Exports	
Metals:	1915	1916	1915	1916
Copper	115,806	72,797	16,931	15,987
Tin	24,229	17,762	22,867	18,652
Lead	134,723	87,928	30,692	18,523
Zinc	52,163	21,870	1,543	919
Quicksilver	792	942	151	443
Minor metals	2,561	2,270	9,531	11,072
Ores, etc.				
Tin Ore	25,158	15,902		
Pyrites	439,300	514,125		

Copper includes contents of ore, matte and precipitate. Exports include reëxports of imported material.

COKE

Connellsville—The market remains approximately even, quotations being $2.50@2.75. Foundry coke is $3.25@3.50 for prompt or contract. Demand has not been heavy but the market has seen no surplus tonnage. Labor scarcity has been an obstacle for the coke makers, the high temperatures and himidity having a bad effect.

The scarcity of spot furnace coke continues and the market is quotable at $2.75@2.85. With cooler weather production will doubtless increase.

Imports of Coal and Coke in Chile for the year ended Dec. 31 were, in metric tons:

	1913	1914	1915
Coal	1,540,747	1,257,559	411,317
Coke	46,337	46,911	50,151
Total	1,587,084	1,304,470	461,468

Of the coal imports in 1915, Great Britain furnished 201,718 tons, Australia 155,541 tons and the United States 51,375 tons. Of the coke 27,994 tons were from Great Britain and 20,172 tons from the United States.

British Exports of Fuel six months ended June 30 in gross tons:

	1915	1916	Changes	
Coal	22,332,590	19,075,461	D	3,257,129
Coke	419,709	744,247	I.	324,538
Briquettes	624,875	684,979	I.	60,104
Steamer coal	7,400,321	6,578,207	D.	822,114
Total	30,777,495	27,082,894	D	3,694,601

The steamer coal is coal sent abroad for use of steamships in foreign trade.

Chemicals

NEW YORK—Aug. 9

Arsenic—Dealers report continued quiet and state present movements are mostly against old contracts. Relatively little for sale on spot but dealers still quote $6.00 to $6.25 per 100 lb. according to quantity desired.

Copper Sulphate—The market is reported rather quiet, but there is little change in range of prices. Export demand is dull at present. Prices range from $8.25 to $10 per 100 lb.

Nitrate of Soda—Trade quiet with little spot in first hands available and for close arrivals 95% is held at $3.07½@3.12½ per 100 lb. with futures held at about the same figures. For 96% prices 5@7½ points higher.

Sulphur—No relaxation of consumers' demand in sight, slow foreign deliveries responsible for increased demand for domestic product. Spot quoted $35 per long ton, New York while shipments are bringing $30 at New York and $30.50 at Baltimore.

Sulphuric Acid—Demand is reported fair and considerable business said to have been placed on contract. Quotations for 60 deg. acid remain at about $20 per ton and 66 deg. at 1½c. per lb.

Assessments

Company	Delinq.	Sale	Amt.
Algomah, Mich.	May 18	.....	$1 00
Alta Silver, Nev.	Sept. 1	Sept. 25	0.03
Belmont, Ida.	Aug. 9	Aug. 26	0 006
Challenge, Nev.	Aug. 23	Sept. 13	0.05
Clear Gift, Ida.	Aug. 7	Aug. 25	0.002
Cons. Imperial, Nev.	July 18	Aug. 10	0.01
Cons. Virginia, Nev.	July 27	Aug. 17	0 05
Emerald, Utah	July 15	Aug. 11	0 001
Friend, Ida	Aug. 26	Sept. 16	0.002
Four Timbers, Ida.	July 26	Aug. 26	0 002
Gold Mt. Champion, Utah	July 20	Aug. 10	0 0025
Great Bend, Nev.	Aug. 15	Sept. 20	0 01
Great Western, Nev.	July 24	Aug. 15	0.005
Hector, Ida.	Aug. 7	Sept. 15	0.005
Hope, Calif.	July 17	Aug. 14	0.01
Hugo, Ida.	July 29	Aug. 30	0.002
Iron Spar, Ida.	July 17	Aug. 15	0.003
Jacket-C' Point-Belcher, Nev	Aug. 14	Sept. 7	0.05
Jack Waite, Ida.	July 27	Aug. 28	0.01
Kewanas Reor., Nev.	Aug. 2	Sept. 6	0.01
Keweenaw, Mich.	Sept. 2	..	1.00
Lehi Tintic, Utah	Aug. 5	Aug. 25	0 0025
Lucky Calumet, Ida.	July 20	Aug. 21	0 005
Nevada-Douglas, Nev.	July 15	Aug. 16	0.10
Nevada Zinc, Nev.	Aug. 14	Sept. 2	0.01
North Lake, Mich.	June 14	..	1 00
Ophir, Nev.	Aug. 16	Sept. 6	0.05
Rico Argentine, Colo.	Aug. 17	Sept. 2	0 01
Sandstorm Kendall, Nev.	Aug. 22	Sept. 26	0 01
Silver Pick, Nev.	July 5	Aug. 14	0 01
Springfield Tunnel, Calif.	Aug. 15	.	0.05
Sunrise, Ida.	July 27	Aug. 28	0 002
Sunset, Ida.	Aug. 5	Aug. 26	0 0015
Swansea Ext., Utah.	July 10	Aug. 1	0.0025
Tar Baby, Utah	Aug. 3	Sept. 4	0.01
Tarbox, Mont.	July 25	Aug. 12	0 005
Tiberius, Ida.	July 8	Aug. 1	0 001
Tintic Central, Utah	July 12	Aug. 8	0050
Ton. Gypsy Queen, Nev.	July 11	Aug. 15	0 01
Victoria, Utah.	July 8	Aug. 2	0 005
Wolf Mt. Copper, Utah	Aug. 2	Sept. 6	0 005
Wonderful, Ida.	Aug. 30	Sept. 20	0 001

Stock Quotations

SAN FRANCISCO Aug. 9 Name of Comp.	Bid.
Alta	‡ 03
Andes	08
Best & Belcher	06
Bullion	01
Caledonia	40
Challenge Con.	03
Confidence	18
Cons. Imperial	01
Con. Virginia	13
Gould & Curry	03
Hale & Norcross	06
Jacket-Cr. Pt.	05
Mexican	17
Occidental	70
Ophir	20
Overman	‡ 04
Savage	05
Seg Belcher	02
Sierra Nevada	30
Union Con.	68
Utah Con.	01
Belmont	4 20
Jim Butler	89
MacNamara	.05
Midway	20
Mont.-Tonopah	23
North Star	16
Rescue Eula	25
West End Con	82
Atlanta	09
Blue Bell	01
Booth	13
C O.D. Con	03
Comb Frac	06
D'field B.B.	02
D'field Daisy	03
Jumbo Extension	07
Pitts.-Silver Peak	‡ 12
Round Mountain	45
Sandstorm Kendall	04
Silver Pick	10
Central Eureka	09
Argo	10
Ariz. Central	10
Big Jim	80
Lazy Boy	12
Oatman No. Star.	‡ 10
Tom Reed	1 55
United Eastern	3 62
United Western	08

LONDON	July 27
Alaska Tre'dwell	£5 15 0
Burma Corp.	3 4 4
Cam & Motor	0 10 7
Camp Bird	0 8 9
El Oro	0 9 0
Esperanza	0 11 6
Mexico Mines	3 17 6
Nechi, pfd	0 15 3
Oroville	0 17 6
Santa Gert'dis	0 12 0
Tomboy	1 2 6

SALT LAKE Aug. 8 Name of Comp.	Bid.
Alta Con	21¼
Black Jack	‡ 05½
Colorado Mining	15
Crown Point	.03½
Daly-Judge	7.75
Emma Cop	54
Gold Chain	20
Grand Central	65
Iron Blossom	1.47½
Lower Mammoth	.03
May Day	.11½
Opohongo	‡ 01½
Prince Con	1.47½
Seven Troughs	‡ 03¼
Silver King Coal'n	2 92½
Silver King Con.	3 22½
Sioux Con	.09¼
Uncle Sam	.06
Yankee	18½

COLO. SPRINGS	Aug. 8
Acacia	03¾
Doctor Jack Pot	09
Elkton Con	14½
El Paso	60
Findlay	03½
Gold Sovereign	.04
Golden Cycle	2 07½
Granite	64
Isabella	.17¼
Jack Pot	05
Jerry Johnson	‡.03½
Mary McKinney	59
Portland	1 5
Vindicator	2

TORONTO	Aug. 8
Adanac	75
Bailey	06
Chambers Ferland	18
Coniagas	4 30
La Rose	56¼
Peterson Lake	22
Right of Way	04
Seneca Superior	18
T. & Hudson Bay	55 00
Temiskaming	58
Trethewey	‡ 21
Wettlaufer-Lor.	15
Dome Exten	.4
Dome Lake	41
[illegible] O'Brien	50
Hollinger	8 90
Jupiter	25
McIntyre	1 20
Newray	46
Porcu. Crown	76
Preston E. D.	03
Vipond	41
West Dome	

N. Y. EXCH. Aug. 8 Name of Comp.	Clg.
Alaska Gold M.	17
Alaska Juneau	7¾
Am.Sm.&Ref.,com	93½
Am. Sm. & Ref., pf.	111½
Am. Sm. Sec., pf. A	92¾
Am. Sm. Sec., pf. B.	84
Am. Zinc	32
Am. Zinc, pf.	62¾
Anaconda	80½
Batopilas Min.	1½
Bethlehem Steel	424
Bethlehem Steel, pf.	125
Butte & Superior	64¾
Chile Cop.	20
Chino	48¼
Colo. Fuel & Iron.	43⅞
Crucible Steel	68
Dome Mines	25⅜
Federal M. & S.	13
Federal M. & S., pf.	35¼
Great Nor., ore ctf.	34⅜
Greene Cananea	47
Homestake	130
Inspiration Con.	48⅝
International Nickel	44⅜
Kennecott	46¾
Lackawanna Steel	71
Miami Copper	33¾
Nat'l Lead, com.	63⅛
National Lead, pf.	112¾
Nev. Consol.	17
Ontario Min	6¾
Quicksilver	2½
Quicksilver, pf	4½
Ray Con.	22
Republic I&S, com.	46¼
Republic I&S, pf.	110
Sloss-Sheffield	43
Tennessee Copper	25¼
Utah Copper	78
U. S. Steel, com	86¾
U. S. Steel, pf.	118¾
Va. Iron C. & C.	44

N. Y. CURB	Aug. 8
Beaver Con.	36
Buffalo Mines	85
Butte & N. Y.	1¼
Butte C. & Z.	4½
Caledonia	65
Can. Cop. Corpn.	1$\frac{7}{16}$
Cashboy	.04
Cerro de Pasco	34
Con. Ariz. Sm.	1$\frac{7}{16}$
Con. Coppermines.	1⅞
Con. Nev.-Utah.	‡$\frac{5}{16}$
Crystal Cop.	1⅛
First Nat Cop.	3¾
Florence	.75
Goldfield Con.	.83
Goldfield Merger.	.07½
Granite	20
Hecla Min.	4$\frac{15}{16}$
Howe Sound	4⅜
Jerome Verde	1½
Joplin Ore & Spel	45
Kerr Lake.	4½
Magma	13¼
Majestic	$\frac{9}{16}$
McKinley-Dar-Sa	60
Mother Lode	30½
Nevada Hills.	.15
N. Y. & Hond.	15½
Nipissing Mines.	6⅞
Oro.	04
Ray Hercules	3⅛
Rochester Mines	.58
St. Joseph Lead	15½
Standard S. L.	1$\frac{3}{16}$
Stewart	25
Success	40
Tonopah	5¾
Tonopah Ex.	5⅞
Tribullion	$\frac{5}{16}$
United Zinc	6
White Knob, pf.	1¾
White Oaks	5¼
Yukon Gold	2$\frac{1}{16}$

BOSTON EXCH Aug. 8 Name of Comp.	Bid
Adventure	2½
Ahmeek	94¼
Algomah	1⅜
Allouez	69½
Ariz. Com., ctfs.	8¼
Bonanza	.25
Butte-Ballaklava	1½
Calumet & Ariz.	68½
Calumet & Hecla	530
Centennial	15¼
Copper Range	68
Daly West	2
East Butte	11¾
Franklin	6½
Granby	80
Hancock	10½
Helvetia	.25
Indiana	2
Island Cr'k, com.	44
Island Cr'k, pfd.	88
Isle Royale	27
Keweenaw	3¼
Lake	11
La Salle	3⅜
Mason Valley	1½
Mass	10¼
Mayflower	2½
Michigan	2½
Mohawk	82
New Arcadian	4½
New Idria	11
North Butte	21
North Lake	1¾
Ojibway	1⅛
Old Colony	1½
Old Dominion	63
Osceola	80½
Quincy	82
St. Mary's M. L.	70
Santa Fe	1⅞
Shannon	7¾
Shattuck-Ariz	25⅛
So. Lake	4⅛
So. Utah	.22
Superior	14
Superior & Bost.	3⅞
Tamarack	34
Trinity	4¾
Tuolumne	.30
U. S. Smelting	67½
U. S. Smelt'g, pf.	50⅛
Utah Apex	3⅞
Utah Con	13
Utah Metal	7⅜
Victoria	2¾
Winona	4¼
Wolverine	47¼
Wyandot	1

BOSTON CURB	Aug. 8
Bingham Mines	89½
Boston Ely	.95
Boston & Mont.	83
Butte & Lon'n Dev.	56
Calaveras	5
Calumet-Corbin	.02
Chief Con.	1$\frac{11}{16}$
Cortez	.30
Crown Reserve	.45
Davis-Daly	1$\frac{11}{16}$
Eagle & Blue Bell	1⅝
Houghton Copper	1⅜
Iron Cap Cop., pf	6
Mexican Metals	.27
Mines of America	2½
Mojave Tungsten	3⅞
Nat. Zinc & Lead	1$\frac{1}{16}$
Nevada-Douglas	1
New Baltic	1¼
New Cornelia	15
Ohio Copper	.08
Oneco	80
Raven Copper	05
Rex Cons.	.18
Rilla	17
United Verde Ext.	31⅜

‡Last Quotations.

Monthly Average Prices of Metals

SILVER

Month	New York			London		
	1914	1915	1916	1914	1915	1916
January	56.572	48.855	56 775	26.553	22.731	26 960
February	57 506	48 477	56 755	26.573	22.753	26 975
March	58 067	50 241	57 935	26.788	23 708	27 597
April	58 519	50 250	64 415	26 958	23.709	30 662
May	58 175	49 915	74 269	26.704	23 570	35 477
June	56.471	49.034	65 024	25 948	23 267	31 060
July	54 678	47 519	62 940	25 219	22 597	30 000
August	54.344	47.163	......	25 979	22 780	......
September	53.290	48 680		24.260	23 591	
October	50 654	49 385	......	23.199	23 925	......
November	49 082	51.714	......	22.703	25 094	......
December	49 375	54 971	......	22.900	26 373	......
Year	54 811	49 684	.	25 314	23.675	......

New York quotations cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

COPPER

Month	New York Electrolytic		London Standard		London Electrolytic	
	1915	1916	1915	1916	1915	1916
Jan.	13.641	24.008	60.756	88 083	65.719	116.167
Feb.	14 394	26.440	63.494	102 667	*	133.167
Mar.	14.787	26.310	66.152	107.714	*	136.000
April.	16 811	27 895	75 096	124 319	*	137.389
May.	18.506	28.625	77.600	135 457	*	162.622
June.	19 477	26 601	82 574	112 432	95 333	137 455
July	18 796	23 865	76 011	95.119	91.409	125 500
Aug.	16.941	......	68 673	....	82.333	....
Sept.	17.502	......	68.915	....	85.250	....
Oct.	17.686	......	72.601	....	88.000	....
Nov.	18.627	......	77.744	....	93.273	....
Dec.	20.133	......	80.773	....	100.43	......
Year.	17 275	......	72.532	....	....	......

TIN

Month	New York		London	
	1915	1916	1915	1916
January	34 260	41.825	156.550	175.548
February	37.415	42.717	176.925	181.107
March	48 426	50.741	180.141	193.609
April	47.884	51.230	166.225	199.736
May	38.790	49 125	162.675	196.511
June	40.288	42 231	167 636	179 466
July	37 423	38.510	167.080	168.357
August	34.389	......	151.440	....
September	33.125	....	152 625	....
October	33 080	....	151.554	....
November	39 224	......	167 670	.....
December	38 779	......	167.000	....
Av. year	38 590	....	163.960	.....

LEAD

Month	New York		St. Louis		London	
	1915	1916	1915	1916	1915	1916
January	3.729	5.921	3.548	5.826	18.606	31.167
February	3.827	6.246	3.718	6.164	19.122	31 988
March	4.053	7.136	3.997	7.375	21.883	34.440
April	4.221	7.630	4.142	7.655	21.094	34 368
May	4.274	7 463	4.182	7 332	20.347	32 967
June	5.932	6 936	5 836	6 749	25.170	31 011
July	5 659	6 352	5.531	6 185	24 611	28.137
August	4 656	......	4.520	......	21.946	......
September	4 610	......	4 490	.....	23.151	.....
October	4 600	...	4 499	...	23 994	....
November	5 155	...	5 078	..	26.278	....
December	5 355	....	5 266	....	28.807	.....
Year	4 673	......	4.567	......	22.917	......

SPELTER

Month	New York		St. Louis		London	
	1915	1916	1915	1916	1915	1916
Jan.	6.386	16.915	6.211	16.745	30 844	89 810
Feb.	8.436	18 420	8.255	18 260	39.819	97 762
Mar.	8 541	16.846	8 360	16.676	44.141	95 048
April	10 012	16.695	9 837	16 525	49 888	99.056
May	14 781	14 276	14.610	14.106	68 100	94 217
June	21.208	11 752	21 038	11 582	100 614	68 591
July	19 026	8.925	18 856	8.755	97.250	50.750
Aug.	12.781	......	12 611	.....	67 786	......
Sept.	13.440	......	13.270	.....	67.841	......
Oct.	12.800	......	12.596	.....	66.536	......
Nov.	15.962	......	15.792	....	88 409	......
Dec.	15.391	......	15.221	......	89.400	......
Year	13.230	......	13.054	......	67.553	......

New York and St. Louis quotations, cents per pound. London, pounds sterling per long ton. * Not reported.

PIG IRON IN PITTSBURGH

Month	Bessemer‡		Basic‡		No. 2 Foundry	
	1915	1916	1915	1916	1915	1916
January	$14 59	$21.60	$13.45	$18.78	$13.90	$19 70
February	14.55	21.16	13.45	18.93	13.90	19 51
March	14.55	21.81	13.45	19.20	13 95	19 45
April	14 55	21 65	13 45	18 95	13 95	19.45
May	14.61	21.78	13.60	19 11	13.83	19 58
June	14.70	21 95	13.67	18 95	13.77	19 34
July	14 94	21.95	13.91	18 95	13.68	19.20
August	16.01	......	15.31	......	14 75	......
September	16.86	......	15 95	......	15.70	......
October	16.95	......	15.96	......	15.80	......
November	17 57	......	16.47	......	17.20	......
December	19.97	......	18 44	......	18.95	......
Year	$15.82	......	$14 76	......	$14.95	......

‡As reported by W. P. Snyder & Co.

Engineering and Mining Journal

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Yuba No. 15 All-Steel Gold Dredge

By Lewis H. Eddy*

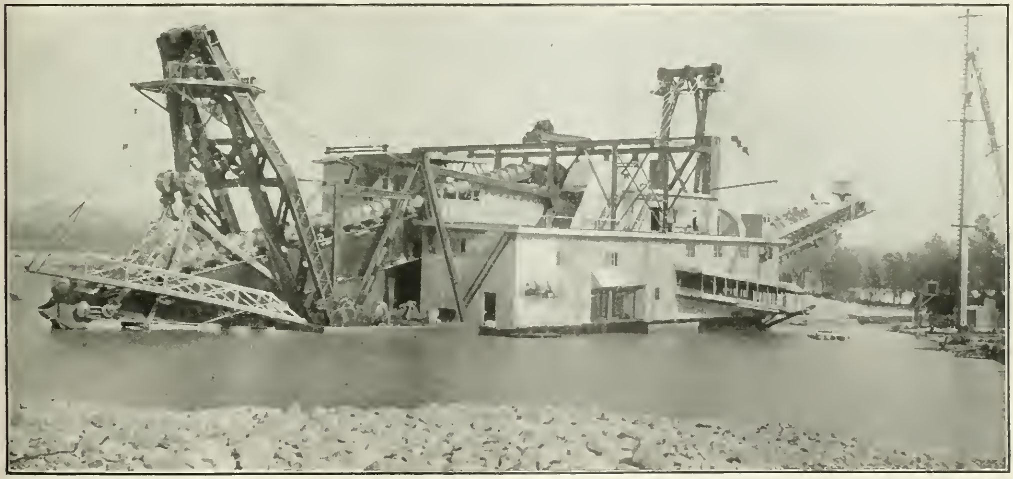
SYNOPSIS—This new 17-cu.ft. dredge started digging at Hammonton in the Yuba Basin field, California, on July 3, 1916. It is said to be the largest all-steel placer dredge ever constructed. It was built by the Yuba Construction Co. for the Yuba Consolidated Gold Fields and weighs over 2,900 tons.

Yuba No. 15 bucket-elevator dredge of 17-cu.ft. bucket capacity, the largest all-steel placer dredge in the world, started digging on July 3, 1916. It is the eighth all-steel placer dredge built in California by the Yuba Construction Co., of Marysville, and the fourth all-steel dredge installed by Yuba Consolidated Gold Fields at Hammonton, in Yuba Basin district, Yuba County.

Construction of No. 15 was begun with actual laying of steel on Feb. 3, 1916; it was ready to launch on Mar. 15, taking off four rainy days. But launching was postponed until Mar. 26 on account of warm weather melting the snow in the foothills and some of the higher mountains, causing a rise in the Yuba River that backed the water up under the hull and prevented the removal of foundation posts and placing of the ways.

Immediately upon completion of No. 15, preparations were made for construction of Yuba No. 16 on the same ways. No. 16 will be of the same bucket and yardage capacity and of the same design as No. 15, except that it will be equipped with two tailing stackers for reclamation of Yuba River channel.

In designing Yuba No. 15 it was evidently the purpose to make the boat similar in most details to No. 14[1], if not patterning after that boat precisely; but in all dredge construction there is a growing demand for improvement in recovery and saving in operating expenses, so that when the construction of No. 15 was settled upon and the dredge stood ready for active digging, there was sufficient difference and improvement to identify it as unique in gold-dredge construction. The one feature of change most noticeable is cutting off the corners of the stern, as shown in an accompanying illustration. This allows the dredge to be more easily turned and is especially adapted to this field.



YUBA'S NEW ALL-STEEL DREDGE NOW OPERATING NEAR HAMMONTON, CALIF.

The hull dimensions are 165 ft. long; 68 ft. beam, with no overhang, and 11 ft. 6 in. deep. The hull is 10 ft. longer and wider than in Yuba No. 14. The well-hole is 8 ft. 3½ in. wide in the clear, and the well-hole pontons each 20 ft. wide at the bow. The width of the well-hole is the same as in Yuba No. 14, but the pontons of No. 15

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*Associate Editor, San Francisco, Calif.

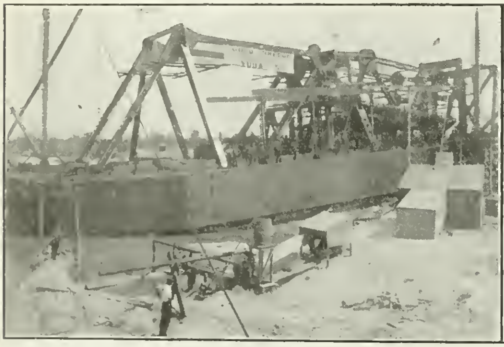
[1] "Eng. and Min. Journ.," Mar. 28, Apr. 4 and 11, 1914.

are 5 ft. wider. The total weight of the hull is 1,700,000 lb. The completed dredge weighs more than 2,900 tons, which is about 900 tons heavier than No. 14.

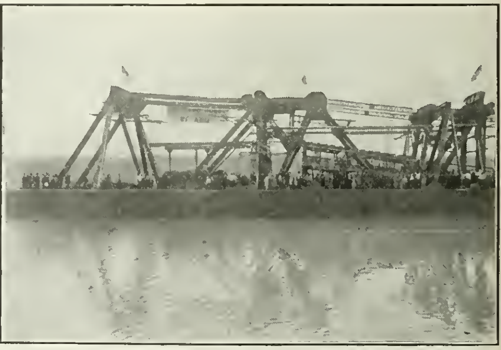
Most of the important parts of No. 15 are of greater weight than those of No. 14. The total weight of the bucket line, composed of 100 buckets, is 488,234 lb.; the buckets weigh 4,440 lb. each, the pins 130 lb. each, and the total weight of the digging ladder equipped is 868,154 lb. The bucket idler weighs 26,000 lb. The weight of the revolving screen is 135,000 lb. The bow gantry weighs 50 tons and the stern gantry 15 tons, or a total of 130,000 lb. The ladder suspension is much heavier than in No. 14. The suspension tackles weigh 13 tons each; the lower tackle blocks, 7¼ tons each.

The spuds weigh 45 tons each, or a total of 180,000 lb. They are each 10,000 lb. heavier than the spuds of No. 14, owing to their greater length. The upper tumbler weighs 41,000 lb. and the lower one 22,000 lb.; this total of 63,000 lb. is 7,000 lb. heavier than the total of No. 14 tumblers.

The dredge is designed to dig 82 ft. below the water line, with a yardage capacity of over 300,000 cu.yd. of material a month. The digging ladder is 154 ft. long, built in six sections, the heaviest section weighing 64,100 lb. The tailing stacker is 175 ft. long, provided with a 42-in. conveyor belt, 283 ft. long. The stacker drive is the common drive on the outer end of the stacker. The digging ladder of No. 14 is 20 ft. shorter than the one on No. 15, and the tailing stacker 39 ft. shorter. The upper tumbler is six-sided, of the same type as No. 14, but the lower tumbler is of the round type, while the lower tumbler of No. 14 is hexagonal. The ladder-hoist winch is larger and heavier than in No. 14, to take care of extra length of ladder and extra weight of bucket line. The swing winch is of the same design as for No. 14. The entire dredge is operated from the winch room. The bucket idler is cast in one piece, 9-ft. 5¾-in. diameter, 1-ft. $11\frac{9}{16}$-in. radius; the rim is 14 in. wide; shaft 11 ft. 1 in. long, 9½-in. diameter. This is practically the same as the idler of No. 14.



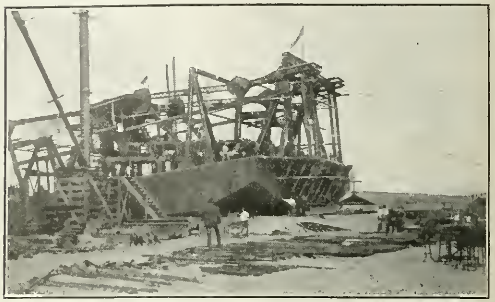
YUBA NO. 15 ON THE WAYS—BOW END



YUBA NO. 15 AFTER LAUNCHING

The revolving screen is the same as on No. 14, except that it is assembled with bolts throughout, and all wearing bars are of manganese steel. It is provided with water nozzles in each end for washing and separating the gravel passing through. The spuds are 70 ft. long and 5 ft. by 3 ft. 1 in. in section; the points are 10 ft. long each. These spuds are 8 ft. longer than those of No. 14 and proportionately larger in section. They are built of steel plates and angles. The pumps are the same as used on No. 14.

The 12 electric motors are of General Electric make. They are as follows: Main drive and ladder hoist, 500 hp.; swing winch, 35; 14-in. high pressure pump, 150; 14-in. low pressure pump, 75; 6-in. 2-stage pump, 50; two 6-in. vertical pumps, 20; 4-in. priming pump, 15; stacker drive, 75; screen drive, 75; stacker hoists, 10; tool drive, 2; total, 1,007 hp.



VIEW OF YUBA NO. 15, SHOWING CUT CORNERS AT STERN—A NEW FEATURE

The main house is framed of 5-in. 6½-lb. channel posts, plates and girts, with 8-in. 11½-lb. channels for rafters. The frame is inclosed with two thicknesses of No. 22 sheet steel, between which is a sheet of $\frac{3}{16}$-in. paper board, all riveted together. Each sheet is connected at the post to the butt strap of 3½x⅛-in. steel, fastened to the post with ⅜-in. round-headed bolts. The roof is of wood, 1¼-in. tongued-and-grooved Oregon pine, covered with No. 10 canvas painted with two coats of Prince's Metallic. The screenhouse and winch-house are of the same construction.

The entire inside and outside of the hull, including the hull trusses and gantries, were sand-blasted to remove mill scale and thoroughly cleaned before painting. The outside of the hull is covered with three coats of paint. The inside of the hull is painted with two coats: the inside bottom and the sides for 2 ft. are covered with "bitumastic enamel."

Grades and Uses of Spelter*

Spelter, like all commercial metal, contains impurities, but, unlike most other metals, none of these impurities are advantageous for any of the purposes for which it is used. The effects of these impurities on different products made from it vary greatly, hence the necessity for several grades differing in purity. Spelter is used for the following purposes, in quantities in the order mentioned: Galvanizing, alloys, rolling, ornamental castings and miscellaneous uses.

For ordinary galvanizing the effect of the common impurities is not very great. Iron is objectionable as causing a loss in dross and in making the coating more brittle and liable to crack and peel off. Lead, up to the limit found in commercial spelter, has no serious effect, but is objectionable when present in large quantity, as it liquates in the bath and does not enter the coating and is therefore wasted. Lead is usually worth less than zinc, and the purchaser does not wish to pay for it at zinc prices.

The four higher grades of spelter are chiefly used for alloys, and the specifications were principally made for the alloy makers and do not, in all cases, call for metal suitable for some of the other purposes for which it is used.

ALUMINUM EXCLUDED FROM HIGH GRADES

In alloys, aluminum is frequently very injurious, 0.01% in many cases making brass useless for the purposes for which it is intended. In the few instances where its presence is desired, it is more satisfactory to add it directly than as a constituent of the spelter. The specifications (as proposed for the American Society for Testing Materials in 1915), therefore, require that the four higher grades of spelter shall be entirely free from aluminum.

Iron is always present in spelter, but is very undesirable in brass and similar alloys, making them harder and greatly increasing the hardness due to cold working. The increased hardness is very objectionable, causing a greater consumption of power and endangering the rolling mills and drawing presses.

LEAD THE MAIN VARIABLE IN SPELTER GRADES

Lead is very objectionable in some alloys and essential in others, and the main variation in the different grades of spelter is in the allowable amount of lead. High-grade spelter, which is used for alloys that are to be subjected to the most severe spinning and drawing operations, can be rejected if it contains over 0.07% of lead, as lead reduces the ductility of brass.

Intermediate spelter, with a lead limit of 0.20%, is used for alloys that do not have to undergo as severe treatment, and also very largely for alloys like manganese bronze that are used both cast and wrought.

Brass special has a lead limit of 0.60% and is mainly used for brasses where the maximum ductility is not required. The lead and iron are limited to 0.60% and 0.03% respectively, because brass made from such spelter is used for ordinary drawing, spinning and forming work where the requirements are not especially severe.

Selected spelter carrying the maximum 0.80% of lead and 0.04% iron is used by brass manufacturers for making alloys to which lead is added in order to secure free-cutting qualities. Material of this kind is usually made into rods and heavy sheets for the manufacturing of small articles by turning, milling and drilling operations. Such brass must contain sufficient lead to reduce the strength of the material and cause the chips to break easily.

Owing to the fact that brass is usually made in crucibles in small quantities, uniformity in the spelter is of the greatest importance. As lead segregates badly, and more markedly the higher the proportion, the lead limit of the average sample is made low enough to allow for this tendency without injurious effect on the product. Even when the brass manufacturer adds lead, he does so in known amounts and thus obtains a uniform alloy from the different pots, which would not be possible if all the lead needed were contained in the spelter.

CADMIUM INTENSIFIES THE EFFECT OF LEAD

There is very little doubt that cadmium in zinc is very injurious for some of the purposes for which it is used, as it renders it harder and much more brittle. There is, however, considerable difference of opinion as to how far these undesirable properties persist in alloys made from zinc containing cadmium. The majority of the brass makers are of the opinion that the high temperature of the brass pots causes so much of the cadmium to volatilize that the residual amount has very little deleterious effect.

There is no doubt that large amounts of cadmium, say 1 or 2%, make brass hard and brittle. We have no reliable information at present showing the effect of small amounts of cadmium on the alloys, and the evidence on this point is extremely conflicting.

Cadmium, together with lead, seems to intensify the effect of the latter and also causes the brass to become more sensitive to the effect of overheating in the various annealing operations to which the wrought material is subjected.

Very little spelter is made containing as much cadmium as is allowed for intermediate and brass special, and the specifications, therefore, put practically no limit on cadmium except for high grade. Whatever the facts may be for alloys, it is certain that the amounts of cadmium allowed by the specifications are much greater than are permissible for other purposes for which zinc is used. The question of cadmium in the better grades is complicated by the fact that until the last year and a half practically all the high-grade and most of the intermediate spelter was made by one company from ores that are free from cadmium. The alloy makers have therefore had no extended experience with the effect of cadmium in the better grades of spelter, and during the last 18 months conditions have been so abnormal that it is difficult to draw conclusions.

HIGH-GRADE SPELTER USED FOR GALVANIZING

High-grade spelter is very extensively used for galvanizing telegraph and telephone wires, which are required to stand sharp bending when making the "lineman's splice" as it has been found that if impure spelter is used, the coating cracks and peels off the joint. The only high-grade spelter that has been used for this purpose is entirely free from cadmium. Cadmium being the element most likely to cause this trouble, it is very doubtful whether metal containing as much as is allowed by the specifications (0.05%) would be suitable for this purpose.

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*By G. C. Stone, W. H. Bassett and M. N. Price, submitted as an addendum to the report of the Committee on Nonferrous Metals and Alloys at the meeting of the American Society for Testing Materials, Atlantic City, N. J.

For rolling, cadmium causes such severe cracking that metal containing much of it is not economical; but as practically all the zinc rolling mills produce their own spelter, this matter is within their own control and the specifications do not affect them.

For ornamental castings no spelter described by the specifications would be satisfactory. The high-grade is all right as far as lead and iron are concerned, but with the maximum cadmium allowed, it would be impossible to make castings of many of the common shapes.

Manitoba Gold-Belt Prospects

In his report to the Public Utilities Commission of Manitoba, Professor R. C. Wallace of the University of Manitoba, recently returned from an examination of the Rice Lake gold district, says in substance:

The original discovery was made at Rice Lake, which has consequently given its name to the whole district. There are four areas in all, however, which are attracting considerable attention—Rice Lake, Gold Lake and vicinity, Long Lake and Halfway Lake, and a belt north of the Hole River. These areas are situated approximately in one belt having a general northwesterly and southeasterly trend. The belt is 10 mi. wide and 40 mi. long, its northwestern end being 16 mi. east of Lake Winnipeg.

During the summer months, access to the camp is obtained over the Bad Throat or Hole Rivers, which are reached by boat from Selkirk. During the past three years the Bad Throat River has been used almost exclusively. On this river the portages are numerous, and with heavily laden canoes a journey of two or three days is necessary to reach the camps. In winter, provisions and machinery are hauled across Lake Winnipeg from Riverton to the mouth of the Bad Throat River and thence by winter road to the camps.

The mining district is situated in a comparatively narrow belt of sediments, greenstone and porphyry, which follows the trend of the Bad Throat and Hole Rivers and is bounded on the north and south sides by granite. Of chief importance is the fact that a central body of granite between Gold Lake and Long Lake has intruded all these formations, sending out quartz veins into porphyry and greenstone and itself showing quartz veins of the same age. It is a feature of special interest that quartz veins in this granite more than a mile from a contact show promising gold veins on the surface. The veins follow almost without exception the trend of the inclosing rock.

In the originally developed district around Rice Lake, the veins were prospected in porphyry and sediments. In the Gold Lake district they occur almost entirely in porphyry, while near Long Lake they were originally followed in porphyry, but later in granite and in diabase.

The character of the veins varies only very slightly with the variation of country rock. They follow well-defined fissures in shear zones and may be traced not infrequently for a mile. As a rule they are narrow, and the few wide lodes that occur carry low values, if any. This feature renders necessary the continuation of good assays to a considerable depth before success can be assured. The veins are well mineralized with sulphides of iron and copper, and to a minor extent with sulphides of lead, zinc, molybdenum and arsenic. The highest surface assays in gold occur where copper sulphides are well distributed in the quartz, as at the Moose mine, and in the granite veins south of Halfway Lake in the Long Lake District. It is improbable that the sulphides of copper will continue in depth, and it is a matter of the first importance to determine whether the gold assays will continue with the iron sulphides at deeper levels. It is encouraging to find that the veins are very well defined, easy to follow and have sharp walls.

The stage of development reached so far is rather immature. Most of the work has been done in the Rice Lake area, where depths of from 50 to 100 ft. were reached and some drifting and crosscutting done. Presumably owing to lack of funds, none of the properties in this section are now being operated, and the original Rice Lake area has been temporarily abandoned for the Gold Lake and Long Lake fields.

In the Gold Lake district the most extensive work has been done on the Moose, Gold Pan, Gold Seal, Pilot and Nevada properties. Of these the Moose alone is now being operated. It is the only property in the entire region in which underground development is now in progress. At the Moose and Gold Pan, depths of over 100 ft. have been reached. Both of these are in porphyry. At the depth attained there is comparatively little change in the width of the quartz veins. The rich showings of the Gold Pan were obtained at a depth of 115 ft. in the vicinity of a heavy diabase dike which intersects the quartz vein. There is no pronounced activity at present, not more than 40 men operating in the whole district.

Real development is seriously hampered owing to lack of transportation facilities. Apart from the high cost of transportation, mine managers find it difficult to obtain good miners under present conditions. Though there is nothing in the development of the camp to justify the building of a railroad, a wagon road is a necessity; and unless one is built, development will be seriously arrested.

The whole country is covered by staking to such an extent that prospectors have to go far afield to discover unclaimed territory. The whole district must be considered as a prospect in the early stages of development. There is nothing as yet to indicate that there will be any very large mines, but several successful ones may develop on a smaller scale. The best opportunities appear to be in the central granite or in the porphyry near the contact with the granite. The quartz veins are somewhat larger in the granite than in the porphyry, but on account of the origin of the gold and associated rock, good assays may be found more persistent with depth in the porphyry.

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The Library of Congress has issued, through its card division, Bulletin No. 15, describing its system of publication and sale of cards for Geological Survey and Bureau of Mines publications. These cards are particularly useful for libraries, but also for those engineers who keep elaborate filing systems. These cards are published not only for the publications of the United States Geological Survey and the Bureau of Mines, but also for the various state surveys, including other publications on the geology of states and of foreign surveys and other publications relating to the geology of foreign countries. Copy of this circular can be had by application to the Libary of Congress.

Some Practical Notes on Mine Surveying

By W. F. Boericke*

SYNOPSIS—Practical hints for surveying in flat deposits. The degree of accuracy should be consistent with the importance of the work. An alternative for shaft plumbing is given.

The methods of mine surveying here described have been found especially applicable to the Wisconsin zinc field and should prove useful where mining and geological conditions are similar—that is, where the deposit is horizontal or nearly so and the workings are comparatively shallow, not over 200 ft. deep, and all worked from the same level. The "pitch," or stope workings, may vary from 10 to 60 ft. or more, averaging about 35 ft. The surveyor's work will consist in preparing plan and section maps of the workings at regular intervals, locating drill holes, keeping track of property lines, etc., besides special work on connections, shafts, raises, etc., that may be required from time to time.

Some of the methods outlined may seem crude and insufficiently accurate for an engineer. It must be borne in mind, however, that the degree of accuracy sought must be at all times commensurate with the importance of the work. In the present instance a precision is not looked for greater than 1 in 1,500 for all ordinary work. Unless conditions are exceptional, a greater accuracy would not be justified by the more elaborate methods and longer time necessary to attain it. Surveying is a business proposition in that the expense entailed for it must give adequate results, and a point is soon reached where the cost of a greater precision is not justified by local conditions. In short, the aim of every surveyor should be consistent accuracy.

A Light Transit with Adjustable Legs Used

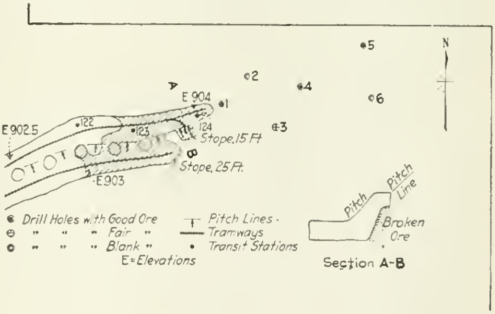
The transit should be light, strong, and keep its adjustments in spite of the rough usage that is inevitable underground. A powerful objective is unnecessary, as there will be few shots underground over 300 ft., and a candle can be easily centered on the ordinary telescope at that distance. It should have the necessary attachments for either the top or side telescope, and this extra piece should always be carried in the transit box for special work in which it is essential. The top of the telescope should be punch-marked for setting up under an overhead station. A full vertical circle is preferable to a half-circle, as it enables the vertical angle to be read when the telescope is plunged.

The tripod should be of the adjustable type, with sliding legs. With such a tripod an experienced man can make a set-up easily and rapidly, in all but impossible places. The plumb-bobs should also be adjustable, having a knurled screw in the head, by which the bob is raised or lowered—a great saving of time.

A 100-ft. steel tape is long enough for all ordinary mine work. A longer tape than this is heavy to handle and is more apt to kink, also is difficult to keep out of the way of shovelers and trammers. If the mine is muddy, it will soon collect enough dirt to make reeling and unreeling impossible without cleaning. Time will be saved in the end by making an extra set-up where shots longer than 100 ft. are necessary. The tape should be marked in plain figures, every foot numbered. The first and last foot should be divided into tenths. In measuring between stations and other important points, the footmark is read by the surveyor's helper, and the tenths and hundreds by the surveyor, the latter being estimated, unless it is preferred to use a flexible steel pocket scale for this.

Tapes should be thoroughly cleaned and dried after each day's work. With careful usage they will last a long time, but when one starts to break it pays to get a new one, as the ordinary repair job will not last long in the rough stopes underground.

For measuring stopes or taking side shots where it is impossible or inconvenient to set up a transit, an instrument of the Brunton type is very valuable. It is essential to pick out a place to work from that is comparatively free from local attraction, proximity to drill columns, machines or cars, making accurate work impossible. To use a Brunton compass quickly and accurately needs considerable practice, but for certain kinds of work it is the best instrument for the job. It is particularly useful in getting the direction of crevices, pitches, etc., that appear in the roof, and in giving approximate lines to work from until a transit survey is possible.



STOPE MAP IN WISCONSIN ZINC FIELD

The modern carbide cap-light is almost a necessity for rapid, accurate angle reading underground. A candle is messy and clumsy to handle, and gives much less light. With the carbide lamp it is possible to read angles to the nearest minute without a reading glass. It is best carried in the cap out of the way, leaving both hands free for other work. The body of the lamp, however, will affect the needle perceptibly, if it is in use, although this can be avoided by proper manipulation. The carbide lamp in the hands of the helper makes a brilliant light behind the plumb-bob string, making a 300-ft. shot entirely possible and rendering it unnecessary for the transitman to bother about the illumination of the string.

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*Mining engineer, Galena, Ill.

A tip in regard to working clothes: Khaki is excellent, but be sure that the coat pockets are big enough. The surveyor must carry several notebooks with him constantly, and his fieldbook must be produced from and returned to his pocket several hundred times a day. Nothing is more ruinous to good temper than a coat pocket into which the notebook refuses to slip easily. The coat lapel should also be provided with a special buttonhole from which to suspend the carbide lamp when it is not on the cap.

The best accessory a surveyor can have in his work is a good helper. If he can get a man who is quick, intelligent and painstaking, who takes an interest in the work and saves a multitude of steps and laborious explanations by doing things without being told, and at a pinch do some checkwork himself, and so eliminate the personal equation, he has, indeed the pearl of great price. But he can't get him. That man has just been promoted to a better job. It is surprising how much more can be done with an efficient helper, aside from the added confidence the surveyor has in the accuracy of the work. Under ordinary conditions one helper is all that is required, but where there are a lot of side shots to be taken, a second man is very useful to handle the tape entirely, the transitman only running the instrument and keeping notes.

Lay the Work Out Before Starting It

Unless the nature of the particular job is understood clearly in advance, time will be saved by going underground at the start with only a compass and sizing up the layout. Before bringing down the transit, the surveyor should plan the work ahead, so as to work to the best advantage. The most important thing is to lay out his permanent stations. If the roof is low enough to be reached with a drill, holes can be drilled overhead and wooden plugs inserted, with a screw-eye or horseshoe nail to hang the plumb from. The advantage of the screw-eye is that a metal tag bearing the station number can be fastened permanently to the screw-eye, thus identifying it. If there is no chance to reach the roof, nails can be driven in the track ties (very unsatisfactory, obviously) or pipes can be driven in the ground. Although it requires more skill in setting up, the overhead plug is the most satisfactory station for underground work. It can be easily found, if properly drilled is rarely lost, and its position can never be changed. To keep it from being shot out, the plug should be driven in about flush with the roof.

In ordinary surveying work the azimuth method, all things considered, is the most satisfactory. The details of this method of running transit lines are so well known as to require no explanation. For station work angles are read to the nearest minute, distances to the nearest hundredth of a foot. Checking is best done by tying-in to a station the coördinates of which have already been established. Side shots and stope measurements are taken rapidly to the nearest half-degree, and the tape read to the nearest half-foot. Where it is possible to use the needle, a single check should be taken before moving the transit to see that there has been no large error in angle.

No set rule can be given for the needle deflection due to setting up over tracks. A good deal depends on the condition of the rails and the direction in which they lie with respect to the meridian. With 16-lb. rails and a 22-in. gage, the maximum deflection of the needle for an H. I. of 4.5 ft. should not exceed 3°. This assumes that the transit is set over the center of the track.

Where a long line is to be run with no turns in it greater than 45° and no necessity for side shots, the double-deflection angle method is very satisfactory and doubtless more accurate than the azimuth method. It is more complicated than the latter, and results are not arrived at so quickly. Two back sights and two foresights are required, and this of course means more time. Its great advantage is that there is a perfect check at all times on the angle work, and instrumental errors due to poor adjustment of the collimation line are eliminated by taking reversed readings.

Underground Leveling More Accurate Than Surface

Levels are run underground in the same manner as on the surface, and the work can be done with more accuracy, on account of perfect atmospheric conditions. The rodman should use a carbide light and a self-reader rod, by which readings can be taken easily to the nearest 0.01 ft. for a distance of 100 ft. Bench-marks may be either permanent frogs, etc., on the track, or the overhead plugs used for transit stations.

The best advice that can be given for surveying is not to waste time in nonessentials. Know what you have to do before starting work. Determine the degree of accuracy you will hold in the work, then work consistently toward that precision. If you are satisfied with a precision of 1 in 1,000, don't waste time in centering to 0.01 in. It is entirely inconsistent to read angles to the nearest 30″ and tape lengths to 0.1 ft. Conversely, if the work is sufficiently important to justify a precision of 1 in 10,000, go to the other extreme and neglect nothing that can affect the accuracy of the work. Particular care should be used in taping, and have only experienced, careful men, who realize that the job means more than getting in an easy shift. It will be of no avail to blame it on the helper when the raise misses the shaft by a foot. The surveyor alone is strictly responsible for the work.

One of the great advantages of the azimuth method is the ease with which transit notes are made available for the office and drawing room. The conversion of azimuth into bearing will become mere routine with a little practice. For calculating latitudes and departures, coördinates, etc., a book of tables is essential for saving time. The coördinates of all permanent stations should be checked at once, by a graphical method. The side shots can then be entered on the map with protractor and scale.

Though a scale of 1 in. to 50 ft. is commonly recognized as standard, it is hard to see where it has any particular advantage. One to 40 is a great deal handier for the mine foreman, who usually has nothing but a broken foot-rule to scale with and whose knowledge of fractions is sometimes hazy. Of course, the larger the scale the more detail can be shown from a survey and the closer it pays to take side shots. On the other hand, if the map must be drawn to a scale of 1 in. to 100 ft., or smaller, it is a waste of time to take a lot of side shots, as they cannot be shown in fine enough detail. Here again the transitman must be consistent in his work.

Surveys are brought up to date every two or three months, and the new ground cut is indicated by hatching, as shown in Fig. 1. Elevations, permanent transit stations, property lines, drill holes, tramways, pitches and crevices are all indicated on the completed map. Smaller maps of the headings that may be of assistance to the shiftbosses are also furnished. Section maps, when required by a change in the height of stope, are taken at right angles to the pitch, at intervals of 100 ft., as shown in Fig. 2.

Two-Shaft Method of Plumbing Used When Possible

For carrying the azimuth underground, where there is no incline, the two-shaft method, in which a wire is suspended in each shaft and a traverse run below and on top between the two, is the quickest and most satisfactory. If there is but one shaft, however, recourse must be had to the top or side telescope, or else the shaft plumbed in the time-honored-method with two wires. Where the shaft is only 5x9 ft. in the clear, giving a base line not over 8 ft. and frequently less than that on account of pumps, wires, ladders, etc., the practical difficulties encountered may cause considerable inaccuracy particularly if the shaft is wet and air currents are troublesome. If only a general map is wanted, a temporary azimuth will serve in many instances. In such a case the azimuth is obtained from the needle by setting up in a drift at a point *A* entirely free from local attraction and obtaining the bearing of the line *AB*. The transit is next set up at *B*, and if there is no local attraction, the bearing should be the same plus 180°. From this point a traverse is run to the shaft, using the azimuth so determined and neglecting the needle. Here a sight is taken on a wire the surface coördinates of which are known. This will locate the points *A* and *B* with respect to the surface stations. If the needle is sensitive and the work is done carefully, this temporary azimuth will not differ more than 1° from the true azimuth and may often be much closer than this. In two cases under my direction the difference between the temporary and true azimuth was 17′ in one and in the other 22′.

It is better to use this method than to survey between two drill holes, below and on top, and calculate the azimuth therefrom. Churn-drill holes sometimes go down surprisingly straight, but the majority are off anywhere from 6 in. to as much as 5 ft. in 100 ft. depth. It is unwise to check the accuracy of a survey on the coördinates of a drill hole. However, a constant seeming tendency of the drill holes to slide to the south, say, would throw suspicion on the survey. In 7 drill holes, located within a radius of 200 ft., 2 were apparently vertical and all the others varied from 1 to 5 ft., but none in the same direction.

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Mineral Output of New York

The mineral production of New York in 1915 is given as follows by David H. Newland, assistant state geologist: Cement, portland and natural, 5,143,024 bbl.; salt, 11,095,301 bbl.; iron ore, 944,403 long tons; natural gas, 7,110,040,000 cu.ft.; petroleum, 928,540 bbl.; gypsum, 516,002 short tons; mineral waters, 8,636,920 gal.; talc, 55,914 short tons; pyrite, 57,211 long tons; graphite, 2,500,000 lb.; garnet, 3,900 short tons; feldspar and quartz, 22,196 short tons; metallic paint, 4,925 short tons; emery, 3,895 short tons; and crude clay, 13,745 short tons. Other mineral substances, including slate pigment, granite, limestone, marble, etc., to the value of $5,648,075 were also produced.

The most interesting item in the year's developments was the entrance of the Northern Ore Co. in the list of producers, this company making shipments of several thousand tons of zinc concentrates, the first that have been made in the state.

Iron ore showed an increase of 192,687 long tons, but was 373,196 tons short of the 1913 production. Other changes were not marked, with the exception of a decline of 456,780 bbl. of cement.

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The Occurrence of Germanium in Zinc Materials*

In a recent issue of the *Journ. Ind. and Eng. Chem.*, W. F. Hillebrand and J. A. Scherrer contribute a short article on "The Recovery of Gallium from Spelter in the United States." In addition to the observations on gallium, mention is made of the fact that Dr. K. Burns, of the Bureau of Standards, has examined spectroscopically several samples of zinc ore from various sources, and has identified in several of them, notably in a Missouri sulphide, the very rare element germanium. These observations concerning germanium are of particular interest to us since in recent work we also have encountered this element in a byproduct derived from Wisconsin blende. The exact nature of this byproduct it is not possible to disclose at present.

The occurrence of germanium in blendes has been noted by Urbain, who by spectroscopic methods detected germanium in 38 out of 84 blendes from various localities. From 550 kg. of one of the richest of these, a Mexican blende, he obtained 5 grams of pure germanium. The amounts of the element found have always been small, the aid of the spectroscope being usually required to establish the identification. In the material at our disposal, however, germanium was found in sufficient quantity to be readily detected by the ordinary chemical reagents.

A roughly quantitative determination of the amount of germanium present in the material was carried out as follows: After distillation with hydrochloric acid and chlorine the sulphide was precipitated from the distillate with hydrogen sulphide. In some experiments the sulphide was weighed directly; in others it was transformed into oxide with nitric acid and weighed as GeO_2. The mean of several closely agreeing determinations gave the value of $GeO_2 = 0.25\%$.

To show whether germanium could be found in other zinc ores, samples of similar byproducts from different ores were distilled with hydrochloric acid and chlorine. The distillates, after dilution, were treated with hydrogen sulphide. If no precipitate was obtained, the test was considered negative. If a precipitate was obtained (other than the turbidity of sulphur), it was filtered off and transformed to oxide with nitric acid. The final test consisted in the formation from the residue of the double potassium fluoride with hydrofluoric acid and potassium chloride.

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*Excerpt from an article by G. H. Buchanan, in the July, 1916, issue of the "Journ. Ind. and Eng. Chem."

From several of the materials very definite confirmatory tests were obtained; others gave satisfactory blanks, while in only a few instances were the results uncertain. In none of the cases where positive results were secured was there found an amount of germanium at all comparable to that found in the material first examined, probably not one-tenth as much. A positive test was secured from Joplin ore and also from some Mexican ores. The Franklin ores gave negative results.

* * *

Mining in China

SPECIAL CORRESPONDENCE

I noticed with interest a reference in the *Journal* last year to an extensive plan of prospecting, under the heading "Mining in China." I am well acquainted with some of the Chinese engineers who have been engaged to coöperate in the prospecting of some of the provinces, but I am waiting to be shown how much real information will be gathered in this way.

I agree with the minister of Agriculture that parts of China are rich in mineral resources, but from my personal observations in West China I am convinced that there are enough known occurrences at least to start a respectable mining industry, if conditions for their development were satisfactory. In the last few years the government has brought forward many plans for developing the mineral resources of China, but it does not seem to have hit on a satisfactory formula yet. There are many conditions that have combined to discourage mining in West China, among which are the following facts: When the Chinese settled this part of China, they gradually pushed the aborigines back into the mountainous parts, where it was impossible for the Chinaman to grow his greatest necessity —rice—and here the aborigines still live in a more or less independent condition. The sovereignty of China is more nominal than real, and in many parts it is very unhealthful for a Chinaman even to travel. In a great many cases these aborigines have either prevented any mining at all or agreed to it only on condition that they coöperate with the Chinese, but retain the controlling interest, which the Chinese almost without exception refuse, although it is the same proposal they offer to foreign capital.

The cost of transportation under conditions existing at present is a serious handicap to anything but a very high-grade deposit in most parts of the province. There is a lack of mutual confidence among the Chinese which makes it impossible to organize anything but a one-man company, which generally has not enough capital available.

ATTITUDE OF THE GOVERNMENT

The attitude of the government in making a government monopoly of many minerals is an obstacle, as also are the unsatisfactory mining laws, or more correctly the unsatisfactory way in which they are administered by the local officials, so that there is no incentive to work the known deposits, let alone search for new ones.

Take, for example, spelter, which reached unheard-of prices last summer. The Chinese producers had a big advantage over any others in that they could increase their capacity very quickly and cheaply. Given mud and a few laborers, the simple Chinese furnaces can be built and made ready to begin operation in from 10 days to two weeks. And yet last summer (1915) when I had an opportunity to visit many of the zinc districts of Yunnan and Szechwan, I found no special activities. In fact, at several places they were not working at all, and at one of them the owner offered to give me the mine if I would work it and give him a good job. At other places they were talking of suspending work. At first I thought they did not know the market value of spelter. On inquiring, I found that they did know, but were not getting the benefit of it. At one place in southern Szechwan the smelters told me that they had to sell all their spelter to a government company at Tls. 3.5 per picul or be liable to a heavy fine and have their smeltery seized. Out of this the smelter has to buy his ore and make what profit he can, which cannot be very much, as it requires four men to operate a furnace of one-picul capacity. This spelter was all being sent to Yunnan-fu, where the price then was Tls. 28 per picul, and freight by pack mule could not be over Tls. 5 per picul. I asked what they had received for their spelter last year (1914), and they said Tls. 3.2, or an increase of a little under 10% when the price of spelter had more than doubled.

THE PROSPECTOR'S COURSE

In several very good editorials the *Journal* pointed out to the zinc miners that the high prices were not due to any lack of zinc ores, but were really a premium on smelting capacity; but in this case the premium appears to be on the discouragement of mining development. I never saw any American prospector, at least when he was sober, give away any information about a new find until he had it recorded and was sure his interests were safe; and as far as I have seen, human nature is the same in China as it is in America or any place else. Therefore I do not anticipate any great rush to inform the local magistrates of any occurrences not already well known to the government.

The central government may be sincere enough in its desire to promote and protect the mining industry; but as long as the local officials can turn an office for collecting royalties into a company with the sole right to buy all ores and metal at its own price, it does not matter much how good the mining laws may be. I simply took zinc for an example, for practically all mining I have seen in West China, with the exception of coal mining, has been throttled by the local officials in some way or another.

[Our correspondent's note respecting the production of spelter in China is of peculiar interest. There is every reason to believe that Europe obtained its first knowledge of zinc smelting from China and that the art is practiced now in China probably in the same way as it was two centuries ago. With respect to the antiquity of zinc smelting in China the following note from the *Journal* of the Royal Society of Arts, June 23, 1916, is of interest.—Editor.]

From 1893 to 1900, specimens of Chinese zinc were examined and found to be of uniform appearance. From inquiry the samples were said to have been taken from slabs, sometimes spoken of as "Ming" zinc. One such slab submitted to me weighed one picul (133⅓ lb.) and bore a date in deep well-molded Chinese characters corresponding to 1585 A.D. The Ming dynasty extended from 1368 to 1644 A.D. It was stated that although they were found to contain no silver, the slabs had at one time been used as coins.

There was much rumor as to the place of storage of these ingots. It was gathered that a large number were hidden in a hill near Lien Chow in the northern part of the Kwantung province, also that the natives in the vicinity were much opposed to any sale or removal, on account of the Fung Shui—the superstition which regards with extreme disfavor any interference with the soil. However, it is probable that difficulties were overcome, as after about 1900 no more was heard of this particular brand of Chinese zinc. All samples contained over 98% of metal, with very small quantities of iron and lead. Modern Chinese zinc is of about the same standard of purity.

The ore is said to be abundant in Hunan, Hupeh, Kweichow and Yunnan, and in this last district to be extensively smelted.

FRANK BROWNE,
Formerly Government Analyst, Hong-Kong.

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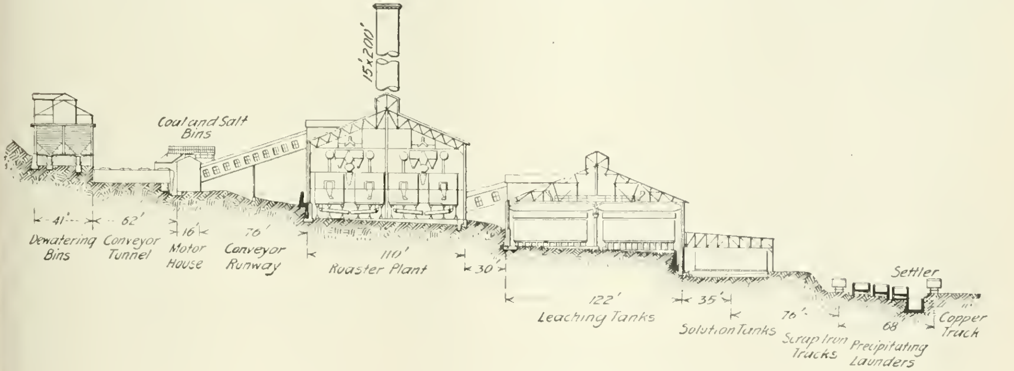
The 2,000-Ton Leaching Plant at Anaconda*

After a series of experiments covering a period of about three years, a 2,000-ton leaching plant for the treatment of the accumulated copper-concentrator tailings was built and put into operation in May, 1915, at Anaconda, Mont. The accumulated tailings in the New Works dump is estimated at about 20,000,000 tons, of which the following shows an average screen analysis: +20-mesh, 22.6%; +40-mesh, 64.7%; +60-mesh, 82%; +80-mesh, 89.1%; +100-mesh, 93.8%; +160-mesh, 97.7%; +200-mesh, 98.5%; —200-mesh, 0.5%. An average analysis of the tailings being treated at present follows: H_2O, 5.63%; Cu, 0.573%; Ag, 0.187 oz. per ton; SiO_2, 81.0%; FeO, 28%; S, 1.9%; Al_2O_3, 9.8%; and CaO, 0.1%.



CROSS-SECTION THROUGH ROASTING AND LEACHING PLANT

The dump is being excavated by an electric hoist equipped with a 4-yd. bucket. The hoist loads the tailings into 50-ton ore cars. These are hauled to the leaching-plant storage bins in trains of 15 cars each. The hoist is capable of hauling 3,000 tons in 8 hr.

The loaded cars of tailings are spotted by means of a 25-ton electric locomotive operated by the third-rail system. The unloading pit is a steel bin capable of holding 350 tons and is long enough for three cars to be unloaded at a time. On top of the pit is a 2-in. grizzly, through which all tailings must pass before going to the storage bins. This grizzly serves to keep out rocks or lumps that would block the feeders, furnaces, etc. Under the steel bin are 22 short-belt feeders, each feeding from its own gate and running at right angles to the length of the bin. These feeders discharge onto a 36-in. belt running lengthwise, which in turn delivers the sand to another 36-in. belt traveling on an 18° angle to the top of the storage bins. The system will handle over 3,000 tons in 8 hr.

The storage bins will hold 6,000 tons of sand tailings. This gives between two and three days' supply for the leaching plant, in case of railroad troubles or difficulties due to cold weather. The bins are of substantial wood construction and are inclosed, the walls and roof of the building consisting of wood sheathing covered with corrugated iron. The bins are arranged in a double row and are hopper-bottomed. The tailings are distributed over the bins by means of a 36-in. belt and movable tripper. Underneath are 36 gates, each with its hopper from which an 18-in. belt feeder delivers to a 24-in. belt running the full length of the building, in the center. By means of other belts, traveling through a tunnel under the railroad tracks and up an 18° incline, the feed is delivered to the top of the furnace building.

There are also small coal and salt storage bins from which a 22-in. belt system conveys coal and salt to bins in the roaster building, the salt being drawn from there to the leaching building as it is required. All belts run at approximately 400 ft. per min.

The furnace building is 232x110 ft. and is of steel and concrete construction. There are 28 MacDougall-type six-hearth furnaces arranged in four rows of seven each. The furnaces are 20 ft. in diameter, each being equipped with two fireboxes, diametrically opposite, the flame entering over a fire bridge directly into the third hearth, the top hearth being designated as the first. The grate dimensions of each firebox are 3x4 ft. Each furnace has a 20-ton feed hopper, to which the tailings are delivered by means of two 24-in. belts each equipped with a movable tripper. The furnaces are fed by 14-in. belt feeders drawing from these hoppers, the amount of feed being controlled by gates operated by means of a screw adjustment, the feed dropping through a hole in the top arch, directly onto the top floor. During the time the feed is on the two upper floors, it is dried and heated; as it drops to the third or fired floor, the sulphur ignites. The three lower floors are kept hot by the combustion of the sulphur in the tailings.

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*Excerpt from an article by Frederick Laist, metallurgical manager, and Harold W. Aldrich, leaching plant superintendent, to be read at the Arizona meeting of the A. I. M. E., September, 1916.

Four flues run the length of the building, one over each row of seven furnaces. Each furnace has two opposite connections, from the top hearth to the flue. All four flues lead into a balloon flue with a downtake of 45°. The balloon flue enters the 15x200-ft. steel stack with a 45° uptake. The stack is unlined. In the bottom of the balloon flue is a 6-in. screw conveyor which delivers the flue dust to the belt-conveyor system that receives the calcine from the furnaces.

The furnaces are air-cooled, air being furnished by four No. 11 Buffalo blowers each direct-connected to a 50-hp. motor. The air intake is at the top of the furnace shaft and the discharge at the bottom. The hot air does not enter the furnaces, but is delivered to the leaching and solution buildings for heating purposes by a suitable piping system. When it is not needed for this, it is discharged into the atmosphere.

Each furnace is equipped with a cylindrical cooler, 30 in. in diameter and 19 ft. long. The cooled calcine enters a mixer or concrete-lined steel cylinder, at the head end of which a very small stream of water is added to settle the dust. The mixer discharges a moist warm calcine to an 18-in. conveyor belt, and by a system of conveyors the calcine is delivered to the leaching building. The ashes from the fireboxes drop into launders and are sluiced out through the main tailrace.

The leaching building is 293x122 ft. and is of steel and wood construction. It contains 10 redwood tanks each 50 ft. in diameter and 14 ft. deep. The average charge to a tank is about 1,000 tons of calcine.

The Leaching Tanks

The tanks are equipped with an ordinary filter bottom, made of 1¼-in. slats resting on 2x4-in. pieces. Above this are two layers of heavy cocoa matting, and on top of the matting is a grating made of 1¾x3½-in. material with 6-in. square spaces. The grating fills with calcine 3½ in. deep and serves to keep the force of the sluicing water from tearing the matting. The acid solutions rot the cocoa matting, but if not disturbed, it will hold its shape and be an efficient filtering medium long after it is too much decomposed to handle. All the steel tank hoops are covered with lead pipes to protect them against leaks of acid solutions. The tanks are in two rows of five each. A 20-in. conveyor belt travels over each row, and by means of a tripper the calcine is dumped into a suitable distributor, which spreads it over the tank.

Each tank has three lead pipes 4 in. in diameter and one 4-in. iron pipe entering at the top. The lead connections are for strong and dilute acid solutions and the iron pipe is for wash water. Above the level of the leaching tanks an iron storage tank is provided for holding the stock of concentrated acid. Its capacity is about 120 tons of 60° Bé acid. All concentrated acid, used to raise the acid strength of any solution, is added to the solution as it goes on the charge in the leaching tanks.

There are seven 10-in. sluicing gates in the bottom of each leaching tank, one in the center and six spaced equidistant from each other in a circle about halfway between the center and the circumference of the tank. These discharge into launders that connect with the main tailings launder. "Acimet" valves and lead piping are used throughout for handling dilute and concentrated acid solutions. The floors of both the leaching and solution buildings are of concrete and are painted with an asphalt-tar mixture for acid proofing. These floors slope to a gutter that connects to a sump and in this way any overflow or leakage of solution is saved and returned to the system by a pump.

The solution-tank building is a lean-to off the leaching building and contains five solution-storage tanks. These are 50 ft. in diameter and 14 ft. deep. Solutions drain from the leaching tanks to the storage tanks and are pumped to the top of the leaching tanks, from the solution tanks, by means of vertical-shaft direct-connected hard-lead centrifugal pumps.

The precipitation of the copper and silver is accomplished with scrap iron. The precipitating launders are of concrete, each about 250 ft. long and having a section of 4x8 ft. available for containing iron. Each launder is partitioned off into four sections by concrete walls. Any of the 12 sections may be bypassed for the purpose of cleaning up. In the bottom of the launders is a heavy wood grating, upon which the iron rests, leaving a space about 6 in. under it, for accumulation of any cement copper which may drop off the iron. In the side of each section at the bottom are four 6-in. holes toward which the concrete bottom slopes. These holes discharge into launders which carry the copper to a settling tank. There it is washed and stored and finally excavated with a clamshell bucket, loaded into standard railroad cars and, at present, shipped to the briquetting plant before blast-furnace treatment. An electrically operated Brown hoist equipped with a lifting magnet handles the scrap iron and loads the copper.

The resulting cement copper carries about 70% copper, from which the silver present is recovered by precipitation. The following data are taken from the reports for the month of October, 1915, which is a representative month, but it is certain that the results will be improved upon, after longer operation: Sand tailings treated, 70,401 tons; copper in feed, 0.575%; silver in feed, per ton, 0.45 oz.; copper in tailing, 0.082%; silver in tailing, per ton, 0.14 oz.; sulphuric acid (60° Bé.), per ton of feed, 64.90 lb.; coal, 3.30% of feed; salt, 1.52% of feed; iron, per lb. of copper, 2 lb. The plant during this month made an extraction of about 80% of the copper and 60% of the silver.

Dip and Strike Calculations

On page 270 of the *Journal* of Aug. 5, 1916, equation (2) in Theodore Simons' letter was inverted. It should be

$$Tan\ b = \frac{sin\ c}{m - cos\ c}$$

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North Butte Mining Co., Butte, Mont., reports a net income of $1,127,646 for 1915. During the year 386,899 tons of wet ore was mined, 83 tons of wet precipitates was shipped, and the smelter treated 378,105 dry tons of ore and 56 dry tons of precipitates. This ore produced 19,235,285 lb. of fine copper, 940,631 oz. of silver and 1,121 oz. of gold. During the year 19,725,510 lb. of copper was sold and delivered at an average price of 16.703c. per lb. Sales and delivery of silver amounted to 944,284 oz. at 50.276c. per oz. Gross sales made during 1915 for immediate and future delivery amounted to 27,805,869 lb. of copper at prices averaging 18.114c. per lb. Many of these sales cover the copper to be produced during the year 1916 and the deliveries of the same to extend through that year. The average cost of producing copper was 15.741c. per lb., and after deducting 2.619c. for gold and silver content, the net cost of copper was 13.122c. per lb. Dividend payments aggregated $387,000 during the year.

Conditions in Mexico

By "A Man from Mexico"

SYNOPSIS—A review of conditions existing in Mexico at the present time, showing the difficulties of prosecuting legitimate work. The financial situation is the worst of many bad features.

There is no country in the world in which the truth is so hard to find as in Mexico It is the land of fake rumors, and the proverb that the unexpected generally happens is strikingly exemplified there. Things occur which to the ordinary stay-at-home seem impossible, and it is safe to say that if a full and true account of the happenings there during the last few years were published, it would not be believed. On the other hand, the average American knows and cares little what happens. Occasionally his attention is attracted by a larger-than-usual scarehead in the daily press, but he soon forgets about it. But if there was cause for intervention in Cuba, there are a hundred reasons for intervention in Mexico. At present we are neither at peace nor at war with that country, and this condition appears likely to continue indefinitely.

Millions of foreign capital are invested there, and if the United States does not do something before the European War ends, some other nation or combination of nations will do it. For example, the railway from Vera Cruz to Mexico City, the Mexico City tramways, the Mexican Light and Power Co. (Necaxa) and others are owned by British and Canadian investors and are being run by the *de facto* government for its own benefit, and it is unlikely that the owners will suffer in silence for very long after the war is over. The *de facto* government offered to hand these concerns back to the owners not long ago, but the latter were not foolish enough to accept them in their present damaged condition. They prefer to wait—watchfully—till the time is ripe and then exact damages from someone. Whether the Monroe Doctrine renders Uncle Sam responsible I do not care to surmise.

Traveling in Modern Fashion

Before making my last vist to the "Land of Mañana" I read the humorous account of "Railway Traveling in Mexico," in the *Journal* of Feb. 19, 1916, and was prepared for the worst. However, I was luckier than your correspondent, because there were cushions on the seats and glass in the windows, the engine did not break down, we did not have to sleep on the ground, and we made the journey in almost schedule time. True, the train was crowded, there was no Pullman from Laredo to Saltillo, no dining car on the train during any part of the journey and no soap or towels in the Pullman from Saltillo to Mexico City; the porter was drunk and affectionate toward passengers and we had to spend 18 hours at Saltillo, much of it at the station, mixed up with half the population, who are ragged and dirty, even for Mexicans; but these were only minor troubles. I found that no passport was necessary on entering the country, but on leaving a permit from the government is required. There was a farcical fumigation of baggage at Neuvo Laredo on entering, but this was simply in retaliation for the United States Government vaccinating Mexicans entering this country on account of the typhus epidemic then raging. While this farce is being enacted, the passenger is surrounded by and brushing against Mexicans wrapped in blankets, some of which are probably inhabited by the louse that spreads the fever. However, I suppose it is all right. It is only the imported louse that the patriotic Mexican objects to and pretends to destroy. Around the mines one is in constant danger from the same source. Thousands of Mexicans and several Americans, including one doctor, have died from the disease carried by the louse.

Passing through the state of Neuvo Leon, the only features of the landscape were unroofed houses, burnt freight cars and bent (dynamited) rails, and at the stopping places, a crowd of filthy women and children selling *tortillas, tomales, leche, agua*, etc. After dark there was no light on the train. On arrival at Mexico City we passed (in a cab) the many triumphal arches erected to welcome the First Chief. These were built several months before, but the *Primer Jefe* had not yet arrived. Rumor says that one of them was found to be charged with dynamite to which a wire was attached and that the discovery led to several workmen losing their lives about sunrise one fine morning near an adobe wall. About two months after this, Mr. Carranza entered the city suddenly from Queretaro, and ordered all the arches to be removed within 24 hours. In Pachuca, also, arches were prepared and stood for months and were finally removed without ever being used.

Conditions in Mexico City

The sale of *pulque* was forbidden in the city and one could not get a drink of any kind unless something to eat was ordered. However, the restriction on *pulque* has been withdrawn and the great national industry is again flourishing. In March a telegram of 12 words from Mexico City to Pachuca (90 km.) cost the equivalent of 3c. United States currency. Needless to say, the Western Union does not run this service. Postage to the United States was equal to $\frac{1}{10}$ of 4c. (U.S.) and the fare to Pachuca 2½c. (U.S.) for a 3-hr. journey. On Feb. 29 a peso was worth 4c. (U.S.) and on Mar. 23, 2c. Merchants used to close their shops or prolong the siesta interval rather than accept this kind of money, so the government issued a decree that if they closed, they remained closed forever. The cost of running the mess at the mine was about $10 per month per man.

When the American troops entered Mexico after the Columbus raid, it was considered good policy to sleep with your boots on and your grip packed. *Gringoes* began to leave the country on various pretexts, and some of those who remained behind sent their wives out. Along the line to the border, crowds collected at the stations and howled for the blood of the *gringoes*. American newspapers came through irregularly, some (for example, the New York *Times*) hardly ever. San Antonio *Light* seemed the most regular. One American entering Mexico, who had an American paper in his pocket, was relieved of it at the border by a Mexican official. Americans are despised, and if one or two are in a car full of Mexicans, they are likely to be insulted. Even if there is no war, it will not be safe for Americans to return till something is done to make the Mexicans have more respect for foreigners.

Zapata has been rather quiet lately. It is said that he is working the Campo Morada Mine and making silver coins. His troops are close to Mexico City and surround El Oro district. Carranza sent Pablo Gonzales against him, and he captured Cuernavaca. Carranza then sent a trainload (about 300 people) to Cuernavaca to administer the government there. This train also carried much ammunition and a considerable amount of the new *infalsificable* paper money. Zapata held up the train, killed the men and old women, and took away the eligible women and girls, the ammunition and the new money, and probably has them still. This happened a few miles south of Mexico City, so it will be seen that the power of the *de facto* government does not extend very far. Trains on all lines are frequently held up and passengers robbed and sometimes killed and the train burned. Sometimes the train is only fired at. For this reason some people thought it safer to stay in than try to get out of the country. The government would not sell postage stamps unless one brought his letters and showed them to the attendant.

THE TANGLE OF CURRENCY

In May the export duty on bullion was raised to 10% ad valorem, the stamp duties were doubled, and mining taxes increased. At the same time millions of rounds of ammunition were purchased—from the United States of course.

Bills above the value of 10 pesos (Vera Cruz issue) were not good unless *resellado*. There were many counterfeits in circulation—even the re-seal being forged. Sometimes when one took his bills to the government to be re-sealed, they would declare them counterfeit and confiscate them. It is said that one intelligent bunch of bandits once stole the government printing press and made quite a lot of money before the authorities recovered it.

Mexican pickpockets are as clever as ever and are reaping a harvest in the overcrowded street cars in Mexico City. Boys at the mines rob the miners on payday. The law is that anyone found guilty of theft shall be shot, but in spite of this many *peones* takes chances and the law is not strictly enforced, otherwise the country would soon be depopulated.

As the result of a strike engineered by the *Casa Obrero Mundial* (a branch of the I. W. W.) and probably backed by the state or federal government, the miners at Pachuca got a raise of wages in May. Until then they had been getting about 3 pesos per day paid in Vera Cruz paper money, plus a *gratificacion*, or present, of 250%, plus a bonus for regular attendance, plus a certain quantity of maize at less than cost price, plus car fare to and from Pachuca. Under the new arrangement they get (if they work five days per week) 50% of their old wage paid in *oro nacional* or its equivalent in paper money at the official rate of exchange, maize at cost price, no *gratificacion,* and no car fare. Those who do not work five days per week will get 25% of their old wage in *oro nacional* or its equivalent. The mining companies will open stores and sell to their employees at cost This arrangement will considerably increase the cost of mining and milling. Let us hope that the price of silver will counterbalance this.

When the new money came into circulation, the newspapers operated or backed by the government called on people to be patriotic and hand in the old money to the government, who would destroy it and thus reduce the national debt. I am not aware that it was reduced to any considerable extent, so the government resorted to stronger measures.

On May 20 there was a general strike in the Federal District, which Carranza squashed by telling the strikers they would be treated as rebels if they did not go back to work. On June 1 the postage rates were raised to 10 centavos *oro nacional* or its equivalent for letters to Mexico and the United Streets. This is equal to about 5c. gold.

Owing to the refusal of the United States Government to withdraw Pershing's troops after their failure to capture Villa anti-American demonstrations took place in several towns, in one case at least led by the state governor and assisted by Carranzista soldiers. This finished up with the usual cry of "death to the *gringoes*." It is estimated that at that time there were about 15,000,000 Mexicans and 3,000 Americans in the country. From the tone of the government press *El Pueblo* and *El Democrata* it was evident that Mexico intended to fight whether the United States would do so or not. Of course this was Carranza's plan to consolidate his people. Up to this time the press had not said anything uncomplimentary about Wilson—rather the reverse—but it made up for lost time when it started.

MODERN MEXICAN FINANCE

In spite of the government's declaration that the Vera Cruz bills would be valid till the end of June for all purposes and after that for payment of taxes, railway freight and fares, on June 2 it issued a decree that bills of 20, 50 and 100 pesos would be of no value after June 5.

This was an easy way to reduce the national debt. Other hard-up countries might copy it. They explained that this would not hurt the poor man, as he would not be likely to have large bills. This is about the most foolish thing the so-called government has done so far. Of course the mining companies, business firms, clubs and private individuals were caught with large quantities of this valueless paper. As it was the day before the weekly pay, the companies had much money on hand which they had to throw aside and replace hurriedly with the *infalsificable* bills or Vera Cruz bills of small denominations. One large mining concern pays about one million pesos (old issue) per week. These *infalsificable* bills had to be bought from the government at the rate of 10c. (U.S.) per peso, that being the rate fixed by the government, which has put all the money changers out of business by decree.

I heard of one case of an army officer who knew that the government intended to repudiate these Vera Cruz bills. He went to a broker in the city and bought a draft on New York for $10,000 and paid for it in these bills, which were declared worthless next day. Of course the broker could do nothing. Probably he is now "broke." Might is emphatically right in Mexico at present. There were anti-government demonstrations, which of course effected nothing. The government announced a lottery scheme by which it would gradually redeem these bills, but everyone looks on them as worthless.

Food was scarce and dear in the city in June, and the only restaurant in which one could rely on getting a meal was the one in which three Carranzista officers were killed one night a few months ago. I believe that even that was closed shortly after I left the city. Meals cost about the same as in the States. The American Club seemed fairly well provided. Some foreigners had to live on beer and sandwiches for several days.

The shops appear to carry very small stocks of goods, but probably they have more in the background. The government has fixed the price at which foodstuffs must be sold, and owing to the unsatisfactory money position, merchants of all kinds wish to sell as little as possible—especially of imported goods, for which they have to pay real money. The less they sell the less money they lose. Some firms were fined for charging too much, and at least one large American firm either closed voluntarily or was closed by order. The scarcity of food is partly due to the fact that the producers do not care to sell for "money" that may be declared worthless at any moment. After the government repudiated the larger bills it was freely rumored that it also intended to declare the smaller ones no longer valid, so many people invested in duty stamps which they did not really require. Carranza and his gang have persistently persecuted the merchants, declaring that they are the cause of the scarcity of food. As a punishment, some of them were compelled to sweep the streets in Mexico City, and the newspapers had a picture of them doing so with a crowd looking on. By the way, rarely a day passes that these papers do not have a picture of Carranza on the front page, posing in some attitude or other.

There was a football match one Sunday between Spaniards and British for the benefit of the Allies' Red Cross at the Reforma Club, near Chapultepec. To see the well-dressed crowd one would not guess at the real condition of the country.

THE PUBLIC GARDENS

The Plaza de la Constitucion (Zocalo), in which there were formerly trees, statues and a band stand, is now a bare, open space. This will facilitate the shooting down of the people by machine guns on the roof of the National Palace, as was done during the *Docena Tragica.* The Alameda has not been injured and even now it is well looked after. Needless to say the new National Theater—that magnificent building of white marble—is still unfinished and is said to be slowing sinking, like the houses in the Avenida Juarez, the city being built on a bog. The new steel-frame capitol building is still in the same state as it was a few years ago. Cuernavaca, once a fashionable resort, is now in a filthy state. A man told me he saw horses and burros looking out of second-story windows.

The train on which I traveled to Vera Cruz did not include any Pullmans or their equivalent. The Mexican Ry. ("The Queen's Own") formerly had its own sleeping cars, but since the government took over the line, these have either been worn out or are being used on other lines, probably as homes for officers and their lady friends. But there were two carloads of soldiers—mostly on the roofs—besides those who traveled (on passes) in the first-class car. The train, as usual, was overcrowded, and to get a seat one had to be at the station before 5 a.m. Trains now run only in the daytime. At each station along the line a file of "soldiers" was drawn up, consisting mostly of old men and boys, dirty, ragged, barefooted or sandaled, with rusty rifles and belts of cartridges.

At one stage of the journey the soldiers on the roof started shooting at a rabbit and the officers in the train joined in firing through the windows of the car. Some of the passengers, thinking that the train was being attacked by bandits, followed the custom of the country and lay down on the floor. The rabbit escaped.

SAVING AN EXIT

The large bridge near Maltrata is guarded by a force of soldiers night and day. This part of the line reminds me of the Short Line from Colorado Springs to Cripple Creek. It is believed that Señor Carranza means to keep this line open if possible, in case he has to leave Mexico City like some of his predecessors, and that he has had part of the old prison of San Juan de Ullúa in Vera Cruz harbor, fitted up as a palace in case of emergencies.

The journey to Vera Cruz occupied 16 hours instead of the usual 10 or 12, and the fare was 108 pesos of Vera Cruz money. As no foreign engineers are now employed on the railroads, there is frequently trouble with the engine. After dark there were no lights in the train nor, as far as I could see, any headlight on the locomotive. Some hundreds of foreigners who stayed in Mexico City till ordered out by the United States Government had to travel in box-cars and cattle trucks and were 36 hours on the way. When they got to Vera Cruz, all hotels were full and they had to sleep on the battleship "Nebraska."

The buzzards are still a feature of Vera Cruz. It is said that they left when the American troops were in occupation, but returned the day the troops evacuated the city.

On June 7, in Mexico City the official rate of exchange was 4 pesos, Vera Cruz issue, for one peso *infalsificable.* On June 9, in Vera Cruz it was 8.30 pesos for one *infalsificable*, and a few days later 10 for 1. The government has stopped the *coyotes* (money changers) from depreciating the value of the paper and is now doing the same thing itself.

Some of the foreign business people in Vera Cruz were fined for giving and accepting American money in the course of their transactions. As a result, one shipping company would not accept fares in United States currency, although that had hitherto been the custom. One has therefore to buy Mexican money from the Government at 10c. (U.S.) per peso. In this way the government becomes possessed of real money with which to buy ammunition and line the pockets of the faithful. Neither will it allow banks to cash checks drawn in United States currency. The manager of the Bank of London & Mexico was arrested for refusing to accept Mexican paper money. But the best joke of all was that the government would not allow people who were leaving the country to exchange a draft on New York for American money or travelers' checks. Evidently they mean to force the new paper currency on the people, though it is of no value outside of Mexico.

One has to get permission to leave the country and has to tell them all about himself, and all baggage is carefully examined at the custom house to make sure that no gold or silver is being taken out of the country. On boarding the steamer your are met by an official who asks if you have any Mexican silver money in your possession, and woe betide you if you have. During the eight months that I have spent in the country I have seen only one piece of silver money.

If going to Cuba, one has to be vaccinated at the office of the Cuban consul in Vera Cruz, for which, strange to say, no charge is made.

There is little shipping business now at Vera Cruz. Wharves are deserted and the rails rusty. There are 30 or 40 hydraulic cranes falling to pieces for want of paint, and water pipes leaking at every joint.

The stone verandas of the warehouses near the harbor are occupied by dirty, half-naked women and children who pass the time hunting for vermin in one another's hair. Box-cars are drawn up near the harbor to catch the breeze, and also near the station, and occupied by officials and their families, while merchants and mining companies up-country cannot get goods forwarded. There are several large half-ruined buildings and dismantled boilers along the waterfront, in which women and children seem to live, and on the stone floors of the railway station and grass plots near-by I saw hundreds stretched out after dark. Of course it is hot in Vera Cruz in June. The street cars seem to be used more as a means of getting a breeze than as a means of getting from one place to another. In the cathedral on Sunday were many male worshippers without coats and some armed with knife and automatic pistol.

Before the steamer sailed, the passengers were examined (in a leisurely Mexican fashion) by the immigration officer. Heaven knows what for, except that Carranza has to find jobs for his supporters and they have to do something for their money besides swaggering around in a uniform. Also, there are probably a few drinks attached to a visit to an outgoing steamer, so the visit is prolonged beyond the sailing hour. I understand that Mexicans who are leaving the country are subjected to a close questioning as to why, where they are going and for what purpose. Not long ago Carranza issued a proclamation stating that Mexicans should not go to the United States to look for work, but should be patriotic and stay at home.

On the way out we passed the whole Mexican Navy—two small ships—at anchor inside the breakwater, and the "Nebraska" outside.

Mexico is in a bad way, but the sun still shines and the bands play in the plazas. It would be a fine country if there were no Mexicans in it. At present it is only fit for Mexicans.

⁂

Risk Not Assumed by Miner

By A. L. H. Street*

In an action to recover for death of a miner in the Joplin district, he having been employed as assistant to a roof trimmer, and the accident occurring through fall of a slab from the roof when a larger one was pried down, the Springfield, Mo., Court of Appeals has sustained judgment in plaintiff's favor on the ground of negligent failure on the trimmer's part to make a reasonable inspection to discover the probable effect of prying the large slab down. The court decided that decedent did not, as a matter of law, assume the risk of such an accident. (Fleming vs. What Cheer Mining Co., 186 Southwestern Reporter, 1115.)

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Miscellaneous Steel Production

The American Iron and Steel Association has issued Bulletin No. 4, which gives some statistics as to the production of various articles of finished iron and steel that were not included in the previous bulletins.

The production of tin and terne plates in 1915 was: Tin plates, 982,958 gross tons; terne plates, 72,978; total, 1,055,936 tons, an increase of 121,695 tons over 1914. Adding imports and deducting exports—which reached the high figure of 151,642 tons—the consumption of tin and terne plates in 1915 was 903,644 tons. There were 31 active works in 1915. Of the tin plates made 13,172,676 lb. were charcoal plates.

The production of galvanized sheets in 1915 was: Iron, 33,729,945 lb.; steel, 1,660,107,051; total, 1,693,836,996 lb. This is a decrease of 245,133,742 lb. from 1914. There was a large increase in the make of sheets in 1915, and the decrease given was due entirely to the high price of zinc, which caused the use of black or painted sheets in place of galvanized.

The production of rail joints and fastenings in 1915 was: Iron, 46,931 gross tons; steel, 423,793; total, 470,724 tons, an increase over 1914 of 98,182 tons.

The production of pipes and tubes in 1915 was, in gross tons: Black, standard 823,767; galvanized, 280,944; oil-country goods, 602,920; O.D. and miscellaneous, 115,113; boiler tubes, 96,930; total, 1,919,674; whereof 206,513 tons were made of iron and 1,713,161 tons of steel. Compared with 1914, there was an increase of 181,970 tons. The total of seamless steel tubes made in 1915 was 139,668 gross tons, whereof 63,488 tons were hot-finished and 76,180 tons cold-drawn. The total increase over 1914 was 49,073 tons.

The make of cast-iron pipe in 1915 was, including fittings, 1,211,870 gross tons, an increase of 54,090 tons over the previous year.

The production and consumption of nails of all kinds are reported as follows, in kegs of 100 lb. each:

	1913	1914	1915
Wire nails	13,559,727	13,132,814	14,583,026
Cut nails	842,038	769,665	775,327
Total production	14,401,765	13,902,479	15,358,353
Exports	1,062,362	885,843	2,146,353
Consumption	13,339,403	13,016,636	13,212,000

Wire nails were made in 1915 by 49 works and cut nails by seven.

The production of forgings in 1915 was, in gross tons: Iron, 2,814; steel, 520,909; total, 523,723 tons, an increase of 182,302 tons over 1914. The production of hammered charcoal-iron blooms and billets in 1915 was 43,121 tons, whereof 42,219 tons were for the marker's own use and 902 tons for sale. As compared with 1914 there was an increase of 1,696 tons.

⁂

The Refractory Zinc Ore Treatment Co. has been organized in Great Britain to put up a plant for the electrolytic production of spelter by the Isherwood process. It will be remembered that that process was tried experimentally at the Raritan Copper Works, Perth Amboy, N. J., a few years ago.

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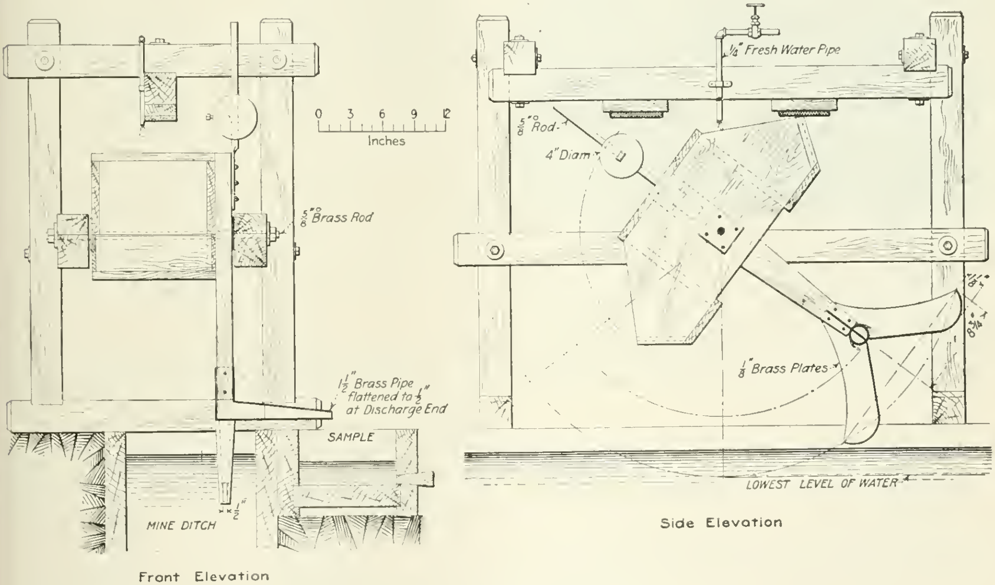
*Attorney at law, 829 Security Building, Minneapolis, Minn.

Details of Practical Mining

A Portable Water Sampler

By Fred M. Heidelberg*

The underground irrigation system installed by the Copper Queen Consolidated Mining Co. necessitated a method of sampling the solution in the ditch after it came from the irrigating beds and before it became mixed with the strong water from other parts of the mine. The following device proved satisfactory in accomplishing this end. Essentially it consists of a scoop on the end of a pendulum. Each time the pendulum oscillates, the scoop dips in the water, gets a sample and deposits it in a sample box at the side of the ditch. The accompanying sketch shows more clearly the details of the device. The entire pendulum consists of a right-and-left water pocket into which the water sample runs, a 4-in. iron ball on a ⅝-in. diameter rod for regulating the pendulum, the scoop and a ⅝-in. diameter brass rod acting as an axis for the assembled pendulum.



Front Elevation

Side Elevation

DETAILS OF SOLUTION SAMPLER

The box forming the water pockets is made of ¾-in. boards fastened together with brass screws; 3x3x⅛-in. brass plates are fastened to each side of the box and serve as a bearing for the ⅝-in. brass rod. The scoop is made of ⅛-in. brass plate cut to form two arms. One arm dips into the water for a sample when the pendulum oscillates in one direction, while the other arm dips out a sample on the return stroke. When the pendulum has come to rest, the slope of the arm is such that the water runs down to the partition of ⅛-in. brass plate between the two arms. This plate extends into the 1½-in. brass pipe, which is flattened at the discharge end so that it gives a slope down which the water runs from the arm into the sample box. The tipping of the pendulum is effected by feeding fresh water through a ¼-in. pipe. By regulating the flow of this water any frequency of oscillations can be obtained. Since each oscillation cuts out about 2 cu.in. of solution water, the size of the sample desired governs the number of oscillations.

The frame supporting the apparatus is made entirely of 3x3-in. timber dapped and bolted together. The bumping bar is likewise of 3x3-in. timber and is provided with a bumping block on which is tacked a piece of rubber belting. The function of the belting is to absorb the shock, which is small, however, with this kind of pendulum. It is to be noted that in placing this apparatus over a ditch, care should be taken not to allow the level of the water to go below the point at which the scoop will take up a sample. This level can be maintained by putting a small dam at a point in the downstream end of the ditch which at this point must be so widened that the water will go over the dam without raising the water in the ditch to overflowing. With a little care the necessary size for the widened parts can be easily determined. It is not a good idea to allow the snout of the scoop to touch the solution water while at rest, since the water as a rule contains ingredients that gradually eat away even the brass plates. In combination with the frame this apparatus seems to have great possibilities as a portable mine-ditch sampler. It can be moved to any ditch in the mine and a sample obtained. It can also be used in the different launders of the surface precipitation plant where it is desired to watch the precipitation in each launder.

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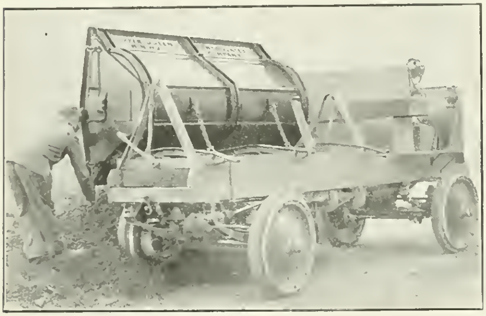
*Mechanical engineer, Copper Queen Consolidated Mining Co., Bisbee, Ariz.

The Jeffrey Quad Two-Way Side-Dump Motor Truck

The accompanying illustrations show a new army-type of 4-wheel drive, two-way side-dump body motor truck cars used by the Copper Queen Consolidated Mining Co., for whom they are manufactured by the Thomas B. Jeffrey Co., Kenosha, Wis. The illustrations tell their own story. The manufacturers claim that the driver can leave his seat, dump the load, replace and secure the body, and return to his seat ready for driving off in half a minute. It drives, steers and brakes on all four wheels. It is an interesting adaptation of motor-truck haulage to mining work.


THE JEFFREY "QUAD"

Tempering and Annealing*

By A. H. Hervey

An engineer is often called upon to make various tools and parts of machines which require a knowledge of tempering and annealing the various common metals.

Steel is roughly divided into four classes, according to the percentage of carbon contained and its capacity for being welded: Soft steel, which is not temperable but is easily welded; medium steel, which takes a poor temper and is weldable; hard steel, which is temperable and welded with difficulty; and very hard steel, which takes a high temper and is not weldable.

A tool of hard steel that requires shaping in a machine or filing should first be thoroughly annealed. To do this, heat the steel slowly and evenly to a dark red, then cover with ashes or powdered lime to allow it to cool slowly—the slower it cools the softer it will be. A quicker way is to use the water-annealing method. To do this heat the steel as before and hold it in a pair of tongs until all color is gone or so that when rubbed with a piece of clean pine it will no longer char the stick, then immerse it in a bath of cold water. It is now ready to be machined. Annealing weakens steel slightly, but renders it better able to stand shocks.

To temper or harden tool steel, heat it slowly and evenly to a red heat for about 2 in. from the cutting edge, then immerse it in a bath of cold water or oil to a depth of 1½ in. till the point is cold. Take the tool out of the bath and polish the scale or coating from the point with a piece of emery cloth or other abrasive, then wipe the surface with a piece of oily waste. Watch the polished surface as the color comes down from the hot shank. When the edge has reached the desired color, which can be learned only by experiment and test, immerse the entire tool in cold water. As a guide it is to be understood that the darker the color the softer the edge will be. The last operation is known as drawing. The proper color is to be determined then, by the use for which the tool is intended.

Soft or medium steel that will not take a temper can have its surface hardened to a depth of about a hundredth of an inch by casehardening. This is done by heating the steel to a dark red and placing cyanide of potash on the part to be hardened, then putting it back in the fire for a few minutes so that the cyanide will be absorbed by the hot steel, and plunging it in a bath of cold water.

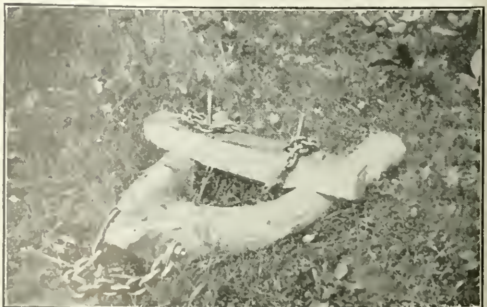
Copper and brass may be annealed by the opposite means to that used for steel—that is, by heating to a dark red and plunging into cold water or allowing it to cool in the air. If brass is heated too hot, it will fall to pieces. If properly done, brass and copper can be annealed many times without injury.

Shoe for Hauling Pipe or Timbers

By R. S. Bonsib*

We recently had occasion to haul several hundred feet of 3-in. iron pipe down a rocky mountain side. This was a difficult operation until the little device, shown in the accompanying illustration, was installed.

The shoe was made of a forked locust trunk, peeled, and the large end cut down to allow the passage of a 12x⅝-in. bolt. A piece of 4x4-in. oak lumber, about 2½ ft. long, was fastened to the fork by means of ½-in. drift bolts, to which were attached two ⅝-in. iron rods,


SHOE FOR HAULING PIPE OR TIMBERS

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*"Power," Aug. 1, 1916.

*Mining Engineer, Low Moor, Va.

about 8 in. long, which served as attachments for the chain. The threaded end of the pipe was fastened to the shoe by means of a chain, leaving the end with the sleeve to drag.

This shoe cost about $1.18 and nearly tripled the amount of pipe handled during the course of a day. It is now being used with the greatest success for hauling out props and other mine timbers.

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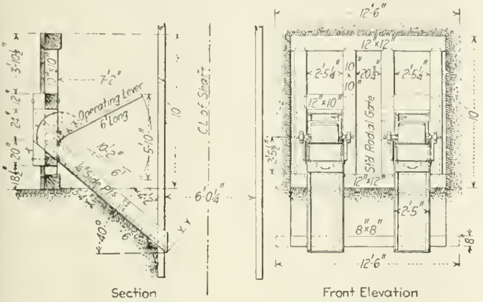
Santa Gertrudis Loading Chutes*

As the ore at the Santa Gertrudis mine, Pachuca, Hidalgo, Mexico, is free running and unusually fine, no measuring chutes are required. The accompanying illustration shows the type of chute used. With these chutes, having a radial gate operated by a hand lever, under favorable conditions the loading time is 15 to 20 seconds.



Section

Front Elevation

DETAILS OF LOADING CHUTE

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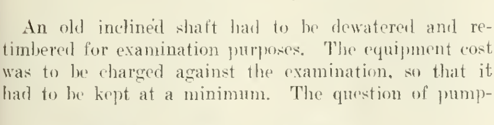
An Improvised Sinking Pump for Inclined Shafts

By Frederick W. Foote

An old inclined shaft had to be dewatered and retimbered for examination purposes. The equipment cost was to be charged against the examination, so that it had to be kept at a minimum. The question of pumping was an important one, as the inflow was considerable.



METHOD OF MOUNTING PUMP ON TRUCKS

A second-hand Worthington pump having a capacity of 50 gal. per min. was bought for $60. The base of the pump was bolted on two sets of wheels and axles, and a shackle was fastened to the lower part of the frame. This was done at the shop for $25, making the cost of the mounted pump $85. Wooden track was run down on the timbering. By means of flexible connections the water was lowered until a new set of timbering and headers were placed. The water was then pumped out as far as the suction would permit, and the pump was disconnected and let down to its new position and the piping reconnected. By the time the water had risen to the bottom of the headers the pump was in operation again. The water rose at the rate of about 2 ft. per hr., so that the pump could be idle long enough for the connections to be changed. By this means a shaft 130 ft. deep was successfully dewatered at a reasonable cost both for initial expense and for operation.

⁂

Sharpening Drills for Bad Ground

Sometimes when a miner encounters seamy or broken ground, especially when it is composed of hard, shattered rock, the ordinary drill, sharpened as shown in Fig. 2, does not give good results, for the edge is frequently driven into a crack so that it is practically impossible to loosen or remove the drill, says *Coal Age,* Aug. 5, 1916.

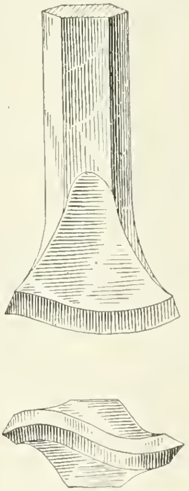


FIG. 1. SHOWING DRILL AS IT SHOULD BE SHARPENED

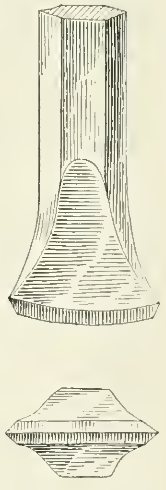


FIG. 2. THE OLD WAY OF SHAPING A DRILL

This difficulty may be overcome by sharpening the drill as shown in Fig. 1, where it will be seen that the corners have been turned back so that the cutting edge assumes a curved outline. Such a drill point as this will ride over ordinary cracks and thus prevent sticking.

⁂

Performance Tests of Power Plants have been investigated by a committee of the American Society of Mechanical Engineers, George H. Barrus, chairman. The result is a set of rules for conducting performance tests of power-plant apparatus, issued by the Society and relating to boilers, reciprocating and turbine steam engines, pumping machinery, compressors, blowers and fans, locomotives, gas producers, gas and oil engines and waterwheels. These codes represent six years of work in revising the former codes of the Society.

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*Excerpt from article by Hugh Rose in August, 1916, Bulletin, A. I. M. E.

Details of Milling and Smelting

Milling Scheelite-Gold Ores*

The scheelite-gold ores of Otago are handled by two main systems of milling. The first, involving coarse crushing of the ore, contemplates the recovery of scheelite primarily and of gold secondarily, whereas the second system, involving fine crushing, has as its primary object the recovery of gold.

Of the numerous mines in the district that have been exploited past the prospect stage, only three have ever attained a steady constant production; namely, the Glenorchy, the Golden Point, and the Highlay. The plans of ore treatment proved successful at these three mines have little in common, as will be shown.

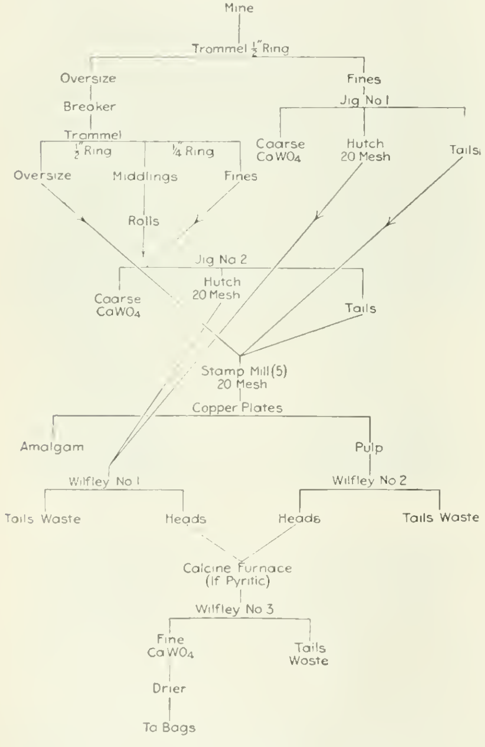

FIG. 1. GLENORCHY MILL FLOW SHEET

At the Glenorchy mine the scheelite occurs in a dense quartz gangue and has associated with it iron and arsenical pyrites. The scheelite has been deposited in the ore channel in distinct layers spaced irregularly through the barren gangue. When first resuming milling operations at this property in 1905, the recovery system followed was similar to that in vogue at Macrae's Flat, described later—stamp crushing and concentration. But after investigating the loss of slimed scheelite due to that system, the management changed to the present one, with excellent results.

The flow sheet of the present arrangement is shown in Fig. 1. Since the scheelite at this mine is very friable, the main object in this scheme is to avoid the former excessive scheelite sliming by obtaining products in the coarse stage from the jigs after subjecting the ore to the least possible amount of crushing.

The oversize that passes the second trommel contains, as a rule, very little scheelite, and this, with reject jig tails, is put through the stamp mill, from which it passes to the concentrating floor over amalgamation plates.

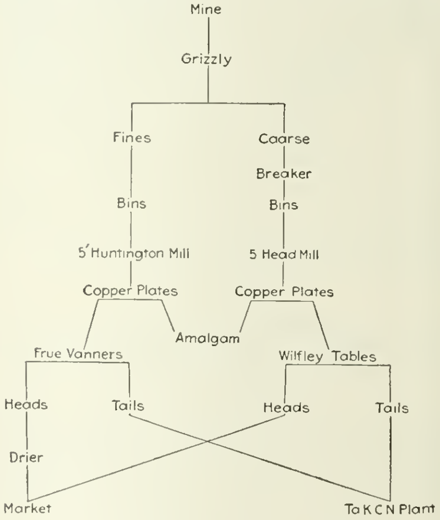

FIG. 2. HIGHLAY MILL FLOW SHEET

The hutch (20-mesh) product from the jigs is further concentrated on a Wilfley table. All concentrates, if pyritic, are then roasted in a cylindrical furnace and redressed to a 70% grade WO_3, the iron tails being sent to waste since their gold content is very low.

During eight years of operation, 1907-14, this mill crushed 5,400 tons, which yielded 547 tons of 70% scheelite and 125 oz. gold. This is an extraction of 7.09% WO_3 and £0.0087 gold per ton crushed, of a total estimated value of £59,138.

Costs are moderately low, being about 18s. per ton for mining and mill delivery and 4s. 6d. per ton for milling and dressing.

The two mills at Macrae's Flat, the Highlay and Golden Point, are both distinguished from the Glenorchy by subjecting the bulk of the ore treated to fine crushing before attempting to make a scheelite product.

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*Abstract from an article entitled "The Scheelite-Gold Mines of Otago, New Zealand," by C. W. Gudgeon, in "Proceedings," Aust. Inst. M. E., No. 21, 1916.

At the Highlay mine, exhausted in March, 1913, the production of 1,000 tons of ore per month was maintained constantly for years, from which the mill produced 4 tons of 70% WO_3 and 50 oz. gold—a recovery of 0.28% WO_3 and 3s. 6d. gold per ton.

The flow sheet of the mill is given in Fig. 2. The scheme devised by the management to eliminate excessive sliming of the scheelite was to put all the fines, containing quite 60% of the total scheelite content, through a 5-ft. Huntington mill. The hard, less valuable scheelite ore was crushed by 800-lb. stamps. Pulp from the Huntington mill passed over amalgamation plates to Frue vanners and from the stamps to Wilfley tables. Direct filling of the cyanide vats was tried unsuccessfully, and subsequently only the coarser sands were cyanided, slimes being discharged to waste.

Costs at this plant were very low, being about 3s. 9d. per ton. The plant was steam-driven, supplied with coal from its own opencut coal-pit, costing 1s. 8d. per ton delivered at the mill.

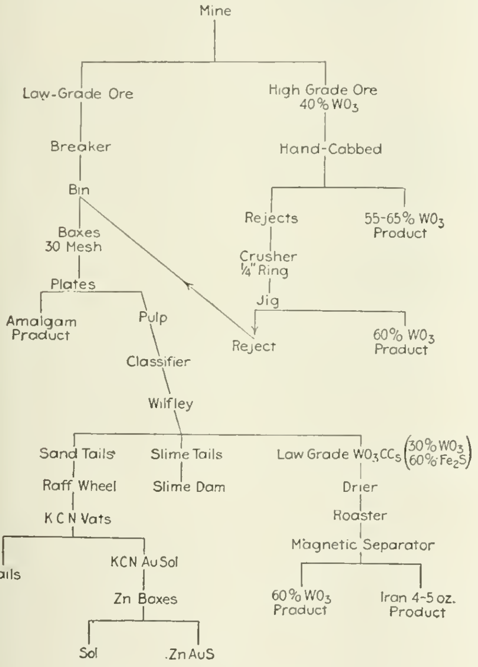

FIG. 3. GOLDEN POINT MILL FLOW SHEET

At the Golden Point the ore occurs in a quartz gangue and has associated with it besides gold, $CaWO_4$, FeS_2, As and S, a typical analysis being as follows: $CaWO_4$, 45.4%; iron compounds, 43.8%; SiO_2, 10.8%.

In the mine all the high-grade ore is bagged and sent to the surface separately, where it is hand-cobbed to a 60 to 65% WO_3 product and bagged for shipment, the rejects of this cobbing passing to the mill for treatment, as shown in Fig. 3.

The milling plant consists of a 55-b.hp. Cambridge suction-gas plant, a 10x7-in. rock breaker, ten 900-lb. stamps, feeders, Wilfley tables, raff wheel, power jig, 250-ton cyanide plant, 6-ft. cylindrical drying furnace, 9-ft. cylindrical roasting furnace, and Weatherill double-roll magnetic separator. This plant is suitable for treatment of ore from either the oxide or sulphide zones, a necessity since the lower mine levels have now reached 500 ft. where the scheelite is associated with pyrites.

Of the total gold in the ore averaging 12s. per ton, 46% is recovered from the amalgamation plates, 36% in the cyanide plant and 7% in the pyritic gold saved in the magnetic treatment. The average low-grade concentrate product of the Wilfley contains 30 to 40% $CaWO_4$, 50 to 55% pyrites and 10% SiO_2, averaging 2½ oz. gold, which concentrate constitutes from 0.5 to 1% of the total ore milled.

The magnetic-separation process in use consists of thoroughly drying the concentrates, then roasting the pyrites to the magnetic-sulphide stage, screening and separation.

In the magnetic separation 45% of the $CaWO_4$ and 21% of the SiO_2 present is deflected over together with the magnetic iron, while the machine is running with high amperage. This iron product is therefore submitted to a second roast and re-treatment, resulting in a clean iron product containing 5 to 6 oz. gold to the ton, and a $CaWO_4$ product 73.4% pure, containing approximately 61.2% WO_3.

Concentrates high in SiO_2 are jigged before going to the separation plant in order to bring the SiO_2 down to 10% or less, which is the premagnetic standard adopted.

The cost at these plants are moderately low, the average for 1,998 tons treated during the last quarter of 1914 being as follows:

MILLING COSTS PER TON

	s.	d.
Breaking, jigging	0	1.9
Stamping	2	3.9
Concentrating	0	4.0
General	0	3.8
Cyaniding	1	1.3
Magnetic separating	1	6.0
Total	5	8.9

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Blueprints Without Tracings

For making blueprints from pencil drawings I make the drawing on a good grade of light-weight unsensitized blueprint paper with an H or HH pencil, says F. A. Dew, in *American Machinist*, Aug. 3, 1916. This paper has a smooth, flat surface, stands erasing well, is cheap, and makes good prints on sun or electric paper.

Use black carbon paper, face side up, under the drawing, and main outlines or any special features can be shown up as clearly as if inked in. Dimension lines can be made without carbon, and will be fainter than outlines, and so different in appearance that it is easier to read the prints than where all lines are of the same density.

For typewritten bills of material, drawing lists, specifications and price lists, use the same paper with black ribbon and black carbon, and the prints will come out very good.

⁂

Antidote for Inhaled Chlorine—According to the "Chemical Engineer" the use of ammonia as an antidote after inhaling chlorine should be rejected, as it acts as a further irritant. A drink of bromo-seltzer or whiskey, or the inhalation of alcohol, chloroform or tetrachloride of carbon is much more effective.

Company Reports

Canadian Mining Corporation

The Canadian Mining Corporation, Cobalt, Canada, reports a production of 4,563,957 oz. of silver, the net profits amounting to $1,193,395 for 1915. This company owns the Cobalt Townsite mine, the Cobalt Lake mine, the City of Cobalt mine, the Townsite Extension mine and the Little Nipissing mine. Dividends aggregating $518,750 were paid during the year. The total tonnage treated at both mills operated by the company was 131,852 tons, from which 2,922,383 oz. of silver was recovered, giving a recovery of 86.22%. The high-grade ore yielded 1,641,573 oz. of silver. The following table gives details of the silver produced:

SILVER PRODUCTION

	Townsite-City Mine		Lake Mine		Total	
	Tons	Oz.	Tons	Oz.	Tons	Oz.
Shipping ore:						
High-grade ore	396.6	928,301	369.2	656,685	765.8	1,584,986
Low-grade cobalt ore	260.4	56,587	......	......	260.4	56,587
Milling ore	97,133.0	2,002,517	34,720.0	919,866	131,853.0	2,922,383
Total....	97,790.0	2,987,405	35,089.2	1,576,551	132,879.2	4,563,956

There were 14,476 ft. of drifts and crosscuts, 1,203 ft. of raises and 106 ft. of winzes run at a cost of $12.06 per ft. In addition to this development work, some diamond drilling was done at a cost of $3.23 per ft. The stoping cost was equal to 19c. per cu.ft. broken or $2.51 per ton broken. An average of 426 men were employed per day, of which 89 were engaged in milling, 305 in mining and 33 in miscellaneous work. For the total tonnage treated all labor employed in mining averaged 1.41 tons per man shift.

The total cost of power consumed was $144,333 o $1.086 per ton of ore. The accompanying table will give details of power costs.

In machine drilling there were 17,776 machine shifts of 8 hr. each worked, which includes time employed in setting up, tearing down, mucking back, staging, scaling, etc. The total number of working days for machines amounted to 309.5, giving an average of 57.4 machine shifts worked per day. The accompanying table gives detail figures on machine drilling during 1915.

The following table gives a comparison of costs for 1914, during which 132,879 tons was treated, and 1915, during which 107,385 tons were treated:

1914 AND 1915 COSTS

	Total Cost		Cost per Ton		Cost per Oz. in Cents	
	1915	9 Mo., 1914	1915	9 Mo., 1914	1915	9 Mo., 1914
Extraction	$231,853.43	$179,542.64	$1.74	$1.67	5.08	5.64
Development ...	58,370.03	90,108.00	.44	.83	1.28	2.83
Exploration	133,955.41	68,883.65	1.01	.64	2.93	2.16
Milling and reduction	446,221.46	260,400.73	3.36	2.43	9.78	8.18
Freight and realization	204,331.11	147,682.20	1.54	1.37	4.48	4.64
Administration and general...	104,651.85	83,064.94	.78	.77	2.29	2.60
Total cost at mine	$1,179,383.29	$829,682.16	$8.87	$7.71	25.84	26.05
Royalties, taxes, manager's commission and head office....	170,158.68	154,896.93	1.28	1.45	3.73	4.86
Grand total...	$1,349,541.97	$984,579.09	$10.15	$9.16	29.57	30.91

Powder consumption amounted to 355,623 lb., of which it took 1.866 lb. per ton of ore and stoping, 21.689 lb. per ft. of shaft sinking, 12.586 lb. per ft. of raising and 11.46 lb. per ft. of drifting and crosscutting. The general average consumption of powder per foot of development work

POWER CONSUMPTION—1915

Cost per ton is based on total tons treated, including high-grade ore

	Electric			Compressed Air			Steam		Totals	
	Kw.-Hr.	Total Cost	Cost per Ton	Cu.Ft.	Total Cost	Cost per Ton	Total Cost	Cost per Ton	Total Cost of Power	Total Cost per Ton
Lake drainage	454,700	$6,849.91	$0.052	160,000	$40.00	....	....	....	$6,889.91	$0.052
Water-supply	860,680	10,755.33	.081	....	....	....	....	....	10,755.33	.081
Drilling	......	....	....	141,895,040	34,954.93	$0.263	....	....	34,954.93	.263
Hoisting	......	....	....	37,368,521	9,200.73	.069	$2,947.49	$0.022	12,148.22	.091
Mine pumping	......	....	....	35,963,939	8,854.64	.067	....	....	8,854.64	.067
Blacksmith shop	......	....	....	13,332,618	3,282.59	.025	....	....	3,282.59	.025
Lake mill	1,633,973	12,253.71	.092	253,248	62.40	....	1,544.02	.012	13,860.13	.104
Lake lighting	75,998	638.94	.005	....	....	....	....	....	638.94	.005
Cobalt Reduction Co.	3,276,353	37,105.26	.279	9,983,030	2,573.88	.019	5,064.59	.038	44,743.73	.336
Cobalt Reduction lighting..	130,699	1,481.84	.011	....	....	....	....	....	1,481.84	.011
Heating	......	....	....	....	....	....	6 504.30	.049	6,504.30	.049
Other	......	....	....	888,520	218.93	.002	....	....	218.93	.002
Totals	6,432,403	$69,084 99	$0.520	239,844,916	$59,188.10	$0.445	$16,060.40	$0.121	$144,333.49	$1,086

MACHINE DRILLING—1915

		Number of Holes Drilled		Footage of Holes Drilled		Tons Ore Broken		Footage Advanced										
								Raising			Sinking			Drifting and Crosscutting			Grand Total	
	Machine Shifts Worked	Total Number Holes	Per Machine Shift	Total Feet	Per Machine Shift	Total Tons	Per Machine Shift	Machine Shifts	Total Feet	Per Machine Shift	Machine Shifts	Total Feet	Per Machine Shift	Machine Shifts	Total Feet	Per Machine Shift	Grand Total Feet	Per Machine Shift
Ore extraction:																		
Drifting ...	2.5	......	...	......	....	28.0	11.20	.....	.....	...	....	....	...	.....	......	...	......	...
Raising ...	22.0	......	...	......	....	117.5	5.34	.....	.....	...	....	....	...	.....	......	...	......	...
Stoping ...	11,484.0	61,247.5	5.33	329,562.0	28.64	91,942.5	8.01	22.0	23.5	1.07	....	....	...	2.5	7.0	2.80	30.5	1.24
	11,508.5	......	...	......	....	92,088.0	8.00	.....	.....	...	....	....	...	.....	......	...	......	...
Development.	1,858.3	15,87[illegible].5	8.54	79,876.5	42.98	......	....	534.4	495.0	0.93	91.0	48.0	0.53	1,232.9	3,399.5	2.76	3,942.5	2.1
Exploration.	4,408.5	41,317.0	9.37	206,374.5	46.80	......	...	604.0	708.0	1.17	33.8	58.0	1.72	3,771.7	11,077.0	2.93	11,843.0	2.6
Total and average.	17,776.3	118,445.0	6.66	615,813.0	34.64	92,088.0	8.00	1,160.4	1,226.5	1.06	124.8	106.0	0.85	5,007.1	14,483.5	2.89	15,816.0	2.51

was 11.617 lb. per ft. The total cost for powder, which includes grades containing 60, 50 and 40%, amounted to $49,146. The average cost of powder per sinking was $3.12 per ft., for raising $1.71 per ft., for drifting and crosscutting $1.61 per ft. The general average cost of powder for development work was $1.63 per ft. The cost of powder for ore stoped was 25.3c. and the total cost of powder for stoping and development of ore treated was 37c. per ton.

The capital expenditures during the year aggregated $100,610, of which $90,745 was written off as depreciation. Ore reserves are estimated at 101,135 tons, containing 3,937,000 oz. of silver. It is stated that the plant, equipment and physical condition of the mill is more efficient and up to date than at any previous time.

* * *

The Laurium Mining Co. of Michigan reports for 1915 as follows: Mine expenses, $1,002; mine taxes, $2,675; Eastern expenses, $1,455; interest, $724. Receipts were $1,200 from the sale of a lot, leaving a balance of liabilities at Dec. 31, 1915, of $19,313.

* * *

Cliff Mining Co. of Michigan reports an expenditure of $12,026 in development and exploration in 1915, miscellaneous expenses and eastern office of $1,271, and interest receipts of $1,031. This meant a decrease in net assets of $12,266, leaving net assets on Dec. 31, 1915, of $24,113. Diamond drilling amounted to 3,686 ft., of which 2,141 ft. was on the Ashbed lode. The lode was found to be 25 to 32 ft. thick, but practically barren of copper. Two holes were put down to explore the Calumet conglomerate and Osceola amaygdaloid, but no commercial copper was found.

* * *

The Right of Way Mines, Ltd., operating at Cobalt, Ont., reports for year ended Dec. 31, 1915, shipments of 308,627 lb. of high-grade ore, concentrates and metallics, carrying 102,274 oz. of silver with 24,057 lb. of ore on hand, estimated to contain 11,262 oz. of silver. Development work at the mine amounted to 522 ft. and 5,754 tons of ore were sent to the concentrator. Profits amounted to $12,662 from direct operations, and after adjustment of interest, general expense, etc., to $4,855. Extraction of low-grade ores will be carried on vigorously in the forthcoming year. A dividend of ½% was paid on Mar. 16, 1916.

* * *

Superior Copper Co. of Michigan reports treating 212,051 tons of rock in 1915 at a cost of $1.88 per ton, producing 18.23 lb. of copper per ton, or 3,866,484 lb. of copper. Mining expense was 10.31c. per lb.; smelting, freight, commission, etc., 1.91c.; interest, 0.07c.; a total of 12.29c. per lb. The copper sold at 18.125c. per lb., or $700,820, and silver sales were, $19,405. Mining expenses were $398,379; smelting, freight, commission, Eastern office, etc., $74,041, and interest was $2,788, leaving an operating profit of $245,017. The expense of acquiring 18,836 shares of the Lake Milling, Smelting and Refining Co. was $240,000, and assessments on account of this company were $5,615, making a decrease of $598 in quick assets for the year. The balance of quick assets on Dec. 31, 1915, was $216,275. Sinking amounted to 281 ft., and drifting and crosscutting to 4,199 ft. No. 1 shaft is now 2,469 ft. below the surface.

* * *

Allouez Mining Co. of Michigan reports dividends of $200,000 paid in 1915 (the first payments by this company) and an increase in quick assets of $599,988. The balance of quick assets on Dec. 31, 1915, was then $963,811. Comparative figures for 1914 and 1915 were as follows:

	1914	1915
Tons of rock treated	354,457	534,705
Cost of mining, milling and taxes per ton of rock	$1.538	$1.365
Pounds of mineral obtained	9,408,470	14,506,440
Pounds of refined copper	6,056,518	10,043,459
Per cent. of copper in mineral	64.37	69.23
Pounds copper per ton of rock	17.09	18.78
Mining expense per pound of copper	9.26	7.27
Construction	0.00	0.19
Smelting, freight, commissions, etc.	1.83	1.84
Interest paid	0.09	0.01
Total cost per pound of copper	11.18	9.31

There was 45 ft. of shaft sinking and 1,858½ ft. of crosscutting done in 1915. No. 1 shaft is now 3,544 ft. deep.

The La Salle Copper Co. of Michigan reports a decrease of assets of $15,522 in 1915, leaving a balance of assets on Dec. 31, 1915, of $91,636. A summary of its operations for the last three years is as follows:

	1913	1914	1915
Tons of rock treated	2,221	45,509	80,959
Pounds of copper produced	43,906	540,731	782,493
Pounds of copper per ton of rock	19.76	11.88	9.67
Feet of sinking	0	94	0
Feet of drifting	141.4	1,123.1	1,125.6

The copper produced sold for 18.22c. per lb. and silver sa amounted to $6,035. The deepest shaft is No. 1, 2,146 ft. down Stamp-mill facilities became available in July at the Franklin mill.

* * *

Tamarack Mining Co. of Michigan reports treating 217,027 tons of rock in 1915 at a cost of $2.52 per ton. From this 6,139,824 lb. of mineral was obtained, from which 3,888,150 lb. of copper was derived, or 17.9 lb. copper per ton of rock, and 63.33% copper in the mineral. Costs were: Mining, 14.04c.; construction, 0.82c.; smelting, freight, commissions, Eastern office, etc., 2.11c.; interest, 0.10c.; total, 17.07c. The copper sold for $742,796, leaving a net working profit of $78,988. The sale of the mill netted $230,000, making an increase in assets for the year of $308,988, and a net balance of assets as of Dec. 31 of $1,204,981. A total of 880 ft. of underground work was done. No. 5 shaft was 5,308.5 ft. below the surface at the end of the year. The report also deals at length with the offer of the Calumet & Hecla company to purchase the Tamarack stock at $3,563,486 or $59 per share, assuming and paying the debts of the Tamarack company and leaving it its stock in the Mineral Range R.R. This deal was blocked later by dissenting shareholders.

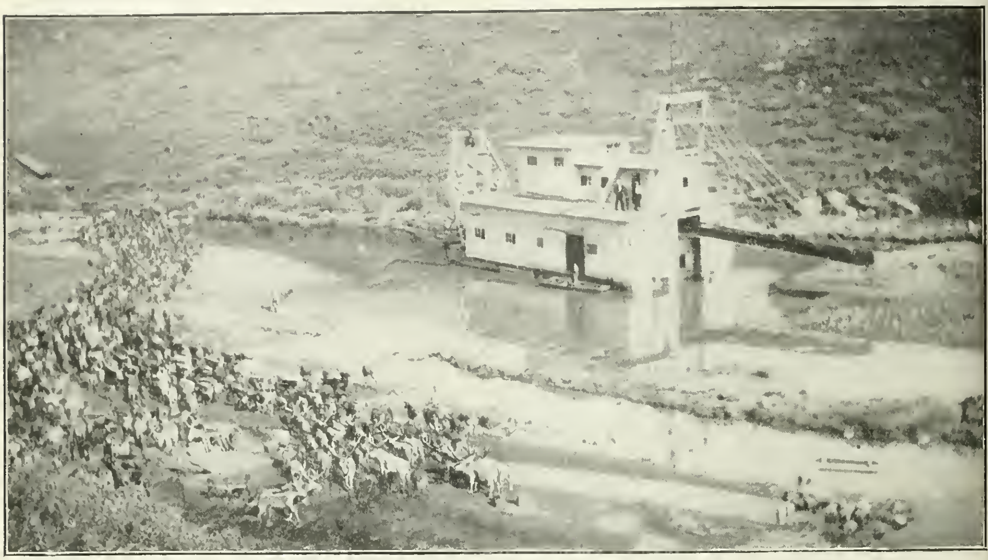
* * *

White Pine Copper Co. of Michigan reports treating 114,039 tons of rock in 1915, at a cost of $2.182 per ton of rock. From this 24.76 lb. of copper per ton of rock was recovered. Costs were: Mine expenses, 8.80c. per lb.; construction, 5.64c.; smelting, freight, commissions, Eastern office, etc., 2.04c.; interest, 0.16c.; a total of 16.64c. per lb. of copper. There was 2,824,145 lb. of copper produced, selling at 18.353c. per lb., a total of $518,319. There were 18,460 shares of preferred stock sold at par, $25, giving receipts of $461,500. Expenses as reported in gross do not agree with the costs per pound of copper as given above, probably due to some not evident method of considering construction costs. The figures as given are: Mining, $291,327; construction, $351,438; smelting, freight, commission, Eastern office, etc., $58,330; interest, $4,377, or a total of $705,473, equal to 24.63c. per lb. The balance of quick assets on Dec. 31, 1915, was reported at $139,786. Sinking amounted to 169 ft. during the year; crosscutting to 8,605 ft No. 2 temporary shaft was 183 ft. deep, No. 3 inclined shaft, 1,090 ft., and No. 4 was 978 ft. from the surface on Dec. 31. The stamp mill was put into commission in April, 1915. There are two units of a nominal capacity of $500 tons each.

* * *

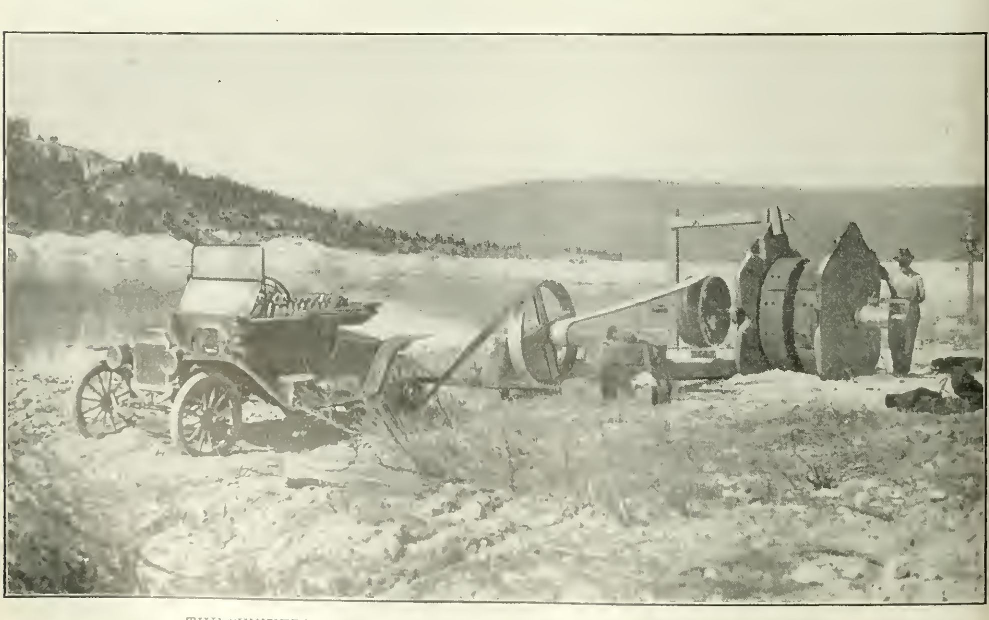
Buffalo Mines, Ltd., of Cobalt, Canada, report a net income of $231,344 for the year ended Apr. 30, 1916. The mill treated 37,152 tons of milling ore and 1,005 tons of sand and slime tailings, making a total of 38,157 tons treated. Of this, 30,079 tons was treated by wet concentration and averaged 19.8 oz. of silver per ton, with a recovery of 431,512 oz., and 8,078 tons was treated by concentration and oil flotation. This ore averaged 25.46 oz. of silver per ton and gave a total yield of 197,601 oz. The cyanide plant treated 6,340 tons of slime averaging 10.54 oz. of silver per ton and produced 55,161 oz. The total recovery by mill and cyanide treatment was 684,274 oz. The total production of silver for the year, including sales of silver, silver on hand and unsettled for at smeltery, amounted to 705,055 oz. The development work for the year consisted of 708 ft. of raises and 1,788 ft. of drifting. In the stopes 291,636 cu.ft. of rock was broken. The total shaft work to date amounts to 2,009 ft. Total drifting to date, 18,486 ft.; and the total area stoped to date, 2,657,542 cu.ft. Waste rock broken and used for filling amounted to 5,982 tons. There is broken and ready for extraction about 8,000 tons of ore in the stopes, 5,000 tons of unbroken ore and 5,000 tons on ore dumps on surface, averaging about 18 oz., 300,000 tons of tailings from the concentrator containing 1,600,000 oz. of silver, 3,000 tons of residue from treatment of high-grade ore containing in addition to silver valnes cobalt, nickel and arsenic. Satisfactory results have been obtained from experimental work conducted on the residue and tailings, and a flotation plant is being constructed with a capacity of about 600 tons per day, with the expectation of treating 450 tons of tails and 150 tons of mine-run ore per day during the coming year.

Photographs from the Field



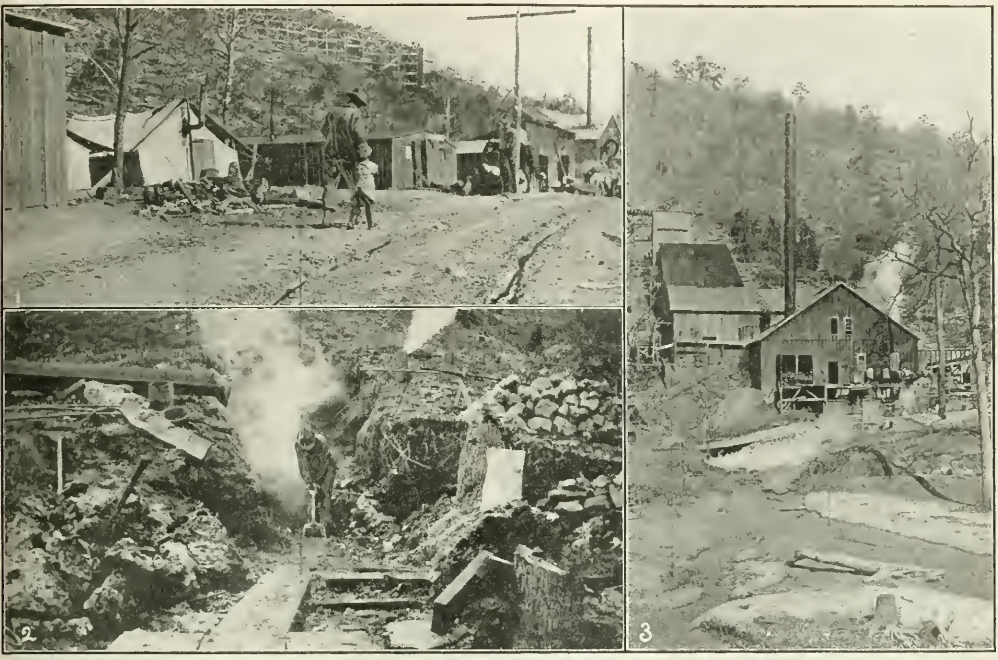
HERD OF REINDEER PASSING A GOLD DREDGE ON INMACHUCK RIVER, ALASKA

The reindeer seems to be animal of rare discernment. They linger about this Union Construction Co. dredge with white men in plain view. They are protected against harm or captivity by white men, but the Government allows the Esquimaux to hunt and herd them



THE "UNIVERSAL CAR" AT WORK IN THE DREDGING FIELDS OF ALASKA

Turning down a tumbler bearing. Dredge pond, 1,280-ft. face. Dredge in the left-hand cornor of pond not visible in this view



—Main St., Rush, Ark. 2—The Gloria mine, near Zinc, Ark., showing how the mines of this region are generally started; the rock pile at the right is high-grade ore. 3—The McIntosh mill, one of the few uptodate mills in the Rush district

The Morning Star mine, one of the oldest in the Rush district. It is practically a quarrying operation

Sure Pop, an important new producer in the Maumee district. It shipped over 2,000,000 lb. of high-grade oxidized ore in 1915

Morning Star Mill, one of the best in Arkansas

Sure Pop Mill—Two days after it began operating

VIEWS IN NORTHERN ARKANSAS ZINC FIELD, WHERE MANY NEW MINES HAVE BEEN OPENED SINCE 1915

Industrial-Preparedness Report

Three months ago the Naval Consulting Board of the United States appointed a committee on industrial preparedness with Howard E. Coffin, chairman. This committee immediately organized every state in the Union for the purpose of taking a great national inventory of the country's resources which could be drawn upon for the national defense in time of need. Such an inventory was a staggering task that well might have employed some organizations the length of a presidential term to accomplish. And yet this committee at the end of a remarkable three-months' campaign reports the task finished in some states and in many of the remainder from 75 to 95% completed.

The results are all the more noteworthy when it is remembered that the work has been accomplished with a volunteer, unpaid organization of engineers and businessmen. The engineers are members of the American Institute of Mining Engineers, the American Society of Civil Engineers, the American Society of Mechanical Engineers, the American Institute of Electrical Engineers and the American Chemical Society.

There are more than 30,000 manufacturing concerns in the country each doing a business of over $100,000 a year, and all of these are being inventoried for the purpose of ascertaining what material they are capable of producing for the fighting line. There are more than 5,000 mines of all kinds in the country, and although the inventorying of the products of these has been a mammoth job, the committee report shows the work practically accomplished.

Arizona was the first state to make complete returns through the organization headed by John C. Greenway, manager of the Calumet & Arizona Mining Co. In California, Chairman C. W. Merrill reports the work well advanced. In Colorado, Chairman R. B. Moore, of the Bureau of Mines, reports great progress. Chairman Stanley Easton of Idaho, manager of the Bunker Hill & Sullivan Co., reports the inventory virtually finished.

In Illinois, progress is being made rapidly on a very heavy job. In Chicago alone there are more than 500 chemical and metallurgical plants to be studied. The state organization is headed by Frederick K. Copeland, president of the Sullivan Machinery Co.

In Kansas, Chairman Whitaker, professor of metallurgy at the University of Kansas, reports that 95% of the state's resources will soon be inventoried. In Michigan the great work under Chairman Alex Dow, president of the Detroit Edison Co., has been split up according to territorial divisions. In the northern-peninsula mining counties the work is in charge of M. M. Duncan, director of the Cleveland-Cliffs Iron Co. The state inventory will be more than 90% completed by Aug. 1.

In Minnesota the work under Chairman H. V. Winchell is well along. In Missouri, Philip N. Moore reports that one of the state's chief contributions toward preparedness will be the output of its lead and zinc mines. Official maps have been prepared showing by reference numbers the locations of plants inventoried, railroad connections, etc.

The work in Montana under the leadership of E. P. Mathewson, manager of the Anaconda Copper Mining Co., is practically completed. Full returns from South Dakota will be made in the near future by Chairman A. J. Clark, metallurgist of the Homestake company. In Utah the work of Chairman W. C. Ebaugh's organization has been carried beyond the specific scope of the inventory, maps and drawings of great value to the Government having been contributed by many great mining and industrial companies.

Congress has now practically completed legislation that will carry out the entire program of the Committee on Industrial Preparedness of the Naval Consulting Board to establish a firm and enduring foundation for the nation's defense.

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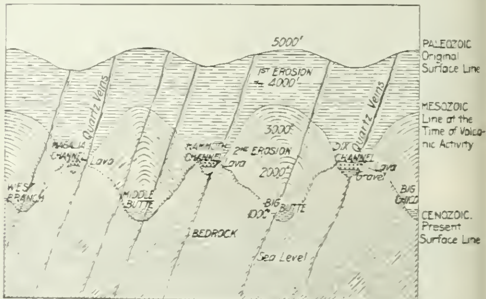
The Quartz Veins of Butte County, Calif.

By J. D. Hubbard*

Even though there are a few operating quartz mines many have wondered why the quartz veins of Butte County, Calif., are not more productive. Recently a strong operating company purchased a group of mines at Forbestown, centering on the Goldbank, which has been in operation for about thirty years. The erosion since the Paleozoic Age has been so great generally that the veins have been cut away to a great depth. This is true also of adjacent counties and is a condition in parts of California which must not be overlooked and of which a careful study must be made.



TRAVERSE SECTION, SHOWING PAST EROSION AND OLD RIVER CHANNELS

The recorded production for 1914, $1,700,000, places Butte County fifth in the list of gold-producing counties of the state. Of this amount about 80% was derived from dredging, about 10% from drift mining and 10% from quartz mining and pockets. The dredge production emphasizes the erosion theory. The drift mines have been neglected for some years, although famously productive in the past. Operating companies seem to be afraid of them as "the paystreak is considered elusive." But is that not so with mining in general? Have the present generation of mining men lost their nerve? It seems that a little of the pluck of the Argonauts is needed. It may be that a lack of knowledge of this particular class of mining is lacking. There is no necessity for this, as it is simply placer mining with underground methods.

The accompanying section gives an idea of past erosion, which seems to be unfavorable to the quartz veins but highly favorable to the ancient river channels in point of future gold possibilities. The modern streams have been pretty well worked out by the early-day miners.

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*Mining Engineer, Paradise, Calif.

Local quartz pockets are frequently found even yet; again indicating erosion to the observing. On the Willard claim, near Magalia, of a very pockety nature and worked by the hydraulic method, the third largest nugget in the state's history was found. This nugget weighed 832 oz. and was valued at $13,312. Another nugget weighed 132 oz., and many weighing from 5 to 11 lb. were also taken from this claim. Another great quartz fissure that runs for over 90 mi., the Mathewson dike, has been worked almost entirely by the hydraulic method. Quartz properties *per se* are not worked that way. And these big decomposed veins cannot be worked any other way without a lot of sorting.

In the foothills the gold is coarse, and the dredges in the valley get the "dust." This is only natural on account of the tendency of gold to "stay put."

It is not the object of this article to discourage the search for pay quartz in this locality, but rather to emphasize the possibilities of the ancient river channels, which received the cream of many ages of erosion in a country rich with gold. The richness of these accumulations of gold has been shown in many instances, notably in the Magalia drift mine, where the gold was literally shoveled up off certain parts of the bedrock.

The quartz veins in this county have a record of total production of many millions in gold, but the drift mines have produced more gold in the past than quartz mines and dredges combined. Much of the wealth of the modern streams came from the ancient rivers where they had been cut through and eroded by later erosions, and after the tilting of the main blocks.

It might prove advantageous for a large mining corporation to be formed to exploit drift mines only and confine its attention to them. It is safe enough and practical, and an unentered field, and the possibilities of large profits are very favorable. The drift mines are more economical in operation than quartz mines under similar conditions. The main thing is to get gravity workings if possible, when low-grade gravel may be worked at a profit. This makes the higher-grade parts clear gain. Water is indespensable of course but it is abundant in the foothill region. An expensive reduction plant is unnecessary, and simple common-sense metallurgy alone is required. Gravity and water are the keynotes. Tailings disposal is of the simplest, the coarse gravel, free from grade and water pressure settles at once, no restraining dams being necessary. There is generally a dry ravine handy for tailings disposal. Even the fine sands are readily checked with the gravel. There is a remarkable absence of clay and fine suspended material in the ancient channels, due no doubt to the natural classification of all streams where grade is concerned, and which tends to deposit all suspended material in the valleys below. A further source of profit are the black sands of the ancient channels, which carry platinum, iridium and gem stones.

Referring to the section, it should be considered as a traverse- rather than a cross-section, as the ancient streams ran generally in a southerly direction, while the modern streams run in a westerly. The tilting of the main blocks to the west after the great lava flows of the Tertiary period are responsible for this.

There are numerous quartz veins in this locality—in fact, a network of them—but they show unmistakable signs of "fissuring out," while in nearly all cases they are pockety in character, which makes mining uncertain.

We should certainly take advantage of what any locality best affords. It is the opinion of the writer that the drift gravel mines, or ancient river channel workings call to us unmistakably to explore intelligently and find for ourselves what they have to show us.

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Foreign Trade in Lead and Zinc

Imports and exports of lead and zinc during June, 1916, are reported by the Department of Commerce as follows:

Articles and Countries	Gross Weight, Tons	Contents Pounds	Contents Dollars
Imports:			
Lead ore:			
England	7	3,034	146
Canada	3,991	3,436,800	130,281
Mexico	1,210	651,632	28,035
Chile	1,584	863,489	34,536
Peru	211	168,042	9,308
Total	7,003	5,122,997	202,306
Lead-base bullion and bullion.			
Mexico, pounds	867,272	830,606	88,442
Lead—Pigs, bars and old.			
Canada	.....	1,100	33
Costa Rica	.....	114	4
Mexico	.....	2,539,682	182,749
Haiti	.....	258	9
Danish West Indies	.....	8,344	478
Chile	.....	4,799	240
Total	.....	2,554,297	183,513
Zinc ore:			
Spain	3,750	3,276,000	90,938
Canada	1,574	1,454,700	44,917
Mexico	13,557	9,078,563	488,704
Guatemala	36	32,000	949
China	61	62,261	3,839
Australia	3,384	2,121,612	127,297
French Africa	200	156,800	11,185
Total	22,562	16,181,936	767,829
Zinc in blocks, pigs, etc.:			
Costa Rica	.....	10,848	744
Panama	.....	2,189	306
Other British West Indies	.....	722	58
Cuba	.....	88,418	7,185
Mexico	.....	17,579	1,278
Haiti	.....	1,165	90
Dominican Republic	.....	1,043	57
Brazil	.....	118,779	12,107
Ecuador	.....	4,549	364
Total	.....	245,292	22,189
Zinc dust:			
France	.....	88,184	18,528
Japan	.....	98,738	23,054
Total	.....	186,922	41,582
Foreign Exports:			
Zinc dust	.....	45,254	11,339
Domestic Exports:			
Lead—Pigs, bars, etc.:			
Produced from domestic ore	.....	14,333,423	1,062,616
Produced from foreign ore	.....	644,073	29,185
Zinc—Pigs, bars, etc.:			
produced from domestic ore	.....	21,465,204	3,768,796
Produced from foreign ore	.....	10,917,865	1,070,261
Zinc plates and sheets	.....	1,152,659	267,860

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American Ozokerite Mining

The American need for ozokerite has heretofore been largely met by imports from the mines in Galicia, Austria, but as the war in Europe has seriously affected ocean transportation, interest in the domestic supply of this material has been stimulated. The deposits of ozokerite in Utah, the principal ones in this country, were visited by H. M. Robinson, of the United States Geological Survey, in September, 1914.

As described in the resulting report, the ozokerite is found in fissures and brecciated zones, principally in the Wasatch formation, of Eocene age. Tests made by the Bureau of Mines on six samples show their specific gravity, solubility, melting point and the fractional distillates they yield, and it is suggested that by boiling crude ozokerite with strong denatured alcohol a commercial separation of the refined product ceresin may be made.

Ozokerite is a nonconductor of electricity and is extensively used for insulating. Candles made from ozokerite have superior qualities. Much of the ozokerite mined is converted into ceresin, a highly purified product which is used to replace or mix with beeswax and has a variety of other uses.

A copy of the report—Bulletin 641-A—may be obtained free on application to the Director of the Geological Survey, Washington, D. C.

New President of Colorado School of Mines

Howard C. Parmelee, for 17 years active in scientific research in Denver and throughout the country, and widely known as a chemist, was elected president of the Colorado School of Mines at Golden, Aug. 10, 1916, succeeding William B. Phillips. He was chosen unanimously from among seven names considered by the board of trustees.

He is president of the Colorado Scientific Society, and for several years has been editor of the *Mining Reporter*. He is editor, also, of the *Western Chemist and Metallurgist*, and Western editor of *Metallurgical and Chemical Engineering*, published in New York.

Mr. Parmelee received the degrees of B. S. and A. M. at the University of Nebraska. He was chemist for the Union Pacific at Omaha for several years before going to Denver, in 1899. His services there include connection with the Globe and American Smelting and Refining companies.

He was one of the organizers of the Teknik Club of Denver and the Western Association of Technical Chemists and Metallurgists. He was secretary of the latter organization for five years.

He holds membership in Sigma Xi, honorary engineering fraternity; Tau Beta Pi, honorary engineering fraternity, Colorado School of Mines; Alpha Chi Sigma, chemical fraternity, University of Colorado; and the American Institute of Mining Engineers. Mr. Parmelee will assume the duties of president Aug. 15.

Michigan College of Mines Second Reunion

The second reunion of the alumni of the Michigan College of Mines, making the 30th anniversary of the founding of the college, was held at Houghton, Mich., on Aug. 8, 9 and 10.

Notwithstanding the unusual activity in metal mining at this time, which might have been expected to keep many from attending, very few were so detained and the attendance was gratifying, amounting to upward of 400.

The alumni themselves had a voice in making the program, and three days of perfect Lake Superior weather made it possible to carry out the plans according to schedule.

On Tuesday morning all registered in the official register of the alumni, a loose-leaf book presented several years ago by the Chicago Club and first used at the Panama-Pacific Exposition. Tuesday afternoon was given over to a general get-together on the campus, inspection of buildings and equipment and the renewal of acquaintances between men some of whom had not met for eight years. Also, that afternoon President and Mrs. McNair tendered a reception to visiting graduates and their wives. On Tuesday evening a smoker was held in the college gymnasium, during which an informal program of stunts was given. The evening opened with an address of welcome by James McNaughton, general manager of the Calumet & Hecla, and a member of the board of control of the college.

Wednesday, the second day, started with a parade organized according to the various clubs of the Alumni Association and led by the Calumet & Hecla band. A buffet lunch was served at noon in the college gymnasium. The afternoon was filled with a formal program of speeches, in which M. E. Wadsworth formerly president of the school, led off with a most interesting history of the early days of the college. A business meeting of the Alumni Association then followed, and in the evening the class dinners were held at various places in Houghton, Hancock and Calumet.

On Thursday, everyone was given the choice of two sight-seeing trips around the copper country. One took in a number of the mines between Houghton and Mohawk, while the other included the Ahmeek mill and the newer installations of the Calumet & Hecla at Lake Linden. Among these the dredge, regrinding, leaching and electrolytic plants were of particular interest, shown by the fact that two-thirds of the crowd selected this trip. The reunion closed with a dance at the gymnasium, Thursday night. Soon after, several hundred happy alumni were on their way to their jobs again, scattered from Maine to Arizona, Canada, to Italy and Honduras, vowing to return again five years later.

Chief Consolidated Costs

The report of the Chief Consolidated Mining Co., Tintic district, Utah, shows that there were total shipments of 42,144 tons of ore yielding, after the payment of transportation, smelting and sampling charges, $742,058. Average gross value per ton was $30.08, while the cost of smelting, freight, sampling, etc., amounted to $12.47, leaving a net average value per ton of $17.61. Total operating costs for six months amounted to $276,266. The cost for machinery and equipment was $14,996; for construction, $8,320; and other expenses and dividends bring the total up to $533,686. Total receipts amounted to $915,275, leaving a net balance on July 1, 1916, of $381,589.

Excessive Tax Assessments

Declaring that the courts will grant relief against a palpable overvaluation of mining property for the purpose of taxation, the Washington Supreme Court has decided that where gold and silver lands were purchased for about $25,000 and money was spent for development work, a valuation for a year in which a profit of $50,000 was derived should be reduced from $80,200 to $50,000, and valuations for succeeding years during which there was either a loss in operations or no development should be reduced from $80,000 and $40,000 to $10,000, exclusive of the value of improvements, $1,500. (First Thought Gold Mines vs. Stevens County, 157 Pacific Reporter, 1080.)

Correspondence and Discussion

Proposed Change of Mining Code

In response to your recent invitation for criticisms of the program of the Mining and Metal Society of America for the reconstruction of the United States mining code, I beg leave to offer the following remarks, necessarily cursory, as an adequate discussion would occupy several issues of the *Journal*.

Primarily, I disagree with the proposal for the separation of all public lands into mineral and nonmineral classes. Aside from the expense and delay incident to any classification at all, the practical results possible to achieve in this line are bound to be most inadequate. A geologist, without the use of prospecting tools, is unable to classify land accurately even for coal and regularly bedded deposits, while for other classes of minerals the difficulties of classification, by inspection alone, are still greater. Then, too, what one generation may consider worthless may later become valuable mineral—for instance, the carnotite beds of Colorado and the porphyry copper of Bingham.

But why need we bother with classification, when there is available the simpler system of the Napoleonic code, by whose operation the separation of mineral rights from surface ownership has long been successfully practiced in Latin countries? For our Federal Government to adopt this system, it would be necessary only to reserve all minerals remaining unclaimed in the granting of future patents to the national domain and to abolish the freehold system for mining land in favor of the leasehold. The latter system is considered the more stimulating to development, the more productive and the more equitable to society.

As to the size of a claim, the proposed 40-acre unit seems entirely too large. Its dominant advantage, of conforming to the Public Land Survey lines which are based on the 640-acre section, can be retained equally well by using any smaller unit obtained by dividing 640 by a multiple of two. It simply involves the fixing of a few more corners. Though there is much in favor of the Mexican unit of 1 hectare (2½ acres), it is likely the Peruvian units of 2 hectares (5 acres) for metallic and 4 hectares (10 acres) for nonmetallic minerals would be small enough for the convenient location of the minimum necessary area.

In the four proposals that the number of claims allowed to one locator should be unlimited, that no discovery of mineral should be required for validity, that all new claims should be speedily registered at the nearest Federal land office, and that no more lateral rights should be granted, I heartily concur.

The existing law, by allowing claims to be held by the locator's own statement of the work, performed puts a premium on perjury; and unless some more efficacious system of inspection can be established than the present one, the work requirement had better be abolished altogether in favor of the areal tax of Spanish America. If claims could be held by work alone and the excess of expenditure on one claim in one year applied without limit over other claims and future years such privileges would almost certainly be gravely abused. Such a law would allow any mine on which a million or so dollars had been spent to lock up a whole county from prospectors for an indefinite time ahead. The New York proposal goes as far in one direction as the decree of General Villa, which prescribed that there must be a continuous active work on every hectare held, went in the other.

Our adoption of the leasehold system for minerals need not necessarily mean a permanent Federal ownership such as prevails in Spanish America, whose nations have smaller territories and more centralized government than the United States. Indeed, leasing is the favorite system of exploiting the minerals of the Australian States.[1] As soon as any state had amended its constitution so as to separate mineral and surface ownership and prohibit the further alienation of public minerals, the privately located Federal mineral rights within its borders could be transferred to it. The transference of a private mining claim from Federal to state ownership would be the equivalent of the present patenting procedure and might well be done within the maximum limit of seven years, from date of location, as is proposed.

The suggested annual areal tax of $7.50 per acre ($300 for 40 acres) appears excessive. Would not the rate of $5 per acre be sufficient? In confining itself to metallic minerals the proposed law seems needlessly narrow, and I prefer to include all minerals within the limits of one uniform code, as Peru does. A convenient scheme would be to divide all minerals into two classes. In the metallic class could be included all underground metallic minerals, and in the nonmetallic class could be included metallic placers and all surface or underground deposits of nonmetallic minerals except the common earths, clays, sands and stones, which would accompany the surface ownership. Then the nonmetallic class could be legally handled just like the metallic class, except that its allowable size of claim could be doubled and its annual work (or tax) requirement per acre located could be halved.[2]

With my proposed leasehold system in effect, prospectors would in the future have to acquire from the landowners whatever surface rights they needed for mining. The public lands could be sold to miners, in the size desired, at the same rate given to farmers, but to facilitate the acquirement of private lands, all mining enterprises should be given the same right of eminent domain that is now enjoyed only by public utilities, as in Latin countries.

In conclusion, I would criticize the proposed law as more empiric than scientific in that it sets out to patch up the baseborn mining code of 1872 rather than to construct an entirely new code based on the correct relation of mankind to the earth in a democratic industrial society and the experience of other nations in handling their mineral lands. The whole proposed law also seems too much in awe of that bugaboo of the conventional lawyer, ancient "vested rights," which are too often but actual wrongs, that canker society at its vitals. Should not a new code hew to the line of scientific equity and refuse to continue hoary injustices or absurdities any longer than is expedient for all concerned? In this way we may continually harmonize our law with our social development and avoid any such destructive internal convulsion as we now behold with horror in Mexico.

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[1] "Mineral Laws of Australasia," by A. C. Veatch, Bulletin, United States Geological Survey, No. 525.

[2] "Natural Taxation of Mineral Land," by the writer, Min. and Scien. Press, November, 1915.

In my new book on Mexico,[3] there is explained a plan for the recovery (through progressive taxation) by the nation of its rights to nonmetallic minerals, which were mostly alienated by the venal mining law of 1883. All such minerals, not actually held for mining purposes, would thus in a few years revert to the government, and the whole unoccupied mineral area of Mexico would again be open to the prospector. R. B. BRINSMADE.

St. Louis, Mo., July 31, 1916.

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How to Sell a Mine

Your reference to this interesting subject in the *Journal* of July 29 is, as you say, just as pertinent as when first published in 1908, and from many letters received it is evident that your suggestions have been acted upon. I frequently receive communications asking if such and such a mining proposition would be of interest to my clients, from owners or operators who have undoubtedly obtained my name from the professional directory in the *Journal*.

While this may place the vendor in touch with some one who is willing to buy or develop property, there is another point of equal or greater importance; that is, a description of the property offered. An intelligent description of that for which the applicant is trying to secure capital is the last thing he thinks of securing and the first for which the capitalist asks.

It may be discouraging to the man with a mine to sell to read the reports of some of the larger companies telling how many hundred propositions they turn down annually, but should he make inquiry, he would probably find that 75% or more had been declined because insufficient data accompanied the report to enable the purchaser to form an intelligent idea of what the owner wished to sell.

While I have kept no record of these points, it is my impression that less than half the reports submitted to me are accompanied by any maps at all; property maps are not rare but full mine maps are so rare as to be interesting and cause one to hunt diligently through the accompanying reports for some indication of what had been found in the various openings shown. And when it comes to a complete sample map of a property that is for sale, this is so very rare indeed that when it does come an engineer experiences the sensation of having made a find even before he has had an opportunity to examine the figures in detail.

If the minds of owners could only be opened to the realization of the fact that a small amount of money spent in careful sampling, assaying and recording, produced much more satisfactory results than a greater amount spent upon a verbose, pseudo-geological report by an "expert" signing his name with B.S., M.E., member A.I.M.E., etc., etc., there would not be so many disappointed owners leaving New York after a vain endeavor to secure interest in their mining ventures.

The report by the owner or practical miner is generally about as useless. A man may know his mine from top to bottom and from end to end; he may know where to find new orebodies and know where they are absent, and yet, if unable to tell in simple language just what he has and what he knows, his knowledge will be of little use in selling his mine.

When an owner is told what it lacking, he is apt to feel that his integrity has been brought in question and can seldom be made to see that it is necessary or advisable to go to the expense of acquiring and furnishing information which the purchaser would have to duplicate in the event of the latter becoming interested.

This statement applies not only to the owners of prospects, small mines and to men of limited business experience, but to men of large affairs and owners of large mines. The information asked for by the purchaser is not expensive to secure, and is of as much benefit to the owner as to the purchaser.

Late in July there came to New York the representative of a gold-silver-copper property in the Southwest. The owners, who are known to a great many of your readers personally or by reputation, had made a report, the most interesting part of which was a small mine map showing certain areas mined out, with the tonnage produced from certain stopes and the smelter returns from those shipments.

As to the value of the material remaining in the mine, it was stated that 900,000 tons of $8 to $9 was developed, but not a single figure or drawing was given to enable the purchaser to form an idea, intelligent or otherwise, as to where such ore existed or how the value was determined.

The owner's representative, the superintendent of the mine, could throw no light on the subject. "The owners, whose reputation you know to be unimpeachable, have made this statement, and I consider that quite ample for securing the attention of financiers," was about all that the representative could say. The price was in the millions, several of them. The last heard it was going the rounds and meeting with the usual reception for lack of information and yet it may be something worth several millions in spite of the handicap given it by its owners.

You have told some of your readers where to look for buyers, please ask them also to tell what they have to sell. And the easiest, cheapest and best help in this direction is that offered by a complete sample map of the property.

Westbury, L. I., Aug. 2, 1916. F. F. SHARPLESS.

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Kennecott Copper Production

The Kennecott Copper Corporation produced 10,750,000 lb. of copper in July, 1916. The production for the last ten months, including July, is given in the accompanying table.

	Lb.		Lb.
July	10,750,000	February	9,750,000
June	10,500,000	January	10,000,000
May	10,500,000	December	10,500,000
April	10,500,000	November	10,000,000
March	10,150,000	October	10,000,000

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[3] "El Latifundismo Mexicano: su Origen y su Remedio," published by Federal Department of Fomento, Mexico City.

Editorials

The Threatened Railway Strike

During the last week the nation has been threatened by a combined strike of the railway engineers, firemen, conductors and brakemen, that would tie up the traffic of the entire country. The four brotherhoods stated plainly that it was their intention to do just that thing. This made a national emergency of the matter, and it was taken to the President of the United States, who intervened for the reason that it had become a national matter. Up to the time of our going to press, Wednesday afternoon, no solution has been reached.

The demands of the railway men crystallize in an eight-hour day and time-and-a-half for overtime. The existing organization of railway divisions does not permit of an eight-hour day and no overtime. Both the men and the managers know that the crux of the matter is the "overtime." The labor leaders see dangling within apparently easy grasp the acme of their present hopes and desires—namely, two days' pay for one day's work. The railways cannot stand any such thing with their present limitations. Here is where the interests of the public come into consideration.

The New York *Sun* put the case concisely and excellently when it said:

> Obviously, the eight-hour day means greater expense to the railroads; that spells higher rates for the public to pay. The treasuries of the carriers can pay out in wages no more than the public puts into them for transportation. Already the railroads have been crippled by regulation that limited their earnings on one side while it increased their expenses on the other. This has hampered their growth, impaired their service and restricted their usefulness to the public. Greater burdens must be offset by increased incomes; and the necessary revenues can be extracted from only one source.

This whole business is becoming well-nigh unbearable. Is a labor monopoly of 400,000 men, dominated by a few leaders, to be permitted to throttle the nation and jeopardize the interests of its 100,000,000 population? There has got to be some permanent settlement of this great problem, and it has got to be soon. When the four railway brotherhoods united in a common interest they directed their efforts toward the creation of a crisis, and the crisis has come.

Silver Price Fluctuations

The price of silver, which reached a maximum this year about the middle of May at 77⅛c. in New York and 37d. in London—the highest for many months—fell off gradually but with some variations to 63c. in New York about the middle of June. With various fluctuations it reached 61c. in New York and 30⅛d. in London on July 11, and has since varied between 61 and 63¼c. in New York, with no marked tendency visible. The demand for silver from the European mints which sent the price up in May was satisfied for the time being, though it is by no means at an end; at any rate the pressure to buy became less urgent, and supplies were more plentiful. There is every reason to believe that mint buying will be renewed before long, and that it will be more or less continuous for some time. The possible approach of peace will not stop it; indeed it may increase the demand when Germany and Austria may come into the market as free buyers. Both nations will probably need silver currency in large amounts.

The release of the mint buying pressure had something to do with the fall in price of the white metal, but another cause was active. The situation in the Far East—usually a heavy taker of silver—has been anomalous. India has not been a liberal buyer in the London market for some months; while in China the usual conditions have been reversed. Owing to the disturbed conditions in that country silver accumulated in the treaty ports, where it had been sent for safety, less being required for business purposes. At the same time the moratorium on debts granted by the government decreased the quantity required for current use. The Chinese sought to utilize the supplies thus accumulated and for the past two months China has been a seller and not a buyer of silver. Statistics do not show the exact quantity taken, but good authorities estimate that it has been not far from 33,000,000 oz.—13,000,000 oz. going to Russia and 20,000,000 oz. to India; the latter quantity, of course, being a direct deduction from the usual purchases in London.

This quantity of silver, it is thought, is near the maximum which China can spare, and it may not be long before buying for that country may begin. Much depends upon political conditions, but the circulating medium must be down to a low point now, and any revival in business activity will demand a large increase. The lower current prices in London serve to encourage Indian buyers, who have watched the market very closely and seem to come in on every downward reaction. Renewal of mint buying, which is possible and even probable at any time, may be expected to sustain or advance prices. Demand in this country for silver for use in the arts, especially for the silver salts used in photography, has been very good, much better than usual. Supplies are not overabundant, there being a considerable decrease in the quantities sent from Mexico, which has been only partially made up by the moderate increases in the United States and Canada. There is no pressure to sell silver, though there is sufficient disposition to supply the market with all that it will take. India is fairly prosperous and will turn to London again as soon as China has sold all she can spare.

So far as can be foreseen no important fall in prices is at all probable, and any considerable change will be in the other direction. The present speculative changes of a few cents at a time may and will continue as long as there is an opportunity to deal and a degree of uncertainty about the future. We do not anticipate a return to the high prices of May; much less to the level below 50c. per oz. which was current a year ago. Whether the approach or conclusion of peace may bring about radical business disturbances which would affect silver as well as everything else is a question on which there are widely divergent opinions. At present that seems too far in the future and too uncertain to affect the present position eriously.

Sampling of Spelter

In the *Journal* of July 8 we discussed the sampling of spelter, indicating the difference in the points of view of the producers and the consumers, especially the brass makers. We remarked that "the specifications of the American Society for Testing Materials require as to sampling only that *at least* 10 slabs shall be drawn." This was technically in error, for at a meeting of that society about the end of June, its specifications were amended so as to require that 10 slabs *shall* be drawn at random. Our editorial was written a month or more previous to its publication, and when it was published the report of the society's meeting had not come to our attention. It is probable that the matter came before the society in the same way that it came before us, and the society was quick to make its specifications precise in this respect.

In the new specifications the contention of the brass maker is upheld, and the producer making a guarantee of spelter is now required practically to insure that every slab will be within the specified limits. An ordinary carload—50,000 lb.—of spelter comprises 820 to 960 slabs, and in drawing only 10 thereof—2% or less—the idea of average composition is thrown to the winds. The only safety of the smelter will be what we suggested; namely, to remelt his spelter, unless it is being produced from an unusually pure and uniform ore. The producer of electrolytic spelter will have less trouble in this respect, for his cathodes have to go into a large melting furnace anyhow. Some producers of electrolytic spelter have already commented to us upon the noteworthy uniformity of their product.

The American Society for Testing Materials did another important thing at its last meeting; namely, the creation of a new class of spelter—"Selected"—coming in between Prime Western and Brass Special. This was simply coming into line with a custom that had developed in the trade during the last 18 months, during which time there has been great discrimination among spelters according to their composition. In fact, the official classification has been largely disregarded, spelter of the superior kinds having been sold to a large extent by specific analysis rather than by the official classification.

There are at present more disputes with respect to the sampling of spelter than in normal times, owing to the extraordinary trade conditions. Manufacturers were lately taking in spelter at 16c. per lb. under contracts made several months ago, the price for spelter having in the meanwhile declined to about 8c. per lb. If the manufacturer had purchased his spelter simply to cover orders previously taken for his own goods the cataclysmic decline was of no great consequence to him, although his failure to gage market conditions better might have been mortifying. If, however, the manufacturer had overbought his requirements—which to a considerable extent has proved to be the case—he was confronted by a stupendous, and possibly calamitous, loss. That has been, therefore, a strong motive for buyers to get out of their contracts if they could and naturally they have held sellers to the strict letter thereof. If a seller fails to make shipment at the specified time, his contract vanishes. This has been a feature of some of the foreign business, in which connection shipments have been hampered for a long time. The wise seller has, therefore lately been especially fore-handed. If he had contracted to ship some spelter in July, he endeavored to get it off in June and thus make sure of it.

In domestic business, and especially in business in brass special, the failure of a shipment to come within the guaranteed limits is seized immediately by the buyer as a sound reason for rejection and abrogation of the contract. An offer by the seller to replace the lot is not entertained. Of course, all business in spelter does not stand upon such a loose footing. In most cases the relations between buyers and sellers are amicable and are founded upon mutual good feeling and the desire to continue to do business with each other during years to come. In many cases, also, the failure of a shipment to come within the guaranteed limits is stipulated contractually to be not a ground for rejection, but simply for penalization according to a scale. It is, perhaps, a little unfortunate that the American Society of Testing Materials should have formulated a new rule at a time when market conditions were in such confusion and without giving adequate opportunity for discussion among producers and consumers, or rather among smelters and manufacturers, although both parties were represented on this committee by distinguished authorities.

The Proposed Copper Tax

Congress has not yet finished the making of the new tax law, and as yet nobody can say what it is going to be. The Senate evidently has made up its mind not to tax copper especially, being clearly impressed by the force of the arguments respecting the unfairness of such a tax. The latest idea of the Senate appears to be to levy a tax of 10% on the net profit in the manufacture of war munitions and a tax of 5% on materials entering into munitions. Thus both copper and cotton and many other things will be subject to a tax so far as they are used for munitions. The latter proposal embodies features that are both humorous and perplexing, and probably some of other kinds also.

The humorous feature is the realization that the proposal means a tax on cotton in so far as it enters into the manufacture of munitions. This excited the ire of the Southern senators, who had been not only complacent, but also eager, when the idea was to tax copper only. It makes all the difference in the world whose ox is being gored.

The perplexing features are the handicap that it puts on the domestic manufacture of munitions and the trouble as to how profits are to be determined. Looking at the first matter, copper sold to an American manufacturer of munitions will be taxed at the rate of 5% on the profits of its sale to munition manufacturers. The manufacturer will then be taxed 10% upon the profits of his business. But if the copper were shipped to Europe and there used in making munitions, it would escape all taxation. As one Republican senator expressed it, this is putting the "reversed English" on the protective tariff.

Looking at the other matter, how is the tax of 5% on the component parts of munitions to be determined?

According to one view, the miner, the smelter, the refiner and any middle man having to do with the business will each be subject to a tax on their profits. Thus also with cotton. But how is the copper miner or the cotton grower going to know whether his product is going into the manufacture of munitions or not, and in many cases how is he going to determine his profit? Another view, which appears to be that of the Finance Committee of the Senate, is that the only person or corporation to be taxed is the one that sells the copper or other products to the munition manufacturers. A natural consequence of this would be that the copper producers, like the cotton producers, would sell their product through brokers to the munition manufacturers, so that only the broker's profit would be taxed.

It is evident that a lot more thinking and tinkering has got to be done before Congress will be able to produce a workable excise measure upon the lines on which its thoughts are running.

BY THE WAY

Senator Sherman of Illinois is undoubtedly a brave man. In the Senate on Aug. 14 he characterized Samuel Gompers of the American Federation of labor as a "public nuisance" and added, "There is no more tyrannical, outrageous injustice than that of labor leaders who live on the sweat of other people's brows." Fancy the temerity of a senator saying such a thing!

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Recent news dispatches have directed attention to the proposed purchase by the United States Government of the Danish West India Islands. As part of the purchase price this Government, it is said, is to relinquish whatever claims it may have in Greenland in favor of Denmark. It is of interest to note that there is small possibility of mineral exploitation in the Danish West Indies, while there may be some of importance in Greenland. Like Alaska, Greenland may some day become a source of mineral wealth.

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A taciturn Hungarian drill runner, cordially disliked by the other miners, was given a one-man drill and a heading to himself by the discerning boss. But even there he could not escape the results of his unpopularity. One day some bright mind conceived the idea of filling the oil chamber on the Hun's drill with oil of asafetida while the Hun was bringing in a stull. Thereupon starting up his drill the asafetida quickly contaminated the drill exhaust, filling the heading with staggering fumes of rotten eggs. Presently the foreman on his morning round met the Hun on his way to the shaft with the drill on his shoulder. "Well, what's the matter with you now?" he growled, eyeing the drill sharply. "D——— drill sick," was the disgusted reply, "somebody give him poison."

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The New York *Sun* was in its best form when it wrote as follows about matches: We affirm that never since the invention of lucifers have the matches furnished to a free and independent people been so unfit, useless and dangerous as those that are in circulation under the misleading title of "safety" at the present moment. We do not refer to the waxed-paper abominations designed to burn the interior of the user's hand; these are no worse than they always have been, because deterioration in their quality and increase in the peril consequent on their use are impossible. We have in mind the common wooden sticks, brown tipped, which are alleged to strike only on the box and which as now compounded won't strike anywhere. Their stick are cut across the grain or else so crushed in preparation that they have no strength. The composition which habit promises will ignite them is of a granite consistency and tears the prepared paper from the side of the box. The inflammable material grows constantly less potent; the foiled striker scratches again and again with no result until in desperation he exerts his strength, acquires a light and has the pleasure of seeing the broken torch burn a hole in his coat or trousers or set fire to the papers on his desk. We expect to be told that the war has absorbed all match-head materials and that the manufacturers cannot get the stuff they need to make a satisfactory mixture. But the war had not necessitated the introduction of crossgrain sticks, knotholes or machinery that breaks the wood half way through before the ultimate consumer is permitted to endanger his life with the completed article. Nor is the war responsible for the ingenious device of affixing the chemical compound to the stick in a manner that allows it to drop off before the match is taken from the box or when it is applied to the striking surface. Probably the Gulf Stream must bear the burden of this. It is guilty of everything that is not charged to the war.

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Safety First

By John H. Carroll

The piston man in eighty-four,
Crimped caps between his teeth,
He's gone; you won't see him no more,
We're buyin' him a wreath;
When we said he'd get hurt some day,
He only laughed and cursed,
He'd still be walkin' round if he'd
Remembered "Safety First."

Mike Stark jumped off a movin' train,
Stepped on a pile of steels,
He lost his footin', down he came,
Fell underneath the wheels.
They had to cut a leg and arm,
He's done for now, for good,
But he'd a-never come to harm
Had he guarded as he should.

A Cousin Jack named Jimmy Ross
Was samplin' in a raise,
He, careless, put a board across
And said, "I hope she stays,"
And then away up near the top,
He loosed a bloody stull.
It was a ninety six-foot drop—
He smashed his bloomin' skull.

The raise-man, 'cross in thirty place,
Forgot to holler fire.
He'd surely got us in the face
If he'd been three feet higher,
The cut hole didn't throw much muck,
And so we got away;
And now we thank our streak of luck,
That we're alive today.

The fellows who've been thru the mill,
A workin' underground,
Say "Watch yourself," no others will,
They've tried—that's what they've found;
There's lots of things can happen,
But the commonest and worst,
Is to get yourself caught nappin'
And forget that "Safety's First."

NEW PUBLICATIONS

NATURAL GAS RESOURCES OF PARTS OF NORTH TEXAS. By Eugene Wesley Shaw and George Charlton Matson. With Notes on the Gas Fields of Central and Southern Oklahoma. By Carroll H. Wegemann. Pp. 129; illus. Bull. 629, U. S Geological Survey, Washington.

ABSTRACTS OF CURRENT DECISIONS ON MINES AND MINING, FROM OCTOBER TO DECEMBER, 1915. By J. W. Thompson. Pp. 74. Bull. 118, U. S. Bureau of Mines, Washington.

MINERAL RESOURCES OF MICHIGAN, WITH STATISTICAL TABLES OF PRODUCTION AND VALUE OF MINERAL PRODUCTS FOR 1914 AND PRIOR YEARS. With a treatise on Michigan Copper Deposits by R. E. Hore. Prepared under the direction of R. C. Allen. 6¼x9, pp. 359, illus. Publication 19, Geological Series 16. Michigan Geological and Biological Survey, Lansing, Mich.

INSTRUMENTS FOR RECORDING CARBON DIOXIDE IN FLUE GASES. J. F. Barkley and S. B. Flagg. Pp. 60, illus. Bull. 91, U. S. Bureau of Mines, Washington.

THE ANALYSIS OF NONFERROUS ALLOYS. By Fred Ibbotson and Leslie Aitchison. 5½x8¾, pp. 230, illus. Longmans, Green & Co., New York.

The authors, who are in the metallurgical department of Sheffield University, have aimed to produce a book which shall at once be of assistance both to the student and to the practicing analyst. It is the most modern textbook we have seen in applying modern physical chemistry to the discussion of the analyst's problems and seems well worthy of a place in the chemists library.

PATENTS RELATING TO OIL-FLOTATION PROCESSES. By R. S. Lewis and O. C. Ralston. Pp. 56, Bull. 8, Utah School of Mines, Salt Lake City, in coöperation with the U. S. Bureau of Mines.

A list of U. S. patents that have been granted, pertaining to flotation processes of ore concentration. No foreign patents are included, but since most foreign inventors have taken out patents here, the list is fairly complete.

THE CANADIAN MINING MANUAL, 1915. Edited by Reginald E. Hore. 7x9½, pp. 432, illus.; $2. Mines Publishing Co., Toronto, Canada.

The avowed object of this publication is to carry to other countries reliable information concerning the mines and mineral resources of Canada. The editor of the "Canadian Mining Journal" is peculiarly well fitted for such a task and, as confidently anticipated, the book is found to do the editor and his collaborators credit in achieving the apparent success of their object. The work gives statistics of production, mining company dividends and lists all the operating mining companies alphabetically. The main features of mining in Canada are covered by nontechnical descriptions easily understood by the layman.

LEAD AND ZINC DEPOSITS IN ONTARIO AND EASTERN CANADA. By W. L. Uglow. Twenty-fifth Annual Report of the Ontario Bureau of Mines, 1916, Part II. Pp. 56; with maps. King's Printer, Toronto.

The demand for metals created by the war has drawn attention to the extensive undeveloped resources of Ontario and has resulted in legislation by the Canadian government for the encouragement of the lead and zinc mining industries. The present report is based upon an examination made by the writer of mineral properties west of Quebec City and east of the western end of the Sudbury basin, special attention being given to occurrences in the southeastern part of Ontario. As the zinc and lead deposits of Eastern Canada are of different well marked types, a genetic classification according to mode of origin has been adopted. The report draws attention to certain areas which deserve a more thorough exploration than they have received, especially the deposits along the north shore of Lake Superior, which are regarded as particularly worthy of investigation on account of the presence of silver. At present mining operations for lead and zinc are being conducted in only three localities in Ontario and Quebec. The only market for the product of these mines is the electrolytic refinery at Welland, Ont., operating on a small scale. The lead smelter of the North American Smelting Co. at Kingston, Ont., has been idle for three years, although it is reported that it may shortly be blown in again.

THE METALLOGRAPHY AND HEAT TREATMENT OF IRON AND STEEL. By Albert Sauveur, professor of metallurgy and metallography in Harvard University and the Massachusetts Institute of Technology. Second Edition, revised and enlarged. 7x10½ in.; pp. 486; illus. Sauveur & Boylston, Cambridge, Mass.

The sale of two impressions in less than three years is not the only indication of the appreciation with which the first edition of this book was received. Anyone accustomed to visit metallographic laboratories, either in iron and steel works or at colleges, has learned to expect to see there a copy of Professor Sauveur's book always ready at hand; those who discuss the subject with the men practically engaged in the works' laboratories hear it quoted more often than any other book on the subject. The reason for this is not difficult to find: It is the only book that attempts to cover comprehensively both the manipulation and the theoretical side of metallography; it deals at length with the apparatus and manual operations of the art; it is written in language easily understood by those not yet versed in the subject; it is comprehensive, but without giving to any part of the subject more space than its practical importance warrants. Many men are now successfully practicing the art without any more training for it than a good general education, some experience in iron or steel works' laboratories and a diligent study of Professor Sauveur's book. It thus successfully reaches the ideals which the author had for it and expressed in the preface of the first edition.

The second edition is a material advance over the first one. In the author's own words, "It was to be expected that even after so short a period as three years there would be need of a revised edition that recent progress might be put on record and a more faithful picture offered of its present status." Thus much new matter has been added to every chapter of the book with the exception of the last four, namely, Constitution of Metallic Alloys, Equilibrium Diagram of Iron-Carbon Alloys, the Phase Rule, and Nomenclature. Under the headings "Apparatus," "Manipulation" and "Heat Treatment" the results are given of many recent discoveries and the subject matter has been greatly amplified and altered. Altogether the book has been increased about 20% in size, the equivalent of nearly 100 pages.

Those who have found the first edition useful may rely upon finding the second one still more so, even though they may possess a copy of the first issue.

NEW PATENTS

United States patent specifications listed below may be obtained from "The Engineering and Mining Journal" at 25c. each. British patents are supplied at 40c. each.

DRILL ATTACHMENT for Drilling Machines. Henry J. Smith, Florence, Colo. (U. S. No. 1,191,542; July 18, 1916.)

DRILL-OPERATING MECHANISM. Joseph D. MacDonald, Butte, Mont.; Frank C. MacDonald, administrator of said Joseph D. MacDonald, deceased, assignor of one-half to Cathrine MacDonald and one-half to Frank C. MacDonald, San Francisco, Calif. (U. S. No. 1,192,657; July 25, 1916.)

FIRE BRICK and Method of Making Same. Sven H. Nordin, Tacoma, Wash. (U. S. No. 1,192,099; July 25, 1916.)

FLOTATION—Process of Concentrating Metallic Ores by Flotation. Homer T. Yaryan, Toledo, Ohio. (U. S. No. 1,191,053; July 11, 1916.)

FUEL — Apparatus for Feeding Finely Divided Fuel. Charles Longenecker, Springfield, Mass., assignor to Quigley Furnace and Foundry Co. (U. S. No. 1,191,203; July 18, 1916.)

FURNACE—Grate Mechanism. James A. Bow and Peter Thill, Great Falls, Mont. and Archer E. Wheeler, London, England. (U. S. No. 1,191,272; July 18, 1916.)

FURNACE BINDING. James A. Bow and Peter Thill, Great Falls, Mont., and Archer E. Wheeler, London, England. (U. S. No. 1,193,109; Aug. 1, 1916.)

FURNACE CONSTRUCTION. James A. Bow and Peter Thill, Great Falls, Mont., and Archer E. Wheeler, London, England. (U. S. No. 1,191,271; July 18, 1916.)

GARNET—Process of Utilizing the Waste Products of Garnet Works. John Davenport, Brighton, Mass. (U. S. No. 1,192,394; July 25, 1916.)

GOLD EXTRACTION—Method of Extracting Gold. Albert W. Smith, Cleveland, Ohio. (U. S. No. 1,193,197; Aug. 1, 1916.)

HOT-BLAST APPLIANCE. Chester A. Orr, Cleveland, Ohio. (U. S. No. 1,192,102; July 25, 1916.)

MINE-SHAFT GATE. Frank P. McClain and John A. Futcher, Rillton, Penn. (U. S. No. 1,191,806; July 18, 1916.)

MOLD—Ingot Mold and Feeder. Bloomfield H. Howard, Aspinwall, and Ernest J. Turner, Pittsburgh, Penn. (U. S. No. 1,192,425; July 25, 1916.)

PHOSPHATES—Treating Phosphates. Christopher G. Memminger, Lakeland, Fla., assignor to Coronet Phosphate Co., New York, N. Y. (U. S. No. 1,192,545; July 25, 1916.)

PLACER MACHINE. Herman Fesenfeld, San Diego, Calif., assignor of one-fourth to K. L Kidd, one-fourth to C. T. Davenport, and one-fourth to A. B. Bowman, San Diego, Calif. (U. S. No. 1,193,248; Aug. 1, 1916.)

ROASTING—Rabble Arm. Harry H. Stout, New York, N. Y., assignor to General Chemical Co., New York, N. Y. (U. S. No. 1,191,848; July 18, 1916.)

SAMPLING—Apparatus for Sampling Ores. Fredrick O. Collar, Ashtabula, and Herbert E. Wetherbee, Cleveland, Ohio, assignors of one-half to Benedict Crowell and Charles B. Murray, doing business under the firm name of Crowell & Murray, Cleveland, Ohio. (U. S. No. 1,192,990; Aug. 1, 1916.)

PERSONALS

J. B. Tyrrell has been at Prince Rupert, B. C.

H. P. Henderson left New York on Aug. 16, for a brief visit to Cuba.

S. H. Dolbear, of San Francisco, is spending a few weeks in Eastern centers.

N. H. Plate has returned to New York from a four-month business trip abroad.

J. A. Bowman has accepted a position as chief chemist for the Andes Copper Co., at Chanaral, Chile

Edwin S. Berry will undertake independent consulting mining engineering in New York after Sept. 15.

W. H. Wright, of the Malm-Wolf Co., sailed from Seattle on July 3 for Alaska, where he will examine placer properties.

Chester W. Washburne has opened an office as consulting geologist in oil, gas and coal work at 66 Liberty St., New York.

Charles J. Gadd has been appointed chief engineer for the Lebanon plant of the American Iron and Steel Manufacturing Co., at Lebanon, Penn.

R. W. Leonard, formerly chief of the engineering staff of the Cerro de Pasco Mining Co., left the property about the middle of July for the United States.

George T. Snyder, chief engineer for the National Tube Co., at McKeesport, Penn., has been transferred to a similar position at the company's works at Lorain, Ohio.

Gen. Sir Alexander Bertram, of the Imperial Munitions Board, Ottawa, will shortly go West to inspect the copper mines in connection with the output of munitions.

A. G. Gullberg, superintendent of motive power for the subsidiary mines of the Calumet & Hecla Mining Co., Michigan, has just returned from a pleasure trip to Europe.

N. C. Whitten, recently foreman in the Anaconda's oil-flotation plant at Great Falls, Mont., has resigned to accept a position with the Cerro de Pasco Mining Co., in Peru.

René E. Hazard, a well-known mining engineer, joined the French army last February and is now acting as interpreter for two British regiments in department of the Somme.

Ward B. Perley, who has been assistant to President Farrell, of the United States Steel Corporation, has been made vice-president and general manager of the Canadian Steel Corporation.

Edward Thoruton, superintendent of Bush-Baxter mine, Twin Buttes, Ariz., has been transferred to Silverbell as superintendent of the Imperial mine of the American Smelting and Refining Co.

W. F. John, who has recently arrived from Honduras, has been appointed mill superintendent of the Tough Oakes, in the Kirkland Lake district, in succession to Charles Randall, who has resigned the position to go to Cuba.

T. R. Hunt has accepted the the managership of the San Juan Mines (Argentine), Ltd., Mineral de Salado, Rodes, Provincia de San Juan, Argentina. He expected to sail from London on Aug. 1 to undertake his new duties.

Sir George T. Beilby, F.R.S., the chemist and metallurgist, Mr. Edward Dent, Sir Robert Hadfield, F.R.S., the metallurgist, and Sir H. Capel Holden, F.R.S., the electrical engineer, have been elected to the council of the Royal Society of Arts.

Dr. Milton Hersey, of Montreal, has returned from a trip through the West, undertaken at the instance of the Canadian Northern and Grand Trunk Pacific railways, to investigate the natural resources and industrial possibilities of the country.

Charles A. E. Blanchet, of Ottawa, has been appointed by the Canadian government as a Commissioner to inquire into the causes of unrest in the asbestos mining industry of Thedford Mines, Que., and the relations between employers and employed.

Andrew Weir, of London, is visiting the Pacific Coast oil region. It is possible that Mr. Weir's visit has some relation to the recent permit given by the Commission of Corporations, authorizing General Petroleum to issue new stocks and bonds.

Harrison A. Dunn is still in prison in the City of Mexico. The latest advices of the Department of State in Washington are that his trial is being pushed by the Mexican authorities, that the American representative in the City of Mexico is exerting every effort in Mr. Dunn's behalf and is hopeful of an early release. Mr. Dunn is reported to be feeling better, both metally and physically.

OBITUARY

Cuno John Daman, of the engineering department of the Anaconda Copper Mining Co., died on July 13, of pneumonia. He was a graduate of the Colorado School of Mines, 1913, and was recently married.

C. E. Miller, a lessee in the Dead Pine mine, at Victor, Colo., met with instant death on Aug. 2, in a manner that can only be explained circumstantially. He was being hoisted alone in the cage, and it seems that he must have fainted and fallen so that his head was crushed against the shaft timbers. He was 45 years old.

Robert Belcher, 32 years old, an oil operator, resident of Berkeley, Calif., was drowned in a creek in the high Sierra. 40 mi. out from Huntington Lake, Calif., on July 24. Belcher was in company with G. W. Lewis and H. U. Maxfield and son, of San Francisco and Fresno. The accident was caused by Belcher's horse slipping from the trail into the creek.

William Henry Hooper, 84 years old, died at Coloma, Eldorado County, Calif., on July 24. He was a native of Ohio and went to California in 1851, stopping at Coloma, the point of discovery of gold by Marshall in 1848. He made his home there continually since that time and after following mining for a number of years, later became a fruit grower. He is survived by four children.

Thomas J. Drummond, of Montreal, one of the most prominent representatives of the iron and steel industry of Canada, died on Aug. 5 at Castine, Maine, where he was spending the summer. He was born in County Leitrim, Ireland, in 1860, and came to Canada with his family in 1866. He entered business life as a member of the firm of Drummond, McCall & Co., iron and steel merchants, established by his brother, George E. Drummond, with whom he was closely associated in his subsequent enterprises. The firm established the Montreal Wheel Works, at Lachine, Que., purchased the Radnor forges, and extended the business, establishing blast furnaces and foundries in Nova Scotia, Quebec and Ontario. In 1908 the Drummond group of iron industries were consolidated under the name of the Canada Iron Corporation with Mr. Drummond as president. In 1909 he became president of the Lake Superior Corporation, retaining that position for several years. He was interested in many other enterprises and in 1908 was chosen president of the Montreal Board of Trade. He was an associate member of the American Institute of Mining Engineers and a member of the Canadian Mining Institute. For some time previous to his death Mr. Drummond was in ill-health and had been forced to give up many of his activities. He leaves two sons.

SOCIETIES

Calgary Institute of Technology. A School of Mining has been organized in connection with the Calgary Institute of Technology. W. A. Davidson, M. E., M. Sc., has been appointed head of the mining department. He is a graduate of McGill University and has had practical experience in connection with coal mining in Nova Scotia and Alberta and occupied the position of manager of the International Coal and Coke Co., of Coleman, Alberta. He will undertake the organization of technical instruction in mining through the medium of classes in the mining centers of the Province.

American Chemical Society, at its New York meeting, Sept. 25 to 30, will conduct a symposium on occupational diseases, presided over by Professor Charles Baskerville, head of the department of chemistry of the College of the City of New York. The subject is interesting and important as well as full of surprises. Housemaid's knee, for instance, which for many years has served as a subject for humorous comment, proves to be a frequent malady of miners. Statistics bring the information that trades carried on in the presence of much dust show a high death rate from diseases of the lungs. The biologist explains that dust is not only minute particles, but that the particles are usually surrounded by a watery envelope, and that clinging to this filament there may be micro-organisms.

The symposium will consider the chemical trades, prophylaxis in chemical industry, diseases incidental to work in aniline and other coal-tar products, cedar lumber, mines, explosives, and a general discussion by the leading authorities of the country. These will include Drs. W. Gilman Thompson, F. L. Hofman, J. W. Schereshewsky, G. P. Adamson, H. K. Benson, W. A. Lynott, Alice Hamilton and Mr. J. B. Andrews.

Editorial Correspondence

SAN FRANCISCO—Aug. 9

Miners' Day at the California State Fair is scheduled for Sept. 6. Four teams in life-saving contests and 12 teams in first-aid contests are a part of the program. The contests will be under the direction of the U. S. Bureau of Mines and the California Metal Producers Association. The demonstration will serve the double purpose of attracting attention to the methods of mine safety adopted in California since the establishment of the mine-safety department of the Industrial Accident Commission by the appointment of a mine inspector acting for the commission and the Bureau of Mines conjointly, and to the mining industry of the state in general. The state fairs held annually at Sacramento have been almost wholly, though not exclusively, devoted to agricultural and horticultural interests. The farmer and the manufacturer of farm implements have held the center of attention and the mining industry has taken a back seat. This has been largely due to lack of interest on the part of mining men and the inclination of the managers of the fair to cater to the farmer. For the past 25 years and longer the mining men of California have done little to advertise the industry and practically nothing to attract investment, until within the past two or three years. Investors in California mines came without invitation and were looked upon by some as interlopers who were endeavoring to rob the old-timers of the property they were holding. The reopening of old mines by investors from other states and of other countries in the last 15 years and the great lack of interest in mining displayed by the present generation of Californians have shown the owners of old mines long idle the necessity for inviting outside investors and the utter futility of depending upon Californian investment. The mine-safety exhibits and the physical demonstration of mine rescue and first aid, it is hoped, will induce a larger and more comprehensive exhibit of the products of the mines at the coming state fair. That is one of the purposes of the demonstration and that will be the result if a proper spirit of coöperation is shown by mining counties.

Additional Oil Lands in California have recently been secured by three of the chief operating and marketing companies, the Shell, the Standard and the Doheny interests. The Shell company has taken over a total of 13,500 acres in Ventura County under agreements with owners and leasers and will thoroughly exploit the land; a field department office has been established at Ventura in charge of B. H. Van der Linden, geologist and field manager; two new test wells have been started. The Standard has made direct purchase of oil lands in the Whittier field, formerly operated by the Canadian Pacific, adjoining the Standard's Murphy lease, consisting of 60 acres; there are about 20 producing wells on the property. In the Maricopa field, the Standard has acquired 26 producing wells under lease for a period of 25 years; this is the property of the M. J. and M. & M. Also 40 acres of the old Wellman lease has been secured, to be operated on a royalty basis of one-fifth of production, in addition to a cash bonus said to amount to $250,000; this land is near the Monte Cristo property, purchased some time ago by the Standard. E. L. Doheny is reported to have closed a deal for the purchase of 400 acres at Casmalia, near the Santa Maria field, at a price said to exceed $250,000. It is believed that the property will be offered to the California Petroleum Co. and the Pan-American Petroleum and Transport Co.

BUTTE—Aug. 10

Opening of Anaconda's Zinc Departments will be the most important event of the summer in Butte mining circles. The company has practically completed its 2,000-ton zinc-concentrating plant at the Washoe works at Anaconda, and its large new electrolytic zinc refinery at Great Falls. One section of the refinery will be put into service now but it is probable that the entire Great Falls plant will not be ready for operation before Oct. 15 as there has been some delay in securing some machinery. The opening of the new zinc department of the Anaconda company is another step toward putting Montana in the lead in the zinc-mining industry. It has only been in the last three years that the Butte & Superior company with its great Black Rock mine and uptodate flotation mill has come to the front as the greatest zinc-producing mine in the world. This was followed by the establishment by the W. A. Clark interests of the Timber Butte mill and the development of the Elm Orlu, another great zinc producer. The latest move by the Anaconda company however has carried the zinc industry in Butte forward another step for it will place Montana not only in the lead as a zinc producer but also as a zinc-refining state.

Reopening of Butte-Duluth is in prospect, after having been idle for nearly a year and a half. On Aug. 7 Judge McClernan signed an order directing Receiver Everett to lease this property in the eastern section of the Butte camp to Alfred Frank and associates for a period of five years. They are to start operations within 15 days of date of lease, increase capacity of plant to 500 tons a day before August, 1917, and are to pay the company 50% of the net proceeds and retain the other 50%. After Feb. 1, 1919, company is to be paid from net proceeds at least $7,500 every three months; failure to make these payments gives receiver right to declare lease at an end. Mr. Frank and associates have lately been operating the Ohio copper mine in the Bingham district, Utah, under lease as the General Exploration Co. He was formerly engineer for the Heinze interests and is thoroughly familiar with conditions at the Butte-Duluth. Under terms of lease he will expend from $50,000 to $100,000 in completing equipment and getting property in shape for operation. The plan is said to be to install a flotation process in place of the electrolytic process employed in the original plant.

DENVER—Aug. 9

Reduction in Tungsten-Ore Prices has been announced by the leading producing companies in Boulder County. The new schedule is $15 per unit for 60% WO_3 with a scale sliding down to $9 per unit for 1% ore. Miners of the state are urging upon officials of the Colorado Metal Mining Association the desirability of Congressional action looking to the placing of a tariff on importations of tungsten, adequate to encourage continuance of mining for this metal. Directors of the association met in Denver, Aug. 9, and considered proposed legislation to be presented to the next session of Congress.

A New Tungsten Area in Colorado is suggested by the finding of a strong vein near Alma in Park County. On the J. G. Blaine, an old claim in Buckskin gulch owned by Harold Koontz, of Denver, the lessees Dan O'Connell, J. J. Shuck, J. E. Dollison and Alexander Davidson have opened a shoot rich in hübnerite. This mineral was identified three years ago by Mr. Dollison, the local assayer at Alma, in ore then being mined from this vein for silver. The same vein has been opened on the Esmeralda claim nearby and prospectors claim they have traced the occurrence of the mineral through Mount Bross and Mount Lincoln northeasterly into the upper Platte River gulch.

Two Dormant But Famous Districts—Creede and Querida—both silver producers, may be revived if present rumors materialize. The Mineral County deal is said to involve the Last Chance, Amethyst, Creede United and New York Chance mines which are under option to Eastern men who propose to drive a central tunnel and to operate the large acreage from one surface plant. In Custer County the old Bassick mine is the attraction. This is a mine that, in addition to having produced heavily in lead and some wonderful horn-silver ore, presents an interesting geological study. The oreshoots fill extinct geyser ducts, the ore being incrustations on the rounded and subangular fragments of trachyte eroded from the walls and now cemented together with a mud that is kaolinized. Besides silver, the coatings of the pebbles contain various minerals of zinc, pyrite, galena, chalcocite and some sylvanite.

SALT LAKE CITY—Aug. 10

The Geological Survey in Big Cottonwood Cañon, now being conducted by the U. S. Geological Survey, has reached Silver Fork and South Fork in the neighborhood of the Cardiff mine. Considerable detailed mapping will be necessary. B. S. Butler, who reported on the geology of Beaver County, is in charge of the survey of the Alta-Cottonwood district.

The First Reduction in Wages—raised several times in the last year, with the rising prices of metals—has now been made by various Bingham and Tintic properties, following the recent lower price of copper. This reduction of 25c. per day was stipulated at the time the increases were made. The Utah Copper Co. has posted notices to this effect at the mine and at the Magna and Arthur plants. The reduction in Tintic is caused partly by the lessened demand for certain classes of ore as well as by the fall in the prices of metals.

Sale of Ohio Copper Co. Property at Bingham and Lark on Aug. 29 is advertised by the sheriff to satisfy a judgment obtained some time ago by the bondholders. The mining claims will be sold at 10 a.m. at the Salt Lake County court house, and the mill and other property in the afternoon at the Lark mill. It is thought that the property will be bid in by the bondholders, although there is a possibility that other mining interests in Bingham may acquire a part of the claims. The property has been advertised in detail in the papers, and under the advertisement it is stated that the purchase price shall be payable in lawful money of the United States, except that the purchaser of any property, after payment in money of proportional share of the costs, may answer his bid with the bonds and coupons of the Ohio Copper Co., upon which judgment was given, and which shall be received in payment for an amount equal to the money to which the holder will be entitled on distribution of the purchase price paid at the sale. The General Exploration Co, which had a lease up to May 20, 1916, is still operating the mine and mill, but the property will be turned over as soon as reorganization has been effected. The leasing company, under the management of Alfred Frank, has been mining and milling 2,240 tons of ore daily, that carried about 21 lb. copper to the ton. The copper minerals are finely disseminated in hard quartzite, making a high recovery by water concentration difficult. Under present milling practice a recovery of about 11 lb. copper per ton was made. Mining by caving has been done very cheaply, the costs being around 22c. per ton, with 16c. per ton transportation charges, through the Mascotte tunnel, to the mill. Copper production has been around 725,000 lb. per month, and operating profits on 27c. copper have been estimated at $101,000 a month. Royalties amounting to $15,000 monthly were paid by the lessees. There was a sliding scale which called for 10% royalty on 16c. copper, and 2% additional for each 1c. increase in the price, making a royalty of 32% with copper at 27c.

FLAT RIVER, MO.—Aug. 8

The Madison County Silver Mine is finding some excellent ore. This mine, worked many years ago for silver, is being reopened by a New York syndicate. The ore consists of argentiferous galena, sphalerite, and wolframite occurring in a quartz vein cutting granite. The tungstic-acid tenor is about 3%. A mill is being constructed and the ore will be treated with stamps, tables and flotation.

New Means of Disposal for Mill Slimes are being adopted by mining companies in the Southeastern Missouri lead district, as it is necessary for the companies to stop emptying the slimes into Big River, the main drainage stream of the district. The St. Joseph Lead Co. is now building a settling basin at Bonne Terre for this purpose. Chat is being used for the dam, which will be approximately 50 ft. in height. The basin will cover about 25 acres. The other lead companies are building similar basins. The slimes will be allowed to settle in the basins, the clear water filtering off through the chat dams.

July Was a Prosperous Month in the Southeast Missouri lead belt, despite the decline in the lead market. All the operations were running to capacity and there were no labor troubles, except for a two-days' strike at the Hoffman, a property of the St. Joseph Lead Co., at which place the miners went back to work after withdrawing their demands. Wages are good, the miners and mill men getting a bonus of 30%. Labor is plentiful as many men are coming into the district from Joplin. The two principal smelting plants, that of the St. Joseph Lead Co., at Herculaneum, Mo., and that of the St. Louis Smelting and Refining Co., at Collinsville, Ill., are now getting all the lead concentrates that they can handle.

Much New Metallurgical Equipment is being tried in this district. Butchart riffles and tables are being extensively installed throughout the lead belt. Mr. Butchart has been personally superintending the installations. The St. Joseph Lead Co. and the Doe Run have placed these riffles on all of the Wilfley tables. The National and the Desloge companies are replacing their old tables with Butcharts. The Federal Lead Co. is reported to have recently closed a contract with Mr. Butchart to supply half of the tables for the new mill. The Butchart table is proving generally satisfactory, making a clean tail and a high-grade concentrate. Each table handles from 65 to 75 tons of material daily. Other metallurgical machinery now being tried out in this district is a Marcy ball mill at the Rivermines plant of the Doe Run Lead Co.; and a Hardinge mill at the Bonne Terre concentrator of the St. Joseph Lead Co., using a feed of jig middlings. Flotation has been coming to the front rapidly. The Minerals Separation and Callow machines are both used. All of the companies are carrying on tests with various oils in their laboratories, and it is reported that the St. Joseph Lead Co. will soon build an experimental laboratory and fully equip it with the necessary apparatus for flotation and mill-experimental work. Oliver and Kelly filters, and steam driers are used to dry the flotation concentrates.

JOPLIN, MO.—Aug. 12

Curtailment of Zinc Ore Production in this district is not so great as is indicated by the turnins. Reports are based on sales and shipment and the smelters have been buying so lightly recently that the bulk of sales has been small. There is a constantly swelling surplus of ore, and while numerous mines are down, others continue to operate and pile up a reserve.

American Zinc, Lead and Smelting Co. plans extensive development of its recently acquired Granby land. Although definite announcement has not yet been made by officials of the company, it is known that one mill, to be the largest in the district, is contemplated, and also one or two other mills. The big mill is to be built south of the camp of Granby, where recent drilling showed unusually rich deposits. The mill, it is said, will have a capacity of 2,000 tons.

Joplin Ore and Spelter Co. has completed two additional blocks at its Pittsburg, Kan., smeltery. The blocks are of 224 retorts each, and bring the total number of retorts at this plant to 1,792, with a capacity of approximately 14,380,000 lb. of spelter per annum. The new smeltery of the Picher Lead Co. at Henryetta, Okla., is also virtually completed, but it is understood will not be started until some solution of the wage problem at the other Henryetta smeltery has been made. At present only one block is being operated at the latter plant.

PLATTEVILLE, WIS.—Aug. 12

The Camp of New Diggings, 2½ mi. southeast of Benton, is developing into one of the largest shippers in the district. It was a large lead producer in early days, after which it remained inactive until a year ago. While not on the railroad, a good macadam road has been built to Benton station and large Garford trucks handle as high as 100 tons daily or 500 tons a week per truck, bringing the haulage cost down to less than 25c. a ton.

BRAINERD, MINN.—Aug. 12

I. W. W. Labor Disturbances have finally reached the Cuyuna district. On Aug. 7 the Croft mine was shut down, and other underground operations on the range have since pursued the same course. The Kennedy mine at Cuyuna still continues to operate, although short-handed. A peculiarity of the so-called strike on this range is the fact that no formal demands were ever made on the mine operators. The strikers simply ceased working and began parading, without meeting the operators or discussing the matter in any way. From statements made by the strike leaders it has been made public that they demand an 8-hr. day, going to and from the work on the company's time, $3 wage per day in dry places and $3.50 in wet places, with no contract work. On Aug. 11, the first lawlessness occurred when a number of shots were exchanged. The offenders were promptly lodged in jail at Brainerd and 75 deputies are now maintaining order. The business men both of Crosby and Ironton have organized to assist in enforcing law and order, and ordinances have been passed prohibiting public demonstrations or parades.

TORONTO—Aug. 12

An Embargo on the Exportation of Mica and micanite to destinations outside of the British Empire has been established by the Canadian government. Special licenses may, however, be granted for the exportation of Canadian mica and micanite consigned to the order of the British consul general, New York, when the purchasers are approved by him and have furnished the required guarantees.

The Nickel-Refinery Site is not yet definitely settled The report that the Interntional Nickel Co. would proceed at once with the erection of the refinery on the optioned site at Port Colborne, Ont., the Lake Erie port of entry of the Welland Canal, is apparently premature. Hon. G. Howard Ferguson Ontario Minister of Mines, states that although the company has secured an option on the Port Colborne site, the locati of the plant there has not been finally determined and tha other proposals are under consideration. The agitators for th refining of all nickel in Canada strongly object to the locatio of the plant at Port Colborne on the ground that it is too ne to the American border. Strenuous efforts are being put for by the citizens of North Bay, Hamilton, and other places t secure the industry. The Minister of Mines favors a Northe Ontario location.

The Mining News

ARIZONA

Gila County

ASBESTOS FIND made by Pierce and Kyle, 45 mi. north of Globe.

INSPIRATION-NEEDLES (Miami)—Force of 31 men at work with three churn drills; two additional machines ordered.

EMPIRE ZINC (San Xavier)—Shipping carload copper ore daily; erecting [illegible] houses; will increase force to 150 men.

Greenlee County

ARIZONA COPPER (Clifton)—July production 2,200 short tons copper.

SHANNON COPPER (Clifton)—Will begin at once erection of first unit of leaching plant to handle oxidized copper ores that are unprofitable to smelt.

EAGLE GOLD AND COPPER (Morenci)—Carlyon & Bunkerl, lessees, have shipped 4 carloads manganese-copper ore to the Shannon smeltery at Clifton; ore carries 20% copper; packed 5 mi. on burros.

ARIZONA NATIONAL COPPER (York)—Another new copper operation on the New Mexico-Arizona line, adjoining the Arizona-Mayflower. Principal development is a 130-ft. shaft on Commerce claim.

ARIZONA-MAYFLOWER (York)—New organization of W. B. Duvall and S. D. Corely, of Duncan, to develop 30 claims, near New Mexico-Arizona line, 9 mi. from York. Ore contains 4% copper, also gold, silver, zinc, lead and considerable bismuth.

Mohave County

LUCKY BOY (Oatman)—Resumption expected about middle of August.

BOUNDARY CONE (Oatman)—Compressor repaired and work resumed on 750-ft. level.

UNITED WESTERN (Oatman)—Crosscutting north on 505-ft. level; crosscut advanced about 370 ft.

CARTER (Oatman)—Control option reported given to Keith & Keith, of Boston. Good ore opened on 350-ft. level.

SCHENECTADY (Chloride)—High-grade lead-zinc-silver ore struck on 120-ft. level; similar to ore from 1,400-ft. level of Tennessee mine.

Pinal County

MAGMA (Superior)—Copper production 2,232,936 lb. in quarter ended June 30.

ANDRADA (Casa Grande)—Shaft being sunk on copper-silver vein; hoist, compressor and drills will be installed; R. W. Ramsdall owner.

ARMENTA BROS. (Casa Grande)—Recently shipped 200 sacks of high-grade silver-lead ore.

Yavapai County

VERDE VALLEY FARMER'S AND STOCKMEN'S PROTECTIVE ASSOCIATION has been formed by farmers in the Verde Valley in the vicinity of the United Verde Copper Co.'s smeltery for purpose of treating with company on smoke trouble. It is said some have taken up barren hillsides so as to collect smoke damage.

JEROME VERDE (Jerome)—Main shaft enlarged down to 325-ft. level.

TIGER TUNGSTEN (Crown King)—Mill closed account strike for more pay.

DUNDEE ARIZONA (Jerome)—Shaft down 300 ft.; sinking at rate of 5 or 6 ft. a day.

JEROME VICTOR (Jerome)—Unwatered to 600-ft. level; pumps gaining on water but slowly.

KAY COPPER (Cañon)—Sold to J. A. Salsbury, of New York; deep development will be started.

FLORA (Prescott)—Struck scheelite ore running 17% WO_3 in Hassayampa district; will drive 400-ft. tunnel.

CALIFORNIA & ARIZONA MINING (Prescott)—Will install pumps to raise gravel from potholes in Hassayampa River

MONARCH (Wickenburg)—Shipping from 10,000-ton dump; $50 ore encountered at 240 ft.; has good auto road, camp buildings and mill.

UNITED VERDE EXTENSION (Jerome)—Has installed 250-hp. engine for use as a spare in case of interruption of electric power by winter storms.

PITTSBURGH JEROME (Jerome)—C. R. Ballard, manager, reports good strike copper ore below 600-ft. level; heavier machinery will be installed as soon as 2-mi. road is completed.

Yuma County

COBRITA [illegible] (Salome)—Has made shipment of 20% copper ore.

GLORY HOL[illegible] **MINES** (Salome)—Has started active work at [illegible] mine.

ALICE [illegible] Riverside mountains, sold to J. C. Rankin, [illegible] developed at once.

YUMA WARR[illegible] developing Harquahala mine; gold strike rep[illegible] under the old Castle Garden stope; [illegible] taken from development work to ke[illegible] stamps one shift daily; sulphide ores bei[illegible] treated in a new mill; John B. Martin, superintendent.

CALIFORNIA

Amador County

KEYSTONE (Sutter Creek)—Station being cut on 1,800 level of incline shaft whence crosscut will be driven to orebody. The 40-stamp mill crushing ore from the 1,000, 1,200, 1,400 levels.

Los Angeles County

POTASSIUM MANUFACTURING CO. (Los Angeles)—Organized to extract potash and other chemical products from kelp; J. P. Waters, John A. Beck, George J. Schmitt and Walter P. Hansell interested. Patents of J. T. Armstrong are to be utilized.

Placer County

BOREALIS CONSOLIDATED (Auburn)—Controlling interest transferred to J. C. Winters, of New York. Property includes three mines known as Eureka, Hathaway and Kirkland, situated in Ophir district. Active development contemplated.

Sacramento County

CHROME ORE INDUSTRY in vicinity of Folsom is being developed extensively. Hill & Hobler, representing San Francisco men, have four motor trucks hauling ore from Negro Hill district to Folsom; shipping three cars a week, all of which goes to Illinois and Pennsylvania. Another company will be shipping as soon as wagon road is completed.

NATOMAS CO. (Natoma)—Reconstruction of Natoma No. 1 near Fairoaks junction is about ready to receive machinery. Work on Dredge No. 7, wrecked some time ago, is progressing; extensive hull repairs said to have been necessary. Dredge No. 4 reconstructed last fall and designed to place soil on top of the gravel leaving the surface level for agricultural use, is now doing good work.

Shasta County

NICKEL ORE reported to have been smelted at Heroult; the ore came from Grants Pass, Ore. Three electric furnaces in operation, two of these treating manganese are supplied from directly across the Pit River and other sources. Employing 125 men.

PITTSBURGH & MT. SHASTA (Keswick)—This gold mining and milling company operating in the copper region near Keswick, having produced $132,000 in gold, will now mine for copper. Permitted to sell 232,500 shares at 30c. to be expended in prospecting and obtaining patent on 22 claims.

Sierra County

AT MOUNT ALTA, rich gravel is being washed. Main tunnel being extended upstream along bedrock, with crosscuts at 35-ft. intervals blocking out gravel for future operation. Fifteen men employed. E. E. Sutro and associates, of San Francisco, own and operate. Nelson Chatfield in charge.

IRELAN (Alleghany)—Another pocket of rich sulphides recently encountered. Quartz vein 5 ft. wide streaked with rich mineral seams. Lower 1,400-ft. tunnel to be driven to 2,000 ft. and connected with upper workings. Fifty-ton ball mill and sawmill being installed.

ROCK CREEK (Downieville)—On Alleghany-Downieville serpentine belt. Tunnel disclosed rich shoot over 100 ft. in length with north end not in sight. Mill installed and crushing begun on high-grade ore stored in bins. Dolan & Bell own and operate.

WISCONSIN-NORTH FORK (Forest)—Amicable disassociation of these old gravel properties effected. The Wisconsin will be opened from the northwest side, with D. E. Hayden in charge. The North Fork, managed by G. F. Stone, will continue sinking 200 to 400 ft. through faulted formation to open quartz vein encountered during operations as a gravel mine.

Siskiyou County

JOE BAR (Yreka)—E. J. Steel purchased this placer mine and is preparing to operate.

PENNSYLVANIA (Yreka)—Rattles and Fawcett have taken over this placer on Elliott Creek.

GOLD RUN (Etna Mills)—W. L. Beall sold his interest to New York men who are preparing to operate on extensive scale.

Trinity County

MANGANESE CO. (Wildwood)—First motor-truck load of two tons of chrome ore from this property hauled to Redding on a test trip by E. L. Curtis; more trucks engaged for same service. Cost of hauling about $7 per ton, distance 60 mi. Company expects to extract and deliver 10,000 tons chrome ore this season.

Tuolumne County

SPRINGFIELD TUNNEL (Columbia)—Company has purchased Elliott property and contemplates early operation. Shaft is being sunk on Ranch mine to intersect deposit of rich gravel opened by 1,200-ft. drift from main drainage tunnel. Tunnel, now in 2,800 ft., will be driven 2 mi. further.

COSMOPOLITE (Groveland)—Optioned by Arthur Brown, J. W. Skelton, Gurley Jones and other Tonopah men. Five claims, equipped with 5-stamp mill, compressor and other machinery, electrically operated. Contemplate installation of ball mill and other equipment to increase capacity to 50 tons.

COLORADO

Clear Creek County

OCEAN WAVE (Idaho Springs)—This Soda Creek property being developed by Bean and associates.

COLORADO CENTRAL (Georgetown)—Marshall tunnel dump being sampled. Mine may be reopened.

EDGAR (Idaho Springs)—Lessees on ground west of Big Five tunnel making regular shipments of good-grade milling ore.

BURNS-MOORE (Idaho Springs)—This property up Chicago Creek leased by G. A. Yeager and associates, who will advance tunnel.

EDGAR (Idaho Springs)—Being developed through Big Five tunnel by Boston Leasing Co. Winze will be sunk an additional 100 ft.

TROJAN (Idaho Springs)—Humphrey & Jones have leased this Gilson Gulch property. Main tunnel advanced 200 ft.; streak of tungsten ore opened.

QUEEN (Idaho Springs)—This property on Seaton Mountain leased to Polly & Hayes, who have installed a hoist and other equipment. A 2½-ft. vein of tungsten ore opened in 20-ft. shaft. Dump will be sorted.

ENID BIG 4 TUNNEL CO. (Idaho Springs)—This new company is incorporated for $150,000; R. W. Shaw, president; A. J. Crosson, manager. The Soda Creek tunnel advanced 300 ft. on low-grade vein; breast shows 3-ft. vein of $7 milling ore.

Hinsdale County

SULPHURET (Lake City)—Lessees sinking incline shaft on vein. Sublease on Cora ground let recently.

PELICAN (Lake City)—Lessees opening good oreshoot in new drift.

GOLDEN FLEECE (Lake City)—New mill nearly completed. Old dumps will be treated while carrying on mine development.

Lake County

WESTERN MINING (Leadville)—Wolftone shaft now drained to 1,000-ft. level. Producing 350 tons zinc-carbonate ore daily.

LACAWANA BELLE (Leadville)—Being worked under lease and bond by Leadville men. Main tunnel being driven in oreshoot.

MANSFIELD (Leadville)—Clarence Jarbeau has leased this group on Prospect Mountain and will advance Lamphier tunnel 250 ft. by contract.

JULIA MINING (Leadville)—This company, under management of Clarence Jarbeau, is shipping 50 tons daily of iron-manganese ore from Cloud City mine, recently drained through Penrose shaft.

FORTUNE (Leadville)—James McNeece, owner, has opened this old property to leasers. Shaft is to be sunk 200 ft. Lead ore high in gold opened, and zinc carbonate being shipped steadily from upper levels.

Park County

TUNGSTEN DISCOVERIES made recently on J. G. Blaine, Rainbow group and Buckskin Joe.

LONDON (Leadville)—Production in first half of 1916 greatest yet made.

San Juan County

SILVERTON SHIPMENTS of crude ore and concentrates in July were: Davey Leasing Co. 40 cars; Gold King, 36; Sunnyside, 35; Congress, 25; Iowa-Tiger, 20; S. D. & G Lease, 17; St. Paul, 21; Dora, 14; J. M. Hyde, 7; Dives Leasing, 6; Atlantic, 5; Pueblo, 4; Silver Lake, Kittimac, Pride of the West, Nevada Leasing and Barstow, 3 cars each; Silver Ledge, North Star, M. E. Watson, Intersection, and Big Giant, 2 cars each; Highland Mary Leasing Co., Joker Tunnel, Hudson, Rogers Leasing, Kansas City, Morgan, J. A. Johnson, Andren-Jackson, one car each; miscellaneous, 5 cars; total, 264 cars.

HIGHLAND MARY (Silverton)—This property at head of Cunningham Gulch leased by J. H. Slattery and Otto Mears.

TOM MOORE (Silverton)—Repairing underground workings preparatory to early resumption. S. L. Martin, superintendent.

NORTH STAR (Silverton)—Boarding house on King Solomon Mountain destroyed by fire, will be rebuilt. Recent underground development highly satisfactory. Philip Flynn, manager.

San Miguel County

TELLURIDE SHIPMENTS of concentrates in July were: Tomboy, 48 cars to Durango; Smuggler-Union, 29 cars to Durango and 14 cars to Blende; Liberty Bell, 15 cars to Durango; Anderson, 2 cars to Florence; Wagner Bros., 2 cars to Durango; total 110 cars.

TOMBOY (Telluride)—In July crushed 13,000 tons, yielding bullion, $37,800, and concentrates, $56,000; operating profit, $28,300.

PRIMOS CHEMICAL CO. (Vanadium)—Mill running at capacity on ore from the Sawpit and Bear Creek properties. Additional equipment being installed at mill. Placerville work temporarily discontinued. About 100 men employed by company in San Miguel County.

IDAHO

Idaho County

GOLDEN SCALE PLACER (Elk City)—William C. McNutt, owner, has started cleanup, after exceptionally long season.

GOLDEN RULE (Elk City)—C. Tiederman and Frank Bosch, owners, are cleaning up at this placer; have handled larger amount of gravel than in former years, owing to favorable water conditions.

MINERAL ZONE (Elk City)—The 3-stamp mill, erected on this property during November, 1915, has been in continuous operation ever since. G. L. L. Baskett, owner. Ore exposed on 50-ft. level for 285 ft. and on 100-ft level for 735 ft. In near future, inclined shaft is to be sunk to the 200 level and mill is to be enlarged. M. F. Tytler, consulting engineer.

MINNESOTA

Mesabi Range

MAHONING (Hibbing)—One shovel stripping at northwest side of pit; many shovels removing ore. Plans at the beginning of the season called for shipments of 2,900,000 tons this summer.

HAROLD (Hibbing)—Ten thousand tons of ore from stockpile is being shipped by rail to Mississippi Valley Iron Co. at St. Louis, Mo. A long all-rail shipment, and the record for this section.

SUSQUEHANA (Hibbing)—Screening plant for separating waste rock from ore now in operation. Power plant under construction; brick-and-steel building will contain three 220-hp. boilers with automatic stokers, besides modern pumps and other equipment.

MISSOURI

Joplin District

GALENA B (Neck City)—Shaft sunk to 228-ft. level to supply mill with water; operations resumed.

BUCKEYE (Galena, Kan.)—Property leased by Price, Devaney and Cole. Draining just completed.

NATIONAL (Joplin)—Mill struck by lightning a month ago, repaired. Three shafts mining 3 to 6% ore.

ZINC CORPORATION (Carterville)—Tract of 800 acres now being drained to 200-ft. level by one Pomona pump.

SCOTTISH (Aurora)—Opened second shaft on United Zinc Co. lease and will now produce three cars every fortnight.

CHAMPION (Duenweg)—New mill completed and about 15 tons silicate being made daily. Mining in several drifts at 75-ft. depth

B. L. & G. (Cardin, Okla.)—Good ore found in all five drill holes. Ore from 140 to 182 ft. Tract adjoins Admiralty Zinc Co. on south.

D. C. & E. NO. 2 (Webb City)—Started new mill in Oronogo bottoms; capacity now 375 tons per shift. Only one of three shafts opened.

TAR CREEK (Cardin, Okla.)—Four drifts show 28-ft. face of rich lead ore at shallow level; new mill turning out 40 tons of lead concentrates weekly. Unable to sink to lower levels account much water.

MONTANA

Jefferson County

BOSTON & MONTANA DEVELOPMENT (35 Congress St. Boston, Mass.)—Park vein encountered in crosscut run from main tunnel at company's Elkhorn mines at head of Wise River. Vein is 14 ft. wide; shows high-grade and milling ore. At company's Spain mine in French Gulch, Deerlodge County, second consignment of motor trucks has arrived and will soon be hauling ore to new spur on Mill Creek connecting with Washoe smeltery.

Flathead County

SNOWSTORM (Troy)—The Banner & Bangle mines recently taken over by this former Cœur d'Alene operating company, are surpassing expectations. Four hundred thousand tons of ore are blocked out that are expected to average 7½% lead, 8½% zinc and from 4 to 5 oz. silver. Mine developed by six tunnels. Mill will be ready last of September.

Lincoln County

ROSE CONSOLIDATED (Libby)—The 10-stamp and concentration mill will be completed by end of month. Tungsten concentrates will be recovered from old tailings. Ore blocked in mine reported to run about $16 in gold per ton. Also some tungsten.

Sanders County

F. S. HOUGHLAND and associates have shipped from Thompson Falls a car of antimony ore, assaying 58.7% Sb, 0.56% As and 0.40% Fe.

Silver Bow County

EAST BUTTE (Butte)—July output at company's Pittsmont smeltery was 1,893,120 lb. of copper and 49,892 oz. of silver, as against 1,639,560 lb. of copper and 41,503 oz. of silver in June. Copper production for seven months was 10,194,120 lb. Cash surplus, Aug. 1 was over $1,400,000.

DAVIS-DALY (Butte)—Excavations for building operations on Davis-Daly ground, which extends through the central part of Butte for about a mile, have shown existence of two veins 40 and 23 ft. wide respectively. Both are ahead of the crosscut being driven westerly on the 2,500 level and lie several blocks west of the Colorado shaft. Foundation for new hoist completed; expected to arrive within a week.

BUTTE & SUPERIOR (Butte)—On the night of Aug. 8 the king bolt holding skip to cage broke when cage was within 150 ft. of surface, allowing skip with its 5 tons of ore to fall to 1,100 level, doing considerable damage to shaft timbers and causing mine and mill to be shut down for several days. Fortunately skip was caught by timbers near 1,200 level and all the men working in the sump below escaped. Another fortunate feature was that new shaft is now finished to 1,500 level making it possible to hoist the men through it.

NEVADA

Esmeralda County

BUTTE GOLDFIELD (Goldfield)—Occasional shipments are being made. Leasers have recently opened 16-in. vein assaying $60 per ton.

PIONEER CONSOLIDATED (Pioneer)—Mill treating 35 tons per day. Amalgamation used. Saves about 65%. Tailing impounded. Higher grade ore segregated for shipment, recent consignment of which assayed about $120 per ton.

Humboldt County

RAGGED TOP (Jessup)—These tungsten mines sold to H. M. Byllesby Co., of Chicago. At present about 35 men employed. Will build mill

ROCHESTER MINES CO. (Rochester)—Codd winze, now down about 800 ft. on dip of vein, is breaking fair mill ore with occasional occurrence of native silver; will connect with

Friedman tunnel and become main outlet from upper workings.

Lincoln County

HAMBURG MINES CO. (Pioche)—Recently organized to work property in Highland district, idle since 1893.

SILVER COMET MINING CO. (Pioche)—Sixty-ton concentrating plant running steadily. Situated in Comet district.

MEADOW VALLEY LEASING CO. (Pioche)—Organized to take over holdings of Yuba Leasing and Development Co. Now operating at No. 3 shaft.

CONSOLIDATED MINING AND SMELTING CO. (Pioche)—Organized to work property about 78 mi. from Pioche. Manager Young states small smelting furnace is being erected.

PRINCE CONSOLIDATED (Pioche)—Dividend of 5c. per share, about $50,000, declared payable Sept. 1. Shipments of ore to Salt Lake continue at about 3,500 tons per week.

CONSOLIDATED NEVADA-UTAH (Pioche)—South crosscut, 1,400-ft. level, in quartzite beyond Yuba dike. Some shipping ore being saved above this level. Mill producing three to four cars concentrates per week.

Lyon County

NEVADA-DOUGLAS (Ludwig)—July shipments amounted to about 25 cars valued between $40 and $50 per ton. Low-grade ores are treated at company's leaching plant.

Mineral County

PITTSBURGH DOLORES (Yerington)—Treating about 70 tons daily of arsenical and antimonial gold-silver ore; cyanide consumption 0.8 lb. per ton. E. J. Schrader, manager.

YERINGTON MOUNTAIN COPPER CO. (Schurz)—Operating producing property, near Schurz, and recently purchased from Glasgow & Western Development Co. the old Adelaide mine situated near Golconda, Humboldt County.

Nye County

TONOPAH ORE PRODUCTION for week ended Aug. 5 was 9,662 tons, valued at $199,996, compared with 9,217 tons for week previous. Producers were: Tonopah Belmont, 2,972 tons; Tonopah Extension, 2,200; Tonopah Mining, 2,000; Jim Butler, 1,200; West End, 718; Halifax, 218; Rescue-Eula, 149; North Star, 59; miscellaneous, 146 tons.

HALIFAX-TONOPAH (Tonopah)—Repairs to northerly crosscut on 1,700-ft. level completed and face being advanced. Stopes between 1,200-ft. and 1,300-ft. levels continue to produce about 175 tons per week.

AFTER ALL MINES CO. (Tonopah)—Northeasterly crosscut being driven on 1,540-ft. level of Tonopah Extension's Victor workings toward Jim Crow claim, from which point general development will be undertaken.

MONARCH PITTSBURGH (Tonopah)—Group of three claims in western section joining Tonopah Extension ground. East and west drifts being run on 1,000-ft. level on north-dipping contact-vein recently encountered about 800 ft. west of shaft.

Storey County

ANDES (Virginia)—Saved 25 cars of ore from development work on 350 level.

UNION CONSOLIDATED (Virginia)—Extracted 383 tons of ore: 2,400 level 202 tons, $31.66; 2,500 level 37 tons, $15.21 and 144 tons, $15.30. Started reopening old 2,300 station of the shaft.

MEXICAN (Virginia)—South drift on west crosscut 2,500 level advanced to 86-ft. point, porphyry and quartz in face. Mexican mill crushed 493 tons custom ore, $25.95 and 122 tons from Mexican storage pile, $11,10 per ton.

NEW YORK

Orange County

FOREST OF DEAN (Highland Falls)—Fall of rock in this iron mine, Aug. 13, killed one man and seriously injured two others.

OREGON

Baker County

HOMESTEAD-IRON DYKE MINES CO. (Homestead)—Shipping about 75 tons daily of 7% copper ore to International smeltery, Tooele, Utah. Building 150-ton concentrator; to be ready in September. Emmet F. Galligan, superintendent.

Josephine County

TAKILMA SMELTING CO. (Takilma)—Shipping from Queen of Bronze mine about 15 tons daily, carrying 10% Cu and $4 gold, to Tacoma Smelting Co. Since May, 1,000 tons have been shipped. Hauled by wagon or auto truck 27 mi. to railroad at Waters Creek. Roy H. Clarke, manager.

UTAH

Juab County

TINTIC SHIPMENTS for week ended Aug. 4 amounted to 203 cars by 26 shippers. The Dragon Consolidated, Chief Consolidated, and the Centennial-Eureka made the largest outputs.

IRON BLOSSOM (Silver City)—Sinking winze in north end of mine near the copper deposit; winze was in ore around the 1,100, but is now in limestone, the copper having dipped to the west. Sinking will be continued to the 1,200, and drifting done to reach orebody.

EAGLE AND BLUE BELL (Eureka)—Work done in the shaft recently indicates the new strike to be of importance. Shaft has been in ore for about 40 ft., and will be continued until in solid ground well below the ore deposit. This will probably be around the [illegible],900 level, which is still 150 ft. above the water level.

Piute County

FLORENCE MI[illegible] MILLING (Marysvale)—Ground is being broken for [illegible] potash mill near the terminus of the Denver & [illegible] at Marysvale.

MINERAL PRODUCTS (Marysvale)—During last three months changes in [illegible] nearly doubled output; dust chamber and [illegible] development has exceeded expectation; sufficient alunite developed to supply the 100-ton plant several years. The fissure carrying alunite is up to 100 ft. wide in places, and other veins parallel the main vein. The tunnel, driven in the vein 1,500 ft., is still in ore.

Salt Lake County

ALTA-MAMMOTH (Alta)—Incorporated Aug. 3 to work nine silver-lead-copper claims in Little Cottonwood Cañon, half a mile above Tanner's Flat. J. Thomas, president.

UTAH METAL & TUNNEL (Bingham)—First dividend amounting to about $350,000, or at the rate of 50c. a share will be paid Aug. 15. Profits for the first quarter of 1916 were $367,523. Gross value of the ore was $678,172, and with income from sale of water, rents, etc., total income was $690,177. Has retired bonds amounting to $129,250, leaving $245,750 outstanding. Cash on hand Apr. 1 and due for metal sold was $961,827. Total profits for 1915 were $594,295. Of this $216,727 came from the Utah Metal end, which began production in May, and $377,568 from the Bingham-New Haven end. Mill recently enlarged to treat 240 tons; flotation installed at a cost of $18,000.

Summit County

PARK CITY SHIPMENTS for week ended Aug. 4 amounted to 4,479,987 lb.; seven shippers.

THREE KINGS (Park City)—Will sink winze on fissure recently opened on 520-ft. or bottom level.

NEW QUINCY (Park City)—Ore was cut Aug. 7 in western workings about 300 ft. above the 900 level. Extent of new find not yet known.

SILVER KING CONSOLIDATED (Park City)—Air connections made between mine and the proposed drain and development tunnel in Thaynes Cañon. Machine drills will soon be started. Ore buckets for new tramway arrived, and cable will be up soon. Production at present about 60 tons a day. Remodeling mill.

AMERICAN FLAG (Park City)—Park City Mines Co. operating a lease is unwatering the 1,100 level. Proposed to sink the shaft, to reach the intersection of American Flag vein dipping east, with the Easter vein, dipping west; expected a short distance below the 1,100. John H. Leavell, H. R. MacMillan, John Pingree and F. V. Bodfish are interested.

Utah County

PACIFIC (American Fork)—Copper-silver ore is being shipped. Returns from shipments this year have been about $20,000. Raising on vein is in progress.

WISCONSIN

Zinc-Lead District

LITTLE GIANT (Shullsburg)—This old mine reopened and producing good ore.

MULCAHY (Shullsburg)—Finished its 200-ton mill and is completing magnetic separating plant to remove the pyrite.

WINSKELL (Shullsburg)—Continues to be a large shipper; now working beneath the "glass rock" horizon—deeper than the usual ore runs.

CANADA

British Columbia

BRITISH COLUMBIA COPPER (Copper Mountain)—After four years of diamond drilling on Copper Mountain, mine development has been commenced. A series of tunnels are to be driven at different levels. Power for initial development work is being obtained from B. C. Portland Cement Co., 14 mi. from Copper Mountain. Current is transformed to 15,000 volts and carried to Copper Mountain over a temporary high-tension line of No. 4 galvanized fence wire; at the mine it is stepped down to 2,200 volts. Compressor plant consists of a Canadian Rand two-stage 10-drill compressor, belt-connected with 150-hp. motor, and a Chicago Pneumatic 6-drill compressor, belt-connected with a 100-hp. motor; Leyner sharpener. First tunnel started on the 3,945 level, now in 500 ft., progressing 18 ft. per day, size 9x10 ft. Bad ground encountered first 300 ft., which necessitated timbering; condition now improving and better rate of progress expected. Diamond drills still being operated both on Copper Mountain and Kennedy Mountain.

Ontario

CROESUS (Munroe)—Buildings destroyed by the fire of July 29 will be rebuilt.

DOME LAKE (Porcupine)—Shaft, down 400 ft., will be continued to 700 ft. Some equipment for 200-ton mill ordered.

DOME EXTENSION (Porcupine)—In first drill hole to tap Dome ore system, 90 ft. of ore reported cut at depth of about 1,000 ft.

NIPISSING (Cobalt)—During July mined ore valued at $288,577; bullion shipped from Nipissing and customs ore, $280,188.

REPUBLIC (Porcupine)—At this mine (formerly the Success) shaft is down 300 ft. Crosscutting is being done in a mineralized belt.

McINTYRE (Porcupine)—Vein along the McIntyre Extension line drifted on for 500 ft.; varies in width from 8 to 40 ft. The big vein on 700-ft. level drifted on for 300 ft.

MILLER INDEPENDENCE (Boston Creek)—New high-grade vein struck about 500 ft. north of original vein; stripped for about 15 ft. Underground work suspended account shortage of water.

WEST DOME CONSOLIDATED (Porcupine)—No. 3 shaft dewatered and sampled, assays running from $4.80 to $8.20 per ton. Diamond drilling disclosed new vein, 6 ft. in width, assaying $14.80 per ton, at an incline depth of 1,229 ft.

HOLLINGER CONSOLIDATED (Porcupine)—For four weeks ended July 14, gross profits were $215,165, from 45,320 tons; average value, $9.15 per ton; working cost, $3.74 per ton milled. Deficit, owing to increased dividend requirements on new capitalization, was $202,934. Delays in delivery of material for new mill now overcome.

The Market Report

Metal Markets

NEW YORK—Aug. 16

During the last week the markets for copper, lead and zinc were active and rising. All of them exhibited features of interest. Large business was done, especially in copper and lead, but also there were some important transactions in spelter.

Copper, Tin, Lead and Zinc

Copper—On Aug. 10 the Russian order for 5,000 long tons of copper, with regard to which there has previously been much interest, was placed. This business was done in London, with call for delivery at Vladivostok. There was sharp competition for it in which the sellers of Australian and Japanese copper participated. The offerings varied considerably according to the deliveries that could be supplied, and the placing of the order was apparently determined by the time requirements of the Russian authorities. The order was filled partly with Japanese, partly with Australian and partly with American copper. This transaction gave an impetus to the market here as well as elsewhere and the volume of business in the New York market, which had been swelling during the previous week, increased further. As in the previous week, the bulk of the business was with domestic manufacturers engaged in furnishing munitions. All of the large producers and agencies were in the market. Several of them agree in estimating that the total volume of transactions during the week was probably in the neighborhood of 50,000,000 lb., and judging from the individual reports to us we regard such an estimate as being not much out of the way.

The bulk of the business transacted during the last week was for November-December delivery. There was some October business done, but October copper is already becoming rather scarce. As to September copper, there is no longer any available, save for trifling quantities that may be with second hands. However, August and September copper is not much wanted, manufacturers being generally supplied fully for that time and gladly acceding to the delayed deliveries on the part of refiners, who have been unable in all directions to turn out as much as they expected.

Prices advanced steadily during the week and a good deal of variation was exhibited, depending upon the position of the sales books of the several producers. As soon as any one sold all of the October copper he wanted to, his asking price was raised. In general there was an increasing differential among the prices for October, November and December copper. A noteworthy feature of the week was good buying for delivery beyond 1916, extending as far as April, 1917. This business was taken at considerably lower prices than what are quoted for the major market at the present time. Sellers are naturally desirous of placing all the copper for 1917 that they can at anything like the present level of prices.

Respecting reports of huge sales to foreign governments, that have been widely circulating in the daily and financial papers during the last week, it may be confidently said that up to the time of our going to press no such business has been consummated. It is possible that some large business of that nature is in negotiation but if so agreement as to price has not been reached. It will be recollected that there were negotiations not long ago which failed owing to inability of the parties to come to terms.

Copper Sheets remain unchanged at last week's quotations, a base of 35½@37½c.

Tin—There was a little business done between dealers and small consumers. There was not much fluctuation in price and there were no features of general interest.

Lead—Some very large business was done, there being transactions for round lots on every day of the week. In the early part of the week some of these transactions were made at low prices. Sellers who had been pressing on the market being thus relieved, an increasing demand from consumers was able to satisfy itself only at rather sharply advancing prices. Beginning with Aug. 15, independent producers were able to realize better than the price of the A. S. & R. Co., and a further show of strength on Aug. 16 probably foreshadows an advance in price by the A. S. & R. Co. There was some noteworthy buying of lead for export during the week.

Spelter—Buying for export also developed in this metal and transactions attaining a handsome volume there was naturally an advance in price from day to day. The differential between prompt and future spelter has naturally contracted to rather small proportions.

The Anaconda company is to put in operation the first unit of its electrolytic plant at Great Falls this month. Additional units will go into operation in short order and the plant is expected to be producing at full capacity by the

DAILY PRICES OF METALS IN NEW YORK

Aug.	Sterling Exchange	Silver, Cts. per Oz.	Copper	Tin	Lead		Zinc
			Electrolytic, Cts. per Lb.	Spot, Cts. per Lb.	New York, Cts. per Lb.	St. Louis, Cts. per Lb.	St. Louis, Cts. per Lb.
10	4.7575	66¼	25¼ @25¾	38½	5 80 @5 90	5 70 @5 80	8.00 @8 37
11	4.7569	66¼	25⅜ @25⅞	38⅞	5 80 @5.90	5.70 @5.80	8 25 @8 50
12	4.7563	66¼	25⅜ @25⅞	39	5 80 @6 00	5 75 @5.85	8 25 @8 50
14	4 7569	66⅜	25½ @26	39¼	5 95 @6 00	5 75 @5 85	8 50 @8 75
15.	4.7569	66⅝	25¾ @26¼	39	6 00 @6 05	5.85 @5 95	8 50 @8 75
16	4 7575	66½	25¾ @26¼	38¼	6 00 @6 10	5 90 @6 00	8 75 @9 00

The quotations herein are our appraisal of the average markets for copper, lead, spelter and tin based on wholesale contracts for the ordinary deliveries of the trade as made by producers and agencies; and represent, to the best of our judgment, the prevailing values of the metals, reduced to basis of New York, cash, except where St. Louis is given as the basing point. St. Louis and New York are normally quoted 0.17c. apart.

The quotations for electrolytic copper are for cakes, ingots and wirebars. Electrolytic copper is commonly sold at prices including delivery to the consumers and is subject to discounts, etc. The price quoted for copper on "regular terms" (r.t.) is the gross price including freight to the buyer's works and is subject to a discount for cash. The difference between the price delivered and the New York cash equivalent is at present about 0.25c. on domestic business. The price of electrolytic cathodes is 0.05 to 0.10c. below that of electrolytic. Quotations for lead represent wholesale transactions in the open market for good ordinary brands. Quotations for spelter are for ordinary Prime Western brands. Only the St. Louis price is herein quoted, St. Louis being the basing market. We quote the New York price at 17c. per 100 lb. above the St. Louis price.

Silver quotations are as reported by Handy & Harman and are in cents per troy ounce of silver bars 999 fine.

Some current freight rates on metals per 100 lb. are: St. Louis-New York 17c.; St. Louis-Chicago, 6.3c.; St. Louis-Pittsburgh, 13.1c.

LONDON

Aug.	Silver	Copper				Tin		Lead		Zinc	
		Standard		Electrolytic							
		Spot	3 Mos.	£ per Ton	Cts. per Lb.	Spot	3 Mos.	£ per Ton	Cts. per Lb	£ per Ton	Cts. per Lb.
10	31⅝	110½	108½	124	26 40	169½	170½	29¼	6 20	47	10 01
11	31⅝	110½	109½	124	26 40	171	172	29¼	6 23	49	10.43
12	31	.		.							
14	31¼	116	113	125	26 61	173½	174½	29½	6 28	49	10 43
15	31¾	114	111	126	26 83	172¼	173¼	30	6 39	49	10 43
16	31 11/16	115	112	126	26 83	171	172	30	6 39	49½	10 54

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2,240 lb., except silver which is in pence per troy ounce of sterling silver, 0.925 fine. Copper quotations are for standard copper, spot and three months, and for electrolytic, price for the latter being subject to 3 per cent. discount. For convenience in comparison of London prices, in pounds sterling per 2,240 lb., with American prices in cents per pound the following approximate ratios are given, reckoning exchange at 4.80: £15 = 3.21c.; £20 = 4.29c.; £30 = 6.43c.; £40 = 8.57c.; £60 = 12.85c. Variations, £1 = 0.21⅜c.

end of October. The high-grade "Anaconda Electric" spelter is acquiring great popularity among consumers. Some large consumers in France have reported that this is the best spelter they have ever had.

By a typograhical error our spelter quotation for Aug. 8 was made to appear 7¾c. instead of 7¾@8c., which was intended, and is the correct quotation.

Montana Zinc Ore—Butte & Superior report for July a total of 51,710 tons ore treated, with a saving of 14.005 tons concentrates estimated to contain 15,200.000 lb. zinc.

Zinc Sheets show no change upon last week's quotations. Demand is fair. Price remains at $15 per 100 lb., f.o.b. Peru, Ill., less 8% discount.

Other Metals

Quicksilver—There was a further decline on small business. At the close we quote $72, New York. San Francisco reports, by telegraph, $75, market dull.

Antimony—This market was very unsettled during the week. A considerable business was done at prices ranging from 9 to 10c. We quote an average of 9½c. for the week.

Aluminum—Market reported quiet without any material change from last week. Business is being done on a basis of about 60c. for No. 1 ingots, New York.

Gold, Silver and Platinum

NEW YORK—Aug. 16

Gold—Somuel Montagu & Co., report from London, under date of July 27, a total of bar gold received by the Bank of England during the week of £903,000. No withdrawals were reported. West African gold output for June, 1916, amounted to £127,107, and Rhodesian gold output for June, 1916, amounted to £333,070.

Transvaal Gold Production in June was 761,764 oz. For the six months ended June 30 the total was 4,631,867 oz., or $95,740,691; an increase of 223,819 oz., or $4,626,339, over the first half of last year. The course of production for the half-year indicates an output approximating $200,000,000 for the year.

Coined Silver in the United States July 1 is estimated by the Treasury Department as follows: Standard dollars, $568,270,900; subsidiary coins, $187,378,094; total, $755.648,994. Of the standard dollars, $490,786,334 are held in the Treasury against silver certificates outstanding.

Silver—The market has ruled steady the past week between 31⅝ and 31¾d. in London. Coinage orders for the English and French mints have been large enough to absorb silver offerings and hold the price firm.

Reports from India are favorable for good demand for silver, but conditions in China are not favorable for higher prices, exchange rates continuing below parity. Market closes steady in London, 31 11/16d.

Samuel Montagu & Co. report from London under date of July 27, that the tendency of prices has been somewhat better during the current week. Improvement have been mainly due to the former tone of China exchanges, which have shown reluctance to fall in sympathy with silver prices.

Bullion on hand at the San Francisco Mint at the close of July 31, 1916, was $370,535.105, an increase over July, 1915, of $69,225,685. Total gold receipts for the month, $5,383,463; silver receipts, $114,799. Australian gold bars received, $103,372; other sources, $5,280,091.

Imports of Silver in Great Britain six months ended June 30 were £6,359,785; exports, £3,939,492; excess of imports, £2,420,293, against £1,036,671 last year. Of the imports this year £5,138,953 were from the United States.

Gold and Silver Movement in the United States five months ended May 31 was:

	Gold		Silver	
	1915	1916	1915	1916
Exports..	$4,761,000	$58,094,000	$20,880,000	$26,398,000
Imports . .	92,583,000	64,245,000	12,119,000	12,229,000
Excess..	I $87,822,000	I $6,151,000	E $8,761,000	E. $14,169,000

Imports of gold in June were heavy, so that the total for the half-year was probably greater than for the first half of last year.

Mexican Dollars at New York Aug. 10 were quoted at 51½@55½c., Aug. 11 at [illegible]c.; Aug. 12 at 51@55c.; Aug. 13 at 51@55c., Aug. 15 at [illegible]; and Aug. 16 at 51¼@55¼c. Not many pesos appeared.

Platinum—There was a [illegible] better demand for this metal. Quotations range from [illegible] to [illegible]. Sales were reported at $58.50, which we quote [illegible] for the week.

Zinc and Lead Ore Markets

Joplin, Mo., Aug. 12—Quotations are given as follows: Blende, high price, $67.95 per ton of 60% zinc; premium ore at $65. Medium is $60@50; low, $45. Calamine, per ton of 40% zinc, $40@30. The average selling price of all grades of zinc is $57.94 per ton.

Lead base price is at $65 per ton of 80% metal content. The high price is $66.20, and the average selling price of all grades of lead is $64.33 per ton.

Shipments for the week ended Aug. 12 were 3,876.1 tons of blende and 932.33 tons of calamine and 934 tons of lead ore. Total value was $338,510 for the week, and $24,949,490 for the year to date.

Producers had thought the downward limit of zinc prices was touched a week ago, but another cut of $5 in the base price of premium ore was made this week. A tendency toward heavier buying by one concern tonight may have the effect of bringing the price slump to an end, though this company was offering only $60 base for 60% grades. It is assumed that no further cut can be made so long as this large buyer is in the field at a price so near the top. This company is not a regular buyer of high-grade ore.

These premises are estimated from the sellers viewpoint. Buyers, on the other hand, assume that with 20,000 tons surplus metal, over 20,000 tons surplus ore here, with surplus ore at the smelters and an unlimited supply in Australia, there is no early prospects of an advancing ore market.

Platteville, Wis.—Aug. 12—Quotations of the district are according to the following figures: Base price per 2,000-lb. ton for material assaying 60% zinc is $57 for premium ore down to $50 for medium grade. For material assaying 80% lead the base price per 2,000-lb. ton is $60@64. Shipments for the week were 2,190 tons of zinc ore and 104.3 tons of lead ore and 201.6 tons of sulphur ore. For the year, to date the figures are 73,723 tons zinc ore, 2,749 tons lead ore and 16,781 tons of sulphur ore. Shipped during the week to separating plants there were 3,239 tons of zinc ore.

OTHER ORES

Manganese Ore—Imports at Baltimore for the week included 15,800 tons of manganese ore from Brazil.

Pyrites—Imports at Baltimore for the week included 4,485 tons from Huelva, Spain.

Tungsten Ore—There was a slightly better feeling in this market, with, however, no great change in price, which we continue to quote at $20. Charles Hardy reports that the foreign demand for tungsten was again the dominating feature in the market. Considerable quantities were sold and at least 200 tons have been absorbed for shipment abroad since the actual buying began, about a fortnight ago. This buying is by no means confined to purchases made in the United States. Peru and Bolivia are also actively canvassed by the foreign buyers, and considerable quantities have been bought there. On July 19 Japan prohibited the exports of tungsten and molybdenum, except under license.

Antimony Ore—No business was reported and buyers were averse to making quotations.

Iron Trade Review

The domestic demand for finished materials is decreasing, owing, in large part, to high prices, labor shortage and slow deliveries. "Iron Age", Aug. 10, notes that following the statements by the leading producer one week ago that it had raised the price of steel bars $2 a ton, or to 2.60c., Pittsburgh, the same interests have announced similar advances in wire products and in contract plates and structural shapes. In a slow market these advances have not stimulated buying. Sales of bars have been made at 2.50c. in the week, pending business at that figure being more readily closed. Independent producers are in some cases quoting higher prices, but these have not been widely established. Manufacturing consumers of steel are facing smaller demand for their products in view of high prices. Implement makers count on 25% falling off in their sales and possibly more. They contend that bars should be reduced rather than advanced.

PITTSBURGH—Aug. 15

An unprecedented famine has developed in unfinished steel and buyers, English consumers in particular, are inquiring in vain for billets and sheet bars for any delivery this year. Prices are bid that would net greater profits than are obtainable on some descriptions of finished steel, light gage sheets in particular, but the mills prefer to carry the steel through to the finished product as any unemployment of men results in their securing jobs elsewhere and every employer is seeking to maintain his organization.

The Carnegie Steel Co.'s successive advances in bars, plates and shapes of $2 a ton are taking root, bars being already up to the 2.60c. price in the general market, while shapes and plates are making for 2.60c. and 3c. respectively. The independents have been closing additional contracts with regular customers before they advanced their prices.

The whole steel market has gained additional strength n the past week, and the change in the past three weeks is very striking particularly as it occurs at the time of year when the market is supposed to reach its stage of greatest quietness. The change has been radical and the future of the steel market is assured for a longer period of time. It is now generally believed that the steel mills will be under pressure for deliveries, with prices strong all along the line, until at east the middle of next year, whereas two months ago there were doubts whether mill activity would be prolonged far nto the new year and it was considered distinctly possible hat some prices might begin receding in September or October.

The new life in the steel market is traceable chiefly to the war, there having been larger bookings of orders for shells and shell steel than were anticipated, while the common appraisement is that the war is destined to last for at least a year yet.

In practically all products the mills are nominally far behind in deliveries, but in most cases the condition arises rom buyers having specified with exceptional liberality in anticipation of mills falling behind. There remain many nstances in which consumers are really incommoded by not receiving as much steel as could be fabricated and put to use. t is believed that some consumers, who were particularly orehanded, are well stocked up, but there is no disposition to resell.

Pig Iron—While the pig-iron market on the surface appears dull, there is decidedly more buying of foundry and malleable grades, the buyers not putting out general inquiries, but picking up the iron quietly, apparently in fear of exciting he market to their disadvantage. There is slightly more nquiry for basic and it is thought possible that with the heavy selling of bessemer by Eastern furnaces, for export, he East may soon inquire of this district for basic iron. Bessemer is dull except for continued export demand, and he supply may run short. Prices are unchanged: Bessemer, $21@21.50; basic, $18@18.25; malleable and foundry, $18.25@8.50; forge, $18@18.25, f.o.b. valley furnaces, 95c. higher delivered Pittsburgh.

Steel—There is an altogether unprecedented famine in soft steel billets and sheet bars, both bessemer and openhearth. Only odd lots are offered, and then only occasionally. The mills without an exception refuse to quote on any regular onnages, asserting that they are entirely sold up for this year. Prices are nominal at $45@50 for either bessemer or openhearth billets or sheet bars. The buying of shell steel has been much larger than expected, as it has continued to late when at the end of May the buying was supposed to be practically over for this year's delivery. Naturally the mills make an effort to hold capacity open for this profitable business and there is a bare possibility that should the buying of shell steel end the mills would find they could spare some soft steel. Rods are quotable nominally at $55@60.

FERROALLOYS

Market is inactive, purchasers being fairly well covered for time ahead.

Ferromanganese—The market for prompt is easier and in general it commands about the same price as contract, $175.

Spiegeleisen, 18 to 22%, is quoted at $45@50, and 25 to 30% at $55@65 at furnace. There is some inquiry for export.

Ferrosilicon, 50% is quoted at $88@89 in lots up to 100 ons; over 100 tons $87@88, and over 600 tons, $86@87, all f.o.b. Pittsburgh.

FOREIGN IRON

Report of Aug. 8, states that in pig iron the demand for orward delivery persists. Deliveries are closely regulated. Fears are expressed of greater tightness in hematite iron. Deliveries are inadequate and export business is curtailed. American 2-in. billets have sold at £13 15s. In the tin-plate market, 200,000 boxes of oil plates have been placed at 29s. o 30s. Sales later were made at 30s. 9d. The market is very rregular.

The "Gazette," London, of July 26, publishes a note of exports that have been prohibited that includes black plates for inning (to all destinations except the Allies, Spain and Portugal), cast-iron pipe, galvanived corrugated and flat sheets, ron and steel plates and sheets (except black plates for tinning, tin plates, tinned plates and lead-coated sheets and ectional material for shipbuilding.) (To all destinations in Europe except the Allies, Spain and Portugal).

IRON ORE

The movement of iron ore down the lakes has been good up to date, and has equalled expectations, surpassing most of them. There have been some difficulties attending the movement, such as the danger of a strike of the lake carying vessels. Wages have been advanced largely and trouble averted by this means, but there is still apprehension in some quarters. The Mesabi strike is continuing and a great part of the underground production is cut off, but the disorder has not reached the openpit mines. Moving the tonnage has been the first consideration, so that ore grade has probably suffered. Special consumers have offered premiums for ore lately, in some cases up to 50c. or more per ton. Shortage of ores for blast furnaces is not likely, although it is a possibility. Furnaces are not disposed to quote on pig iron for the first half of 1917, due to this possibility. Total ore on docks on Aug. 1 was 4,810,671 tons, as compared with 6,539,933 tons on Aug. 1, 1915. Shipments from lower lake ports to furnaces during the month amounted to 5,289,590 tons.

COKE

There is reported a steady hardening of prices of spot furnace coke market. The stiffness is due to light production, and future prospects brighten as time of completion of additional byproduct ovens is prolonged. The "Courier" reports that the total production for week ended Aug. 5 was 394,200 net tons, and shipments of 10,960 cars.

Connellsville—While demand for prompt furnace coke from consumers is barely in evidence there is buying by middle interests to apply on contracts, with very light offerings, and the market is strong at $2.75@2.85. There is no interest in contract coke. The Youngstown Sheet and Tube Co. expects to begin putting the first two batteries of its byproduct coke plant in operation today or tomorrow, the other two batteries, making 204 ovens in all, to follow next week. This company is now receiving about 70,000 tons of Connellsville coke per month, the contracts being arranged to change to coal contracts. Ovens will be blown out to the extent of 20 to 35,000 tons a month of coke, but at least 35,000 tons a month will remain available for other consumers, and the coke market should therefore ease off in time.

PETROLEUM

It is reported, under date of Aug. 10, that a further cut of 10c. per bbl. in Mid-Continent crude oil is the fourth successive reduction since July 24 last. Mid-Continent crude, now quoted at $1.15 per bbl., is 40c. below the high of this year, and indications point to additional recessions before the low is reached. Texas oil, which is in direct competition with Oklahoma, also has been reduced 10c. per bbl. to the $1.15 basis. Pennsylvania, as well controlled as this eastern field is, will be unable to escape the influence of the Mid-Continent market, it is expected. There are 81,000,000 bbl. of oil in storage in the Mid-Continent field, half owned by Prairie Oil and Gas Co. Total storage shows a decrease in value of more than $32,000,000 at present market price, compared with high this year. Prairie's theoretical loss alone amounts to more than $16,000,000.

California valley: 14 to and including 17.9 gravity, 63c. per bbl.; 18 to and including 18.9 gravity, 64c. For each increase in gravity above 18, one cent a barrel increase is made. Southern: 16 and including 17.9 gravity, 63c.; 18 and including 18.9 gravity, 64c. One cent a barrel is added for each degree increase in gravity above 18.

Chemicals

NEW YORK—Aug. 15

Arsenic—With spot quoted at only $6 per 100 lb., absence of important demand is apparently responsible for a lack of upward tendency in prices. Production is stated to be well sold ahead and contract deliveries are big enough to prevent any accumulations.

Copper Sulphate—Market quiet with only a moderate business in small lots reported for the last week. Export trade dull and domestic consumers apparently content to buy in small installments. Prices quoted at $8@10 per 100 lb.

Bleaching Powder—Reported that resales of offerings are keeping spot market unsettled. Difficult to sell large drums at present and these are sellers at 4½c. per lb. Export packages held at 5½@6½c. per lb. Contracts for next year are quoted at 2½@2¾c. per lb.

Sulphur—Prices showing a tendency to harden as a result of consumers' strong demand. New York shipments quoted at $30 per long ton and Baltimore at $30.50. Spot quoted at $35.

Sulphuric Acid—Prices for nearby deliveries steady with some concessions on long-time contracts. Offerings of 66-deg. at 1½c. per lb. reported, with 60-deg. at 1c. per lb. available to buyers.

Assessments

Company	Delinq	Sale	Amt.
Algomah, Mich.	May 18		$1.00
Alta Silver, Nev.	Sept. 1	Sept. 25	0.03
Beaver Gold, Utah	Aug. 19	Sept. 16	0.01
Belmont, Ida.	Aug. 9	Aug. 26	0.006
Challenge, Nev.	Aug. 23	Sept. 13	0.05
Clear Grit, Ida	Aug. 7	Aug. 25	0.002
Coal Creek, Ida	Aug. 25	Sept. 26	0.005
Cons. Virginia, Nev.	July 27	Aug. 17	0.05
Exchequer, Nev	Sept. 5	Sept. 26	0.03
Emerald, Utah	Aug. 15	Sept. 9	0.00½
Friend, Ida	Aug. 26	Sept. 16	0.002
Four Timbers, Ida.	July 26	Aug. 26	0.002
Great Bend, Nev.	Aug. 15	Sept. 20	0.01
Hector, Ida.	Aug. 7	Sept. 15	0.005
Hope, Calif.	July 17	Aug. 14	0.01
Hugo, Ida.	July 29	Aug. 30	0.002
Jacket-C.Point-Belcher, Nev.	Aug. 14	Sept. 7	0.05
Jack Waite, Ida.	July 27	Aug. 28	0.01
Kewanas Reor., Nev.	Aug. 2	Sept. 6	0.01
Keweenaw, Mich.	Sept. 2	..	1.00
Lehi Tintic, Utah	Aug. 5	Aug. 25	0.0025
Lucky Calumet, Ida	July 20	Aug. 21	0.005
Nevada-Douglas, Nev.	July 15	Aug. 16	0.10
Nevada-Stewart, Ida.	A 3	Sept. 2	0.003
Nevada Zinc, Nev.	Aug. 14	Sept. 2	0.01
North Lake, Mich.	June 14		1.00
Ophir, Nev	Aug. 16	Sept. 6	0.05
Paloma, Utah	Aug. 21	Sept. 9	0.01
Phedora, Ida	Aug. 29	Sept. 29	0.001
Rico Argentine, Colo.	Aug. 17	Sept. 2	0.01
Rio Grande Grubstake, Nev.	June 22	Aug. 31	0.002½
Sandstorm Kendall, Nev.	Aug. 22	Sept. 26	0.01
Silver Pick, Nev.	July 5	Aug. 14	0.01
Sixes, Nev.	Aug. 23	Sept. 8	0.10
Springfield Tunnel, Calif.	Aug. 15	..	0.05
Sunrise, Ida.	July 27	Aug. 28	0.002
Sunset, Ida.	Aug. 5	Aug. 26	0.0015
Tar Baby, Utah.	Aug. 3	Sept. 4	0.01
Ton. Gypsy Queen, Nev.	July 11	Aug. 15	0.01
Utah, United, Utah	Aug. 12	Aug. 30	0.01
Wolf Mt. Copper, Utah	Aug. 2	Sept. 6	0.005
Wonderful, Ida.	Aug. 30	Sept. 20	0.001

Stock Quotations

SAN FRANCISCO Aug. 16	
Name of Comp	Bid
Alta	‡ 03
Andes	09
Best & Belcher	06
Bullion	01
Caledonia	‡ 40
Challenge Con	‡ 03
Confidence	18
Cons. Imperial	01
Con Virginia	‡ 13
Gould & Curry	03
Hale & Norcross	06
Jacket-Cr. Pt.	‡ 05
Mexican	17
Occidental	70
Ophir	24
Overman	‡ 04
Savage	04
Seg Belcher	02
Sierra Nevada	31
Union Con	67
Utah Con.	01
Belmont	4 25
Jim Butler	88
MacNamara	05
Midway	20
Mont.-Tonopah	23
North Star	15
Rescue Eula	25
West End Con	80
Atlanta	09
Blue Bell	‡ 01
Booth	13
C.O.D. Con	03
Comb. Frac	06
D'field B.B.	03
D'field Daisy	‡ 03
Jumbo Extension	07
Pitts.-Silver Peak	‡ 12
Round Mountain	45
Sandstorm Kendall	04
Silver Pick	11
Central Eureka	‡ 09
Argo	‡ 10
Ariz. Central	‡ 10
Big Jim	85
Lazy Boy	‡ 2
Oatman No. Star.	‡ 10
Tom Reed	‡ 55
United Eastern	3 62
United Western	‡ 08

LONDON	Aug 4
Alaska Tre'dwell	£5 15 0
Burma Corp	3 5 0
Cam & Motor	0 10 7
Camp Bird	0 8 3
El Oro	0 8 3
Esperanza	0 11 0
Mexico Mines	3 17 6
Nechi, pfd	0 [illegible] 3
Oroville	0 17 0
Santa Gert'dis	0 12 0
Tomboy	1 2 0

SALT LAKE Aug. 16	
Name of Comp.	Bid.
Alta Con	‡ 21½
Black Jack	‡ 05¼
Colorado Mining	‡ .15
Crown Point	.03
Daly-Judge	7 75
Emma Cop	‡ 54
Gold Chain	20
Grand Central	65
Iron Blossom	1 50
Lower Mammoth	03
May Day	.10½
Opohongo	‡ 0[illegible]
Prince Con.	1 50
Seven Troughs	‡ 03¾
Silver King Coal'n	2 90
Silver King Con.	3 32½
Sioux Con	.09
Uncle Sam	.06
Yankee	18

COLO. SPRINGS	Aug. 16
Acacia	‡ 0[illegible]
Doctor Jack Pot	.09⅜
Elkton Con.	14½
El Paso	60
Findlay	.03
Gold Sovereign	.04¼
Golden Cycle	2.07½
Granite	.64
Isabella	.17
Jack Pot	05
Jerry Johnson	‡ 03¼
Mary McKinney	.28
Portland	1 68
Vindicator	2 12

TORONTO	Aug. 16
Adanac	‡ 75
Bailey	07¾
Chambers Ferland	.19
Coniagas	4 45
La Rose	55
Peterson Lake	.23
Right of Way	04
Seneca Superior	28
T. & Hudson Bay	55 00
Temiskaming	60
Trethewey	‡ 21
Wettlaufer-Lor	15
Dome Exten.	26½
Dome Lake	42
Foley O'Brien	.50
Hollinger	28.10
Jupiter	.27
McIntyre	1 36
Newray	.48
Porcupine Crown	65
Preston E. D.	‡ 03
Vipond	‡ 41
West Dome	40

N. Y. EXCH. Aug. 16	
Name of Comp.	Clg.
Alaska Gold M	17
Alaska Juneau	‡7¼
Am.Sm.&Ref.,com	98
Am. Sm. & Ref., pf	‡111
Am. Sm. Sec., pf. A	93
Am. Sm. Sec., pf B	‡84
Am. Zinc	32
Am. Zinc, pf	65
Anaconda	83¾
Batopilas Min	1¼
Bethlehem Steel	465
Bethlehem Steel, pf	125
Butte & Superior	67¼
Chile Cop	20¼
Chino	50½
Colo. Fuel & Iron	45
Crucible Steel	72½
Dome Mines	‡25⅜
Federal M. & S.	‡13
Federal M. & S., pf.	‡35¼
Great Nor., ore ctf	36¼
Greene Cananea	45¾
Homestake	‡130
Inspiration Con	51¼
International Nickel	44⅜
Kennecott	49½
Lackawanna Steel	72½
Miami Copper	34¾
Nat'l Lead, com.	65
National Lead, pf	‡112¾
Nev. Consol	18¼
Ontario Min	‡5¾
Quicksilver	2½
Quicksilver, pf	4½
Ray Con	24½
Republic I&S, com	48½
Republic I&S, pf	112
Sloss-Sheffield	45
Tennessee Copper	25½
Utah Copper	81
U. S. Steel, com	89
U. S. Steel, pf.	117⅜
Va. Iron C. & C	‡44

N. Y. CURB	Aug. 16
Beaver Con	‡ 36
Buffalo Mines	‡ 85
Butte & N. Y.	1¼
Butte C. & Z.	5½
Caledonia	58
Can Cop Corpn	1 11/16
Cashboy	.04½
Cerro de Pasco	36½
Con. Ariz. Sm.	1½
Con. Coppermines.	‡1⅞
Con. Nev.-Utah	‡ 5/16
Crystal Cop.	1 1/16
First Nat. Cop.	4
Florence	‡ 75
Goldfield Con	81
Goldfield Merger	08½
Granite	‡ 20
Hecla Min	5
Howe Sound	4⅝
Jerome Verde	1 9/16
Joplin Ore & Spel	‡ 45
Kerr Lake	‡4⅜
Magma	15
Majestic	‡ 9/16
McKinley-Dar-Sa	‡ 60
Mother Lode	.30½
Nevada Hills	‡ .15
N. Y. & Hond.	15⅜
Nipissing Mines	‡6½
Oro	‡ 04
Ray Hercules	3⅛
Rochester Mines	.64
St. Joseph Lead	‡15½
Standard S. L.	1 3/16
Stewart	.25
Success	.34
Tonopah	‡5¾
Tonopah Ex.	5¾
Tribullion	5/16
United Zinc	‡6
White Knob, pf	‡1½
White Oaks	5¼
Yukon Gold	‡2 1/16

BOSTON EXCH Aug. 16	
Name of Comp.	Bid
Adventure	3
Ahmeek	99
Algomah	1½
Allouez	59½
Ariz. Com., ctfs.	9¼
Bonanza	.25
Butte-Ballaklava	⅜
Calumet & Ariz.	70½
Calumet & Hecla	525
Centennial	15
Copper Range	63⅜
Daly West	2¼
East Butte	13
Franklin	7¼
Granby	87
Hancock	14
Helvetia	.25
Indiana	3½
Island Cr'k, com.	47
Island Cr'k, pfd.	88½
Isle Royale	‡27
Keweenaw	3⅜
Lake	13½
La Salle	4
Mason Valley	2
Mass.	13⅜
Mayflower	3
Michigan	3¼
Mohawk	91
New Arcadian	6
New Idria	11½
North Butte	22¾
North Lake	2¼
Ojibway	1¼
Old Colony	2¾
Old Dominion	69
Osceola	88½
Quincy	88½
St. Mary's M. L.	76¼
Santa Fe	1⅞
Shannon	8½
Shattuck-Ariz	27¼
So. Lake	6⅞
So. Utah	23
Superior	16¼
Superior & Bost.	4
Tamarack	39
Trinity	5⅜
Tuolumne	.35
U. S. Smelting	71½
U. S. Smelt'g, pf.	50½
Utah Apex	3 15/16
Utah Con	81
Utah Metal	8¼
Victoria	3 9/16
Winona	5½
Wolverine	51½
Wyandot	1⅜

BOSTON CURB	Aug. 16
Bingham Mines	10
Boston Ely	.99
Boston & Mont.	82
Butte & Lon'n Dev.	58
Calaveras	4⅞
Calumet-Corbin	02½
Chief Con	1⅞
Cortez	.30
Crown Reserve	.35
Davis-Daly	1⅞
Eagle & Blue Bell	1¾
Houghton Copper	1⅜
Iron Cap Cop., pf	6
Mexican Metals	27
Mines of America	‡2½
Mojave Tungsten	3⅛
Nat. Zinc & Lead	63
Nevada-Douglas	1
New Baltic	1¼
New Cornelia	13½
Ohio Copper	.05
Oneco	80
Raven Copper	‡ 05
Rex Cons	.20
Rilla	.18
United Verde Ext.	31¼

‡Last Quotations.

Monthly Average Prices of Metals

SILVER

Month	New York			London		
	1914	1915	1916	1914	1915	1916
January	56.572	48.855	56.775	26.553	22.731	26.960
February	57.506	48.477	56.755	26.573	22.753	26.975
March	58.067	50.241	57.935	26.788	23.708	27.597
April	58.519	50.250	64.415	26.958	23.709	30.662
May	58.175	49.915	74.269	26.704	23.570	35.477
June	56.471	49.034	65.024	25.948	23.267	31.060
July	54.678	47.519	62.949	25.219	22.597	30.000
August	54.344	47.163	.....	25.979	22.780	.....
September	53.2[illegible]	48.680	.....	24.260	23.591	.....
October	50.654	49.385	.....	23.199	23.925	.....
November	49.082	51.714	.....	22.703	25.094	.....
December	49.375	54.971	.....	22.900	26.373	.....
Year	54.811	49.684	.....	25.314	23.675	.....

New York quotations cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

COPPER

Month	New York		London			
	Electrolytic		Standard		Electrolytic	
	1915	1916	1915	1916	1915	1916
Jan.	13.641	24.008	60.756	88.083	65.719	116.167
Feb.	14.394	26.440	63.494	102.667	*	133.167
Mar.	14.787	26.310	66.152	107.714	*	136.000
April	16.811	27.895	75.096	124.319	*	137.389
May	18.506	28.625	77.600	135.457	*	152.522
June	19.477	26.601	82.574	112.432	95.333	137.455
July	18.796	23.865	76.011	95.119	91.409	125.500
Aug.	16.941	.....	68.673	.....	82.333	.....
Sept.	17.502	.....	68.915	.....	85.250	.....
Oct.	17.686	.....	72.601	.....	88.000	.....
Nov.	18.627	.....	77.744	.....	93.273	.....
Dec.	20.133	.....	80.773	.....	100.43	.....
Year	17.275	.....	72.532	.....	.....	.....

TIN

Month	New York		London	
	1915	1916	1915	1916
January	34.260	41.825	156.550	175.548
February	37.415	42.717	176.925	181.107
March	48.426	50.741	180.141	193.609
April	47.884	51.230	166.225	199.736
May	38.790	49.125	162.675	196.511
June	40.288	42.231	167.636	179.466
July	37.423	38.510	167.080	168.357
August	34.389	.....	151.440	.....
September	33.125	.....	152.625	.....
October	33.080	.....	151.554	.....
November	39.224	.....	167.670	.....
December	38.779	.....	167.000	.....
Av. year	38.590	.....	163.960	.....

LEAD

Month	New York		St. Louis		London	
	1915	1916	1915	1916	1915	1916
January	3.729	5.921	3.548	5.826	18.606	31.16
February	3.827	6.246	3.718	6.164	19.122	31.98
March	4.053	7.136	3.997	7.375	21.883	34.44
April	4.221	7.630	4.142	7.655	21.094	34.36
May	4.274	7.463	4.182	7.332	20.347	32.96
June	5.932	6.936	5.836	6.749	25.170	31.01
July	5.659	6.352	5.531	6.185	24.611	28.13
August	4.656	.....	4.520	.....	21.946	.....
September	4.610	.....	4.490	.....	23.151	.....
October	4.600	.....	4.499	.....	23.994	.....
November	5.155	.....	5.078	.....	26.278	.....
December	5.355	.....	5.266	.....	28.807	.....
Year	4.673	.....	4.567	.....	22.917	.....

SPELTER

Month	New York		St. Louis		London	
	1915	1916	1915	1916	1915	1916
Jan.	6.386	16.915	6.211	16.745	30.844	89.81
Feb.	8.436	18.420	8.255	18.260	39.819	97.76
Mar.	8.541	16.846	8.360	16.676	44.141	95.04
April	10.012	16.695	9.837	16.525	49.888	99.05
May	14.781	14.276	14.610	14.106	68.100	94.2
June	21.208	11.752	21.038	11.582	100.614	68.5
July	19.026	8.925	18.856	8.755	97.250	5[illegible].75
Aug.	12.781	.....	12.611	.....	67.786	.....
Sept.	13.440	.....	13.270	.....	67.841	.....
Oct.	12.800	.....	12.596	.....	66.536	.....
Nov.	15.962	.....	15.792	.....	88.409	.....
Dec.	15.391	.....	15.221	.....	89.400	.....
Year	13.230	.....	13.054	.....	67.553	.....

New York and St. Louis quotations, cents per pound. London, pounds sterling per long ton. * Not reported.

PIG IRON IN PITTSBURGH

Month	Bessemer‡		Basic‡		No. 2 Foundry	
	1915	1916	1915	1916	1915	1916
January	$14.59	$21.60	$13.45	$18.78	$13.90	$19.7
February	14.55	21.16	13.45	18.93	13.90	19.5
March	14.55	21.81	13.45	19.20	13.95	19.4
April	14.55	21.65	13.45	18.95	13.95	19.4
May	14.61	21.78	13.60	19.11	13.83	19.5
June	14.70	21.95	13.67	18.95	13.77	19.3
July	14.94	21.95	13.91	18.95	13.68	19.2
August	16.01	.....	15.31	.....	14.75	.....
September	16.86	.....	15.95	.....	15.70	.....
October	16.95	.....	15.96	.....	15.80	.....
November	17.57	.....	16.47	.....	17.20	.....
December	19.97	.....	18.44	.....	18.95	.....
Year	$15.82	.....	$14.76	.....	$14.95	.....

‡As reported by W. P. Snyder & Co.

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Mining Practice at Santa Gertrudis, Mexico*

SYNOPSIS—Geological report of five years ago substantiated by subsequent findings. Remining of filled stopes has proved profitable, but cost is greater than that of mining virgin ore. Purchased electric power used entirely. Safety-first campaign reduces accidents, which, on account of type of labor employed, had been higher than in American operations.

The properties of the Santa Gertrudis Co., Ltd., lie within the Pachuca district, Hidalgo, Mexico, connected by three railway lines with Mexico City, 55 mi. southwest, and by two lines with Vera Cruz, 250 mi. southeast. The ores were formerly divided by sorting into two classes, smelting and milling, the former averaging about 2 oz. gold and 335 oz. silver, the latter 0.12 oz. gold and 23 oz. silver. The smelting ores were sold to custom plants, principally the American Smelting and Refining Co.'s smeltery at Aguascalientes. The milling ores were treated by the patio process at the Guadalupe hacienda, Pachuca. This patio was probably the largest in existence at the time and continued in active operation up to March, 1910.

ORE SORTING METHODS OF A FORMER AGE AT MEXICAN MINES

In January, 1910, the mines and patio were sold to English interests represented by Camp Bird, Ltd. Two ew companies were formed, the Compania de Santa ertrudis, S. A., to operate the mines, and the Compania Beneficiadora de Pachuca, S. A., to build and operate a ustom cyanide milling plant.

The historical geology of the Pachuca district is described by Fred. J. Pope, as follows:

1. The most recent sedimentary rocks in the district belong to the Cretaceous period.

2. The Cretaceous rocks were penetrated by large intrusions of andesite (referred to hereafter as primary andesite) which occur as elliptical dome-shaped masses, striking northwest-southeast. These andesite bodies are from 8 to 15 mi. long and from 6 to 10 mi. wide.

3. A period of erosion during which the contour of the andesite domes was changed.

4. Andesite flows (secondary andesite) which rest unconformably on the primary andesites.

5. A second period of erosion, again exposing areas of primary andesites.

6. A series of rhyolite flows which partly covered the primary and secondary andesites.

7. A third period of erosion which exposed large areas of both the primary and the secondary andesite. During this period there were many intrusions of quartz-porphyry dikes which cut the primary and secondary andesites and the rhyolite. For the most part they do not affect the economic tenor of the veins. In occasional instances, however, the veins are locally impoverished where they cut these dikes. Relative to the extent of the orebodies, these dikes are very small and have no economic value.

8. A period of areal faulting, probably due to subsidence and adjustment caused by the large, dome-shaped masses of primary andesite cooling at depth. During this period fissures were formed, rock between the walls was brecciated and there was a heavy silicification, but practically no economic values were brought into the veins. It was essentially a period of fissuring, brecciation and silicification.

9. A second period of faulting with movements relatively much less than during the first period. It was during and immediately subsequent to this secondary faulting that the veins received their economic values

10. Erosion and minor faults.

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*Excerpt from article by Hugh Rose in August, 1916, Bulletin, A. I. M. E.

In discussing the magnetic variations of the primary andesite, Mr. Pope further states:

> The primary andesite in which the Santa Gertrudis vein occurs is not a homogeneous rock. There are local variations due to differentiation in cooling. For the most part the andesite has a slight grayish-green color, is porphyritic and breaks with a rough surface. This is the prevailing normal type and averages approximately 65% silica. A more basic variation averages a little over 60% silica, is porphyritic, dark green in color, breaks with a conchoidal fracture and is very tough. Between these two types there are all graduations, and one often graduates imperceptibly into the other. Both occur at all levels to the bottom of the mine, a depth of 2,000 ft.
>
> Operations in the Pachuca district have demonstrated that the tough basic phase of the primary andesite is not favorable to the formation of ore and that all the large orebodies are found in the normal type. This is due to the fact that after the primary faulting and silicification, the basic phase was as tough or tougher than the original rock and thus resisted the secondary fracturing and subsequent introduction of economic values.[1]

The veins are not simple fissures filled with silica and economic minerals, but in a general way may be described as crushed zones varying from a few feet up to 50 and in some instances over 100 ft. in width. Usually both foot and hanging walls are fairly well defined, but in many places the dividing line between ore and wall rock can be determined only by systematic sampling.

As a rule the hanging wall is heavy owing to fracturing and to slips or faults parallel to the vein and in consequence must be carefully supported when mining the ore.

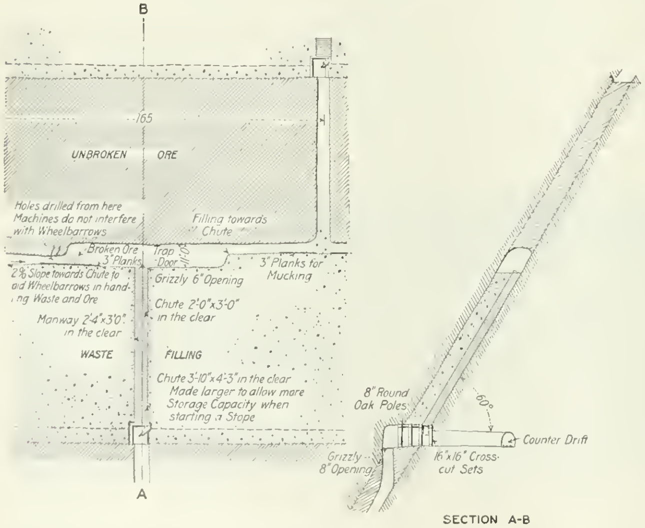

B
165
UNBROKEN ORE
Holes drilled from here Machines do not interfere with Wheelbarrows
Filling towards Chute
Broken Ore
3" Planks
Trap Door
3" Planks for Mucking
2% Slope towards Chute to aid Wheelbarrows in handling Waste and Ore
Grizzly 6" Opening
Chute 2'-0"x3'-0" in the clear
Manway 2'-4"x3'0" in the clear
WASTE
FILLING
Chute 3'-10"x4'-3" in the clear Made larger to allow more Storage Capacity when starting a Stope
8" Round Oak Poles
60°
Counter Drift
Grizzly 8" Opening
16"x16" Cross-cut Sets
A
SECTION A-B

FIG. 1. METHOD OF MINING VIRGIN ORE

The veins of the district are notable for the size and persistence of the oreshoots. As a rule the oreshoots do not outcrop, but are discovered at varying depths of one hundred to several hundred feet from the surface and in the upper levels are shorter and often have a distinctive pitch, generally to the east. Several of these shoots usually combine in depth to form the main great oreshoot of the mine. In the Santa Gertrudis vein a number of the smaller shoots were thus worked to depths of from 800 to 900 ft. At about this horizon they joined together, forming an orebody which persisted for another 600 to 700 ft. in depth, having a length in the several adjoining properties of some 3,000 ft. and a width averaging 18 ft. The grade of this great oreshoot was not less than $20 per ton[2].

At a horizon of about 1,800 ft. from the surface the veins, though still strong, become rapidly impoverished and at 2,000 ft. little payable ore is to be found. Below this horizon explorations are being conducted to discover the possible existence of a new zone of mineralization, but such work is not sufficiently advanced to permit any forecast of results.

The ores generally are clean, carrying very small quantities of lead, zinc or iron and with little or no manganese, none of which has any economic importance. The principal economic mineral is silver sulphide—argentite. The commercial values are confined to gold and silver, which are present in the proportion of 15% and 85% respectively. By weight, for each 1,000 oz. of silver there is usually 5 oz. of gold present.

The mining systems in general use are: (a) Overhead stoping without timbering, with filling; (b) overhead stoping with timbering and filling; (c) overhead stoping with shrinkage, with and without subsequent filling. In mining virgin ore in place system (a) is most generally adopted, being used where the hanging wall is too heavy to employ shrinkage stoping, but sufficiently strong to hold until the stope can be filled. Fig. 1 illustrates the details of this system. Foot-wall drifts (counterdrives) in the harder andesite are kept open after the sill floor of the vein has been stoped out and filled. Crosscuts from the counterdrive are run through the vein every 165 ft. and heavily timbered with chutes for drawing the ore from the stopes. These chutes are carried up with cribbed timbers as the stope advances and are divided into two compartments, one for ore and one for manway. Between each two crosscuts a raise is put up to provide entrance for the waste used in filling. Spreading this waste is done with wheelbarrows. Throughout the Pachuca district the remining of the old areas has become of great importance. The old fills are generally payable, and in most cases ore in place is also found on the walls. At first sight it might appear that such territory would be cheaper to mine than virgin ground. But this is not the case, for both the hanging wall and the ore are heavier, making it necessary to adopt system (b) with resulting slower extraction of ore at higher cost. Fig. 2 illustrates the details of this system, which in the main follow those of system (a) with the addition of square-set timbering. As the timbers are soon covered by the waste filling, light sets of 8x8-in. square or of equivalent round posts are sufficient. Sets measure 7 ft. 5 in. high by 5 ft. in the clear.

---

[1] Mr. Pope's report was made after a brief examination undertaken at the time of the purchase of the properties by the Camp Bird interests. Subsequent developments over five years have confirmed his findings in general. Several ore-bearing veins occur in basic andesite areas, but oreshoots are small and of relatively small economic importance. In the main North Vein, wherein the principal oreshoots are located, the lean parts of the vein within the ore-bearing horizon usually occur where the vein passes through the tough basic phase.

[2] United States currency and dry short tons used throughout unless otherwise specified.

System (c) is only applicable in one small stope in the Santa Gertrudis mine and hence need not be discussed in detail. In general it is used more commonly in the Real del Monte district than on the Pachuca side, the walls in the former district being much harder and more secure.

Levels were formerly driven 75 to 100 ft. apart. More recently the distance has been increased to 165 ft. (50 m.) vertically. It is questionable whether a greater distance than this could be used economically because of difficulty of holding open the timbered chutes.

Ore breaking is entirely overhand, using air hammer drills and 7/8-in. 40% gelatin powder. Filling for the stopes formerly obtained from caving stations in the hanging wall is now derived partly from development headings. To provide excess requirements a quarry is being opened on the surface to tap which a central raise in hard foot-wall rock is being put up. This raise will deliver or receive waste at each level.

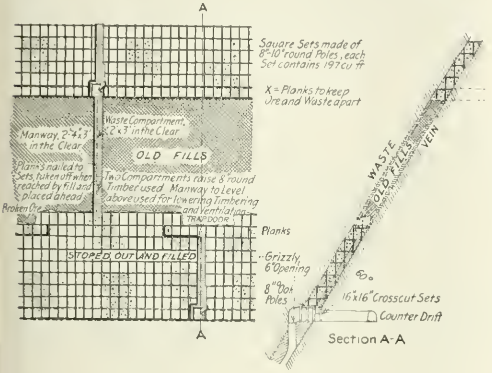

A
Square Sets made of 8"-10" round Poles, each Set contains 197 cu ft
X = Planks to keep Ore and Waste apart
Waste Compartment, 2'x3' in the Clear
Manway, 2'-4"x3' in the Clear
OLD FILLS
Planks nailed to Sets, taken off when reached by fill and placed ahead
Two Compartments raise 8" round Timber used Manway to Level above used for lowering Timbering and Ventilation
Broken Ore
TRAPDOOR
Planks
STOPED OUT AND FILLED
Grizzly, 6" Opening
8" Oak Poles
A
WASTE
OLD FILLS
VEIN
60°
16"x16" Crosscut Sets
Counter Drift
Section A-A

FIG. 2. METHOD OF REMINING OLD AREAS

SINKING SAN FRANCISCO NO. 2 SHAFT

Shaft sinking is generally against considerable water—200 to 400 gal. per min.; 3 1/8-in. machine drills are used. Electric firing of rounds has been tried, but with only partial success, on account of breaking timbers which must be carried close to the bottom. Electric time fuses have been used with better success and when intelligently handled are an improvement upon ordinary fuse firing. Of special interest was the construction of a two-compartment shaft (San Francisco Shaft No. 2) adjacent to the existing three-compartment San Francisco Shaft No. 1. A pillar of rock, 20 ft. wide, was left to protect the latter shaft, which was kept in operation; sinking and raising were carried on coincidently from several different levels. The shaft raises were timbered in two compartments, a light cage being used in the manway to handle men and tools. A small electric hoist at the foot of the raise served the cage, the hoisting rope being carried over a sheave swung from a movable beam at the top of the raise timbers. Sinking was done by usual methods. Work was commenced in March, 1912, and the shaft completed with pockets at a number of levels and put into operation in May, 1913, a distance of 1,768 ft. from the collar to the 19th level. Steel timbering, bought cut to proper lengths but fabricated locally, was installed throughout. No. 18 galvanized corrugated sheet lagging was used where necessary, being slipped into place on the outside of sets and held secure by small steel clips riveted to the sheets and fitted over the flange of the I-beam wall plates. The cost of the shaft without pockets was: Raising and sinking, $24.62 per ft.; timbering (steel), $20.33; loading and tramming, $0.65; hoisting (waste to surface), $6.23; explosives, $2.92; lighting, $0.59; miscellaneous, $0.27; total, $55.61 per foot.

All drifting and crosscutting of importance is done with 3 1/8-in. machine drills, using the horizontal bar mounting, two machines to a bar, the muckers cleaning up the breakage while the top part of the round is being drilled. Raising is entirely accomplished with air hammer drills. Winzing is generally by hand and only a relatively small amount of it is done, raising being generally cheaper and more rapid. Air hammer drills are occasionally used in winzing in hard ground.

Development costs per foot average:

	Shaft Sinking (Against Water)	Drifting and Crosscutting	Raising	Winzing
Labor	$59 25	$3 75	$2 50	$4 75
Timber	8 45	10	35	10
Explosives	3 25	1.70	70	60
Lighting	70	.05	06	06
Tracking and piping	1.00	60	.12	
Power	15 60	.50	50	.55
Maintenance, machine drills	50	05	10	
Tools	45	10	10	10
Tool sharpening	1 50	.60	60	.10
Hose, pump fittings, etc.	1 50	05	05	
Lubricants	25	.02	02	
Supervision	1 05	30	.30	.30
Totals	$93 50	$7.82	$5 40	$6 56

Tramming underground is by hand and electric haulage. Four main levels are equipped with electric haulage using 2.5-ton Jeffrey trolley locomotives, 250 volts. A battery locomotive was tried without success, the equipment being insufficient to handle the load against varying grades and track curvatures. In the locomotive haulage, a train is made up of ten U-dump cars each of 20 cu.ft. capacity, equal to about 0.9 of a dry ton of Santa Gertrudis broken ore. The cars are equipped with Whitney roller-bearing wheels and in general are giving good satisfaction. The center of gravity is sufficiently low to require complete filling for easy dumping, allowing the cars to be emptied over the shaft pockets without stopping the train. Waste for stope filling is loaded into the empty cars from the waste chutes on the return trip, when required. On hand-tramming levels the ore is passed, wherever possible, to electric haulage levels for transportation to shafts. Tracks are 20-in. gage, 16- and 20-lb. rails.

Men and material are handled in San Francisco Shaft No. 1; two double-deck cages operating in and out of balance and served by an Allis-Chalmers double-reduction geared electric hoist, using three-phase 50-cycle 440-volt 300-hp. induction motor with grid-type resistance, rope speed 1,000 ft. per min.; also in San Juan shaft, two single-deck cages operating in balance and served by a converted 150-hp. electric hoist, rope speed 700 ft. per min.

Ore and waste are handled in San Francisco Shaft No. 2, two 5-ton skips operating in or out of balance and served by a Fraser & Chalmers single-reduction herringbone-geared hoist using three-phase 50-cycle 440-volt 350-hp. induction motor with liquid-controller type resistance, rope speed 1,000 ft. per min., capacity 800 tons per 8-hr.

shift; also in San Guillermo shaft, one 3.5-ton skip operating counterbalanced and served by a duplicate of the hoist used on San Francisco No. 1; rope speed 1,000 ft. per min., capacity 200 tons per 8-hr. shift. This compound shaft is of interest because of its unusual characteristics. It is of old-style masonry from collar to 9th level; heavily timbered through the vein to the 13th level, has a twist of 30 deg. between the 13th and 15th levels to bring it parallel to the vein: between the 15th and 16th levels is a 50-ft. radius compound to convert the shaft to 60-deg. incline at which it continues to the 20th level, a total vertical and inclined length of 2,090 ft. Except for the heavy part through the vein, but little trouble has been experienced in the operation of this shaft, despite its small size in the upper section.

Plough-steel ropes of flattened-strand construction are used for hoisting, 1 in. diameter on men and materials hoists and $1\frac{1}{8}$ in. diameter on the ore hoists. Ropes are systematically inspected, as per South African requirements. After two years' service new ropes are put on, even though the old ones show no undue wear.

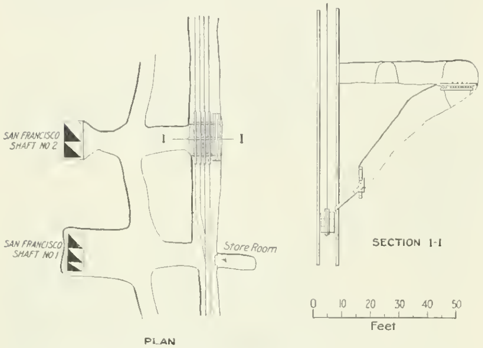


FIG. 3. ARRANGEMENT OF POCKETS AT LOADING LEVELS

On all working levels there are pockets serving the skips. Fig. 3 shows characteristic arrangement of the grizzly on top of the pocket and the tracking layout. Because the ore is free running and unusually fine, no measuring chutes are required, skip loading being accomplished accurately and with minimum loss of time by manipulation of the gates. With ample ore supply—that is, pocket fairly full—the loading time is from 15 to 20 sec.

The main pump station (Fig. 4) is on the 18th level near the San Guillermo shaft. The 10-in. discharge column of Mannesman drawn-steel tubing with bolted forged-steel flanges and round copper gaskets is carried horizontally on concrete pillars to the San Francisco Shaft No. 1 and thence vertically to the tunnel level, a total length of 2,967 ft. and a vertical lift of 1,328 ft. The equipment of the station consists of three 500-gal.-per-min. horizontal-duplex double-acting Prescott high-duty pumps, each driven through one reduction of herringbone steel gearing by a three-phase 50-cycle 1,040-volt 250-hp. General Electric induction motor, 180 r.p.m. No water-hammer difficulties have developed during three years' service, and the equipment in general has given excellent satisfaction. A traveling crane made the installation easy and assists materially in repair work. The pumps were installed under a guarantee of 85% efficiency based on power delivered to motor pinion. The motor efficiency was measured at the factory. A series of tests made by the local staff, after the pumps had been in operation for over a year, gave the following results:

No. of Pump	Water Pumped, Gal. per Min.	Static Head, Ft.	Static Head, Lb.	Dynamic Head, Ft.	Dynamic Head, Lb.	Theoretical Water Hp.	Input to Motor Hp.	Motor Efficiency From Curve	Input to Pump Hp.	Pump Efficiency, Sump to Discharge	Combined Pump and Motor Efficiency
1	480	1,328	573	1,371	591	160	193	93.1	180	89.2	83.0
2	481	1,328	573	1,371	591	161	199	93.1	186	86.6	80.7
3	469	1,328	573	1,371	591	157	192	93.1	179	88.9	81.6
1 & 2	950	1,328	573	1,388	599	317	408	93.1	380	83.6	77.8
1 & 3	940	1,328	573	1,388	599	314	400	93.1	372	84.4	78.5
2 & 3	939	1,328	573	1,388	599	314	403	93.1	375	83.6	77.8
1, 2 & 3	1,421	1,328	573	1,418	612	475	650	93.1	605	78.4	73.0

R.p.m. of motor, 480; hp. of motor, 250; voltage of motor, 1,040; r.p.m. of pump, 49.6; length of stroke, 3 ft.; original diameter of plunger, $4\frac{5}{8}$ in.; diameter of plungers at time of test, $4\frac{9}{16}$ in.; calculated displacement of plungers at $4\frac{5}{8}$-in. diam., 519.4 g.p.m.; calculated displacement of plungers at $4\frac{9}{16}$-in. diam., 505.5 g.p.m.: temperature of water, 87 deg.; weight of water, 8.304 lb. per U.S. gal.

In pump 3, after tests, a small stick was found under one valve.

Average gallons per minute pumped, 815; per day, 1,173,600; average pumping cost, including auxiliaries per day, $208.21; per gallon, 0.0177c.

The old main pump station was at the 15th level and consisted of two 8-stage Sulzer centrifugal pumps direct-connected to 480-hp. induction motors of German make, no load speed, 1,200 r.p.m., capacity 3,600 liters per min. each. These motors were designed for 60-cycle current and at 50 cycles failed to handle the water satisfactorily because of reduction in speed. One of these units is now installed on the 18th level and being connected into the suction of the pump remaining on the 15th level. The two now serve as a reserve unit of about 1,000 gal. per min. capacity.

Water from the 20th level is pumped to the 18th level by a 1,000-gal.-per-min. Alberger centrifugal pump, electrically driven. In shaft sinking below the 20th level No. 10 Cameron sinking pumps are used with air at 80 lb. pressure, and as the lift becomes too great for the air pumps, electric centrifugal station relay pumps are installed.

The natural ventilation of the mine is good, owing to the many shaft connections and to communications with the eastern adjoining properties, Barron and La Blanca. A motor-driven Sirocco fan is occasionally used temporarily to ventilate some section pending the completion of connections for natural air currents.

Particular attention is paid to keeping all parts of the mine free from refuse or filth. Special sanitary buckets are provided in suitable places on each level, which the men are required to use and are systematically taken to the surface for cleansing, lime being applied liberally underground to limit odors.

The main levels where there is much traffic are sprinkled with water daily, from a small truck fitted with a barrel having an ordinary sprinkler attachment. Good drinking water is piped to each shaft station. A well ventilated and heated change room is provided, equipped with shower baths of hot and cold water. This facility is not ordinarily found at a mine in Mexico, but its use is to be encouraged.

Within the last two years an active safety-first campaign has been in hand with very gratifying results. As is well known to all operators in Mexico, the native labor is unusually careless of danger or ordinary precautions against accident. Hence the problem presents exceptional difficulties and requires all the more careful attention to preventive details. Because of the reckless irresponsibility of the individual, coupled with a callousness to accidents which in fairness must be charged to the operators as well as to the men, the accident rate in Mexican mines is abnormally high. And for the reasons stated, this rate will always compare unfavorably with those of well-regulated mines in the United States or Europe. Nevertheless, a great deal can be done to improve this condition.

After securing information from some of the leading American mining companies experienced in safety-first measures, similar steps were undertaken here. A book of instructions covering accident prevention and first-aid measures was issued in Spanish and English. The shift bosses, or "capitanes," of each mine section were made directly responsible for accidents, careful statistics being kept of the work of each boss, with a monthly premium of money to the one having the best record for the month and a gold watch with suitably engraved inscription for the best record for six months. An annual contest is held in which various crews compete in rescue and first-aid measures. Bosses and men are drilled in the use of oxygen helmets. A monthly bulletin is printed in Spanish and distributed among the men, in line with similar bulletins issued by American companies.

As of interest to other operators in Mexico, some of the mechanical measures undertaken will be described briefly. All shaft entrances are provided with self-closing gates. After trying out several types, the one selected as most simple and efficient is merely swung off center and closes by gravity without undue jar. The upper gate is similarly swung, to protect the individual from falling rocks while standing at the shaft. Many accidents in Mexican mines are from men carelessly stepping into open chutes or manways in stopes or levels. All chuteways throughout the mine are now covered with rail grizzlies; manways either have a trapdoor of light corrugated iron or, where this interferes with ventilation, the timber is carried up sufficiently so that the top can be covered, leaving an opening at one end or on the footside for passageway. This opening is kept small enough so that a man cannot slip into it inadvertently. All manway openings on levels have in addition a warning red electric light.

Explosives to be used currently are stored underground in suitably placed crosscuts fitted with steel doors set in masonry. Fuse and caps are similarly stored separately. It having been found impossible to prevent the practice of crimping the caps with the teeth, fuse is now issued from these underground stores, cut to desired length and with caps properly crimped on by the storekeeper. The main storage of explosives is situated some distance from the property.

Rock falls are a principal cause of many accidents. As elsewhere, the main preventive is constant vigilance on the part of the bosses combined with such coöperation as it is possible to secure from the men. This spirit of coöperation is obtainable only in a limited amount in Mexico, but continued application will bring it forth to a helpful extent.

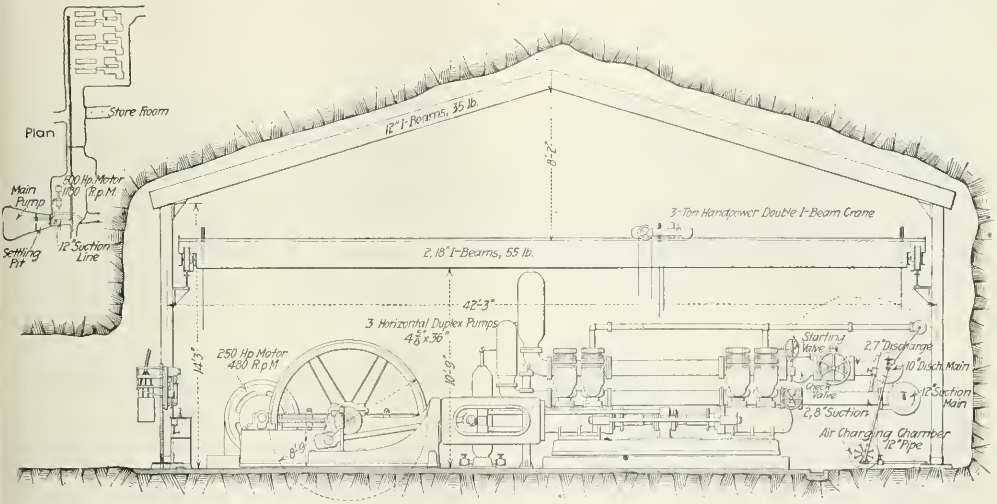


FIG. 4. MAIN PUMP STATION ON 18TH LEVEL

Following are accident statistics before and after safety-first measures were undertaken:

ACCIDENTS PER 10,000 SHIFTS

	Deaths	Requiring Operation	Trivial	Tota
Before..	0.574	1.436	12.067	14.277
After........	0.331	0.669	8.358	9.361

Trivial accidents include numerous bumps, scratches, slight cuts, etc., which do not incapacitate men from working.

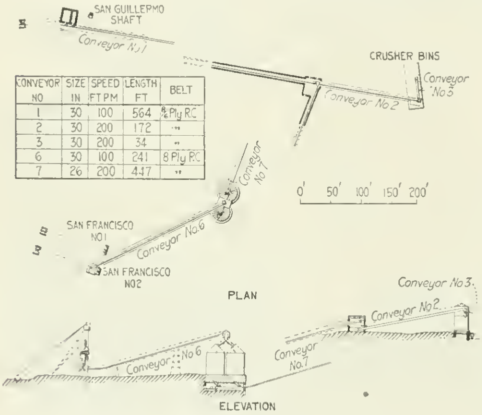
COMPLETE MINING-COST RECORDS KEPT

For convenience of comparison and of preserving complete records in compact form, the monthly costs are entered upon a tracing form from which blueprint copies are taken. The system requires perhaps less work than where similarly detailed costs are typewritten, whereas the advantage is obvious over any method that does not permit continuous column comparison of items.

Average costs are given herewith. These do not include recent results which, because of special influences, have been too low to represent fairly what should be obtainable under normal conditions:

	Per Dry Short Ton
Development..	$0.52
Ore breaking	1 47
Mine to mine bins.	24
Drainage.... .	24
Surface expense..	04
General expense.	27
Total mining cost....	$2 77

These results are on the basis of a daily production of 1,000 short tons of ore and may be taken as fairly representative of the Pachuca district. In the adjoining Real del Monte district lower costs are obtainable because the harder walls permit the adoption of the shrinkage system of stoping, with consequent reduction if not elimination of expenditure for square-set timbering and filling. At Santa Gertrudis, for each ton of ore extracted two-thirds of a ton of waste must be supplied and handled for filling and 17 ft. b.m. of timber is used. The shrinkage system affords another important advantage in Mexico by providing a reserve of broken ore which may be drawn upon more heavily at times to make up for current deficiencies due to numerous feast days and a relatively low constancy of labor. Another important factor affecting local mining costs is the light weight of ore in place and filling ore (old fills). The former averages 13.6 cu.ft. per ton. the latter 17.2 cu.ft. per ton. At Santa Gertrudis the moisture in the ore averages 5% and filling ores represent 65% of the total tonnage mined.



CONVEYOR NO	SIZE IN	SPEED FT PM	LENGTH FT	BELT
1	30	100	564	8/6 Ply R.C
2	30	200	172	"
3	30	200	34	"
6	30	100	241	8 Ply R.C
7	26	200	447	"

FIG. 5. SURFACE CONVEYING SYSTEM

A fair grade of timber is obtainable at $20 per 1,000 ft. b.m. Other supplies, if carefully purchased in quantities, cost about the same as in a mining district in Colorado or Nevada.

Labor efficiency is low, the complicated mining system likewise adversely affecting the duty per man. Including all labor in stopes for drilling, timbering, filling, etc., 1.27 tons of ore per man shift is broken and placed in the chutes: based upon all underground labor, including bosses and foremen. 0.687 ton of ore per man shift is delivered to the surface.

Power is purchased at from $45 to $50 per hp.-year from the Mexican Light and Power Co., whose hydro-electric plant is about 75 mi. away.

All ore is delivered from the mine by self-dumping skips, discharging into surface ore bins. Thence it is transported to the crushing-plant ore bins by means of belt conveyors. Fig. 5 shows in plan the conveying system from the San Francisco No. 2 and San Guillermo shafts to the crusher bins, and also a cross-section of the line from San Francisco Shaft No. 2.

Because of the previously mentioned free-running quality of the ore, plus the unusual percentage of fines which reach the belts first and form a cushion or bed for the larger rocks, the system operates with minimum wear or trouble. Hand-operated sector gates are used throughout, the chutes lips being hinged and counter-weighted to swing up from the belt when not in use.

On account of remining old fills, a large amount of decayed wood comes up with the ore and is picked off at the belts. Careful sorting tests have proved that waste picking cannot be done at a profit. Under close supervision 3.5% by weight was picked off averaging $0.70 per ton at a cost of $0.30 per ton waste; increasing the waste sorted out to 5% resulted in an increase of value to $1 at a cost of $0.40 per ton waste. The actual cost of passing these grades of material through the mill, less value recovered, is calculated to be lower than the sorting cost plus recoverable value lost. Therefore waste sorting has not been adopted. Sorting high-grade ore for shipment to smeltery, because of small quantity available as against high milling efficiency, is not profitable.

This "mine bins to mill bins" cost has averaged $0.02 per dry short ton. Belt wear is exceedingly low. Belt No. 2 is the only one that has been replaced once against a total of 1,131,708 tons handled to date. Belt No. 1, originally installed and put into operation in June, 1911, has handled 691,999 tons of ore and from all appearances is good for a repetition of this duty. Belts 6 and 7, a later installation, have been in operation since May, 1913, handling a total of 439,709 tons and showing little wear.

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Power of Syndicate Managers

By A. L. H. Street*

Authority vested in the managers of a syndicate of stockholders in a copper-mining company to do anything deemed proper or necessary in carrying out the purposes of the syndicate is held by the Supreme Judicial Court of Massachusetts, in a recent case, to have empowered the managers to employ a mining expert to complete a partial report of the value of orebodies controlled by the company. But the same opinion declares that the managers were without power to vote a block of stock to certain persons, to be delivered at the termination of the syndicate agreement, in consideration of faithful services rendered the company, howsoever commendable the action might be as a recognition of moral obligation. (Bradley vs. Borden, 112 Northeastern Reporter, 417.)

⁂

The Possibilities of Establishing Chemical Industries in South Africa is dealt with in an important report issued by the Development of Resources Committee of the South African Institute of Electrical Engineers. The report is confined to South Africa's chief industries, agriculture and mining. These industries taken together now require annually more than £2,000,000 worth of chemicals, all of which are imported in the form of fertilizers, cyanides and nitrates. The essential elements for the successful manufacture of the compounds are cheap electricity, abundant coal and limestone, and all these are available in South Africa.

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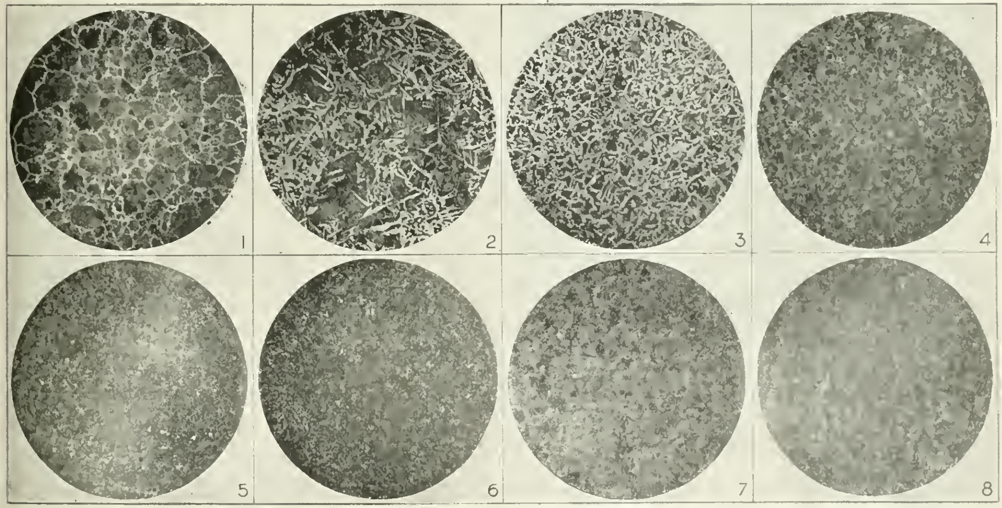
*Attorney at law, 829 Security Building, Minneapolis, Minn.

Testing of Dredge Bucket Pins

By Ralph A. Young*

SYNOPSIS—While the use of alloy steels in bucket pins has been more or less successful in producing metal of the necessary hardness and toughness, prices are almost prohibitive. By experimenting with carbon steels and evolving proper annealing processes for the steel following forging, the search for carbon steels the equal of alloy-steels has been successful. Hard, tough carbon steels are now produced having a tensile strength of from 85,000 to 111,000 lb. per sq.in.

In the mining of gold by the use of the elevator dredge, one of the great problems that confronts the engineer and dredgeman is the securing of suitable pin material to hold the bucket line together. There is an old adage that a chain is no stronger than its weakest link, and this also holds true concerning the bucket line, as it is as strong only as its weakest pin. It is absolutely essential, therefore, to have a pin as perfect in workmanship and design as can be produced. In addition, the pin must be of sufficient hardness to withstand without lubrication the wearing action of sand and yet be tough enough to stand up under severe shocks and constant vibration.



FIGS. 1 TO 8. PHOTO-MICROGRAPHS OF STEEL BILLETS

Figs. 1 to 3—Showing different grain structure due to varying temperatures of forging. Figs. 4 to 6—Results of Annealing. Figs. 7 and 8—Finished steel

Of pertinent interest at this time is a brief history of the dredge pin, which serves to show in a measure wherein some of the materials used in the past have failed. The first pins ever brought to the writer's notice were forged from steel of about 0.25% to 0.30% carbon, machined and placed in the bucket line. These pins, being very soft, soon wore and had to be replaced. The next pins were made from openhearth steel of 0.40% to 0.45% carbon content, and these gave better service, but were not trustworthy. About this time the size of dredge buckets was enlarged and hence it was necessary to increase the strength of the pins. Higher-carbon steels were used, some being made with carbon as high as 0.90%, but when this point was reached the leaf of the pins began to break, while the cost also increased owing to the difficulty in machining.

Oil tempering at one time was reported to be the proper treatment of all pins. This consisted in heating the pins to a dull red—about 1,200° F.—plunging them into a tank of tempering or fish oil and allowing them to cool in the oil. This process, if properly carried out, would relieve all internal stresses produced in the pins during the forging process, but often it did more harm than good, owing to the fact that the pins were not evenly heated throughout; therefore, instead of relieving the strains, the tempering set up new ones, so after being placed in service, they soon broke when subjected to severe shocks and vibration. Various forms of tempering or heat-treating were then resorted to which, because of being performed by those who were inexperienced in such work, caused the pins to fail sooner than they would if they had been used as forged. Nickel, nickel-chrome, chrome and chrome-vanadium steels have also been used with varying success.

In the use of the alloy steels the purchaser, unless he employs a metallurgical engineer, is somewhat at the mercy of the manufacturer, for he may buy alloy steel at a good price, but if the manufacturer has a tendency to be unscrupulous, he may furnish an inferior grade of material, and the service obtained is no better than that of ordinary steel. Some very good results, however, have been obtained from the use of the alloys named, and much is to be said in their favor, but at the present time it is almost impossible to get some of these alloys, except at a prohibitive figure.

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*Chemist and engineer of tests, the Marion Steam Shovel Co., Marion, Ohio.

With the advent of improved methods of manufacturing manganese steel, it appeared for a time as if the dredge operator had found a panacea for all his troubles, and for many purposes it has given splendid success, but not for use in dredge pins. Manganese steel is a metal with a high coefficient of expansion and a very low heat conductivity. A dredge pin in use on one of the larger machines is a thick piece of metal ranging up to 7 and 8 in. in diameter, and unless the manner, speed of heating, temperature used and quenching are absolutely correct, internal checks develop that do not show up at the time of manufacture, but usually do shortly after the first use in service.

Another point that must be taken into consideration is the cost. Manganese steel, to be of any value, must contain from 12 to 13% manganese, which means the addition of about 20 lb. of 80% ferro-manganese to every 100 lb. of steel. One has only to glance at the quotations in the daily metal market to see the reason of the recent advance in price of manganese steel. In 1914, 80% ferro-manganese sold at $36 per ton; today it is quoted at $400 to $450 per ton. In addition to the first cost, one must add that of heat-treatment (manganese steel is almost worthless as cast), also the cost of grinding, because it is too hard to machine and must be ground to shape. Another point worthy of consideration is that when a manganese-steel pin is taken from a line for any cause whatever, it is worth only its price as scrap, as it cannot be forged out into anything else, as is often done with the carbon and other alloyed steel pins.

CARBON STEEL CHOICE GOVERNED BY EXPERIMENTS

The foregoing facts have led the writer to try to produce in a measure from carbon steel the same results, or better, that have been attained by use of alloys. In the first place, by careful experimenting and from a knowledge gained by past experience, a steel was chosen whose carbon content would, with proper treatment, produce a high degree of hardness and yet retain sufficient toughness to prevent breakage. The next step was to secure metal of uniform composition, free from burnt oxides, incorporated slag and piping. Metal thus described, can be procured only from the mills where great care is taken when the steel is made, by using a fine grade of melting stock, melting properly, taking tests of metal from time to time, and when the desired carbon is reached, tapping the metal from furnace and pouring.

The practice in some plants is to run the carbon down rapidly by use of large quantities of iron ore, then when tapping, to bring the carbon up to the desired point by the addition of pig iron, coal, coke or mixer metal. The last-named method is not so bad, but the others at times have a tendency to leave incorporated gases in the metal, which cause small holes in ingots, and these holes when rolled show up in the billet or bloom in the form of seams.

Before tapping or when it is tapped into the ladle, the metal should be so treated than when poured in to the ingot molds, it will set rapidly, thereby not allowing carbon, sulphur, phosphorus and any minute particles of impurities to segregate. Metal properly treated in the ladle will shrink and have depression, or "pipe," at the top of the ingot. When this reaches the rolls, a sufficient crop (usually 9% to 10%) should be made to eliminate this defect.

The billets from which the pins are to be forged are rolled from this steel. When these reach the forge department, test drillings are again taken to check the mill, and test specimens are also cut from many of the billets, prepared and examined under the microscope for any incorporated impurities that might not show up in the chemical analysis. By examining specimens under the microscope, cut from outside and center of the pins, it is possible to select a billet of the right size, so that the metal receives the effect of the forging all the way through.

It is a well-known fact that no two pins are finished at the same heat in the forge shop. Photo-micrographs, Figs. 1, 2 and 3 show the different grain structures that exist in different pins—in fact, at different points in the same pin, as that shown in Fig. 2 was taken from one end, and that shown in Fig. 3 from the opposite end of the same pin. Since the pins go direct from the forge to the machine shop and thence into the bucket line, such photos explain in a measure why one pin will wear and another one break.

When the pin leaves the forge shop, it is sent to the heat-treating department. This operation is one of the most important in the whole process of manufacture, and here every operation is safeguarded by the finest of instruments. When steel is heated to a certain temperature, physical changes take place, and in order properly to develop the greatest strength and hardness in a piece of steel it is essential to know at what temperature this change takes place, as different steels have different critical points.

The photo-micrographs shown in Figs. 4, 5 and 6, will help make plain the results attained by the heat treatment. Fig. 4—Sample was heated to 1,450 deg. F. and cooled. Fig. 5—Sample heated 50° F. higher than sample 4, or 1,500° F., and cooled. Fig. 6—Sample heated 50° F. higher than sample 5 or 1,550° F. and cooled. All were reheated to the same temperature. The physical properties were as follows:

Sample number	4	5	6
Tensile strength, lb. per sq.in.	99,900	111,250	98,500
Elastic limit, lb. per sq.in.	57,640	82,000	73,250
Elongation in 2 in., %	22.5	25.5	24.5
Reduction of area, %	48 9	60.8	53.3

Judging by the results of the physical tests, No. 4 was not heated quite to the transformation point; No. 5 was slightly over and at the right temperature, while No. 6 was heated too high. From this outline explanation is apparent the importance of knowing at what temperature the critical point is located, so the pins can be properly heated. To determine this, an instrument called a Transformation Point or Critical Point Apparatus has been placed on the market. When this point is determined, it is then necessary to have a properly constructed furnace or oven connected with recording pyrometers that are accurately calibrated against a standard.

In addition to the pyrometers it is the practice of the writer to place on every load of steel to be treated pyrometric cones that melt down when a certain temperature is attained. By placing these in all corners of the oven, it is an easy matter to see that all portions secure the same temperature. The rate of heating, fuel used, method of firing, manner of cooling, quenching and reheating are all carefully watched. Attached to the body of pin and also to the leaf are prolongations of ample size for test bars. As soon as the heat treatment is complete, these bars are sawed from the pins and sent to the physical and microscopical laboratory. Specimens are prepared and examined under the microscope to determine if the heat treatment has been properly conducted, and if so, the specimen is photographed for record. The remainder of the bar is tested for hardness on Olsen's hardness machine, which tests for hardness by measuring the depth of penetration of a steel ball under a load of 5,000 lb. (This load may be changed, depending on grade of material.)

By comparing the results thus obtained with those from pins that have proven successful in the field, the hardness can be regulated. After the bar is tested for hardness, it is machined to standard 2-in. test bar and pulled for tensile strength, elastic limit, elongation and reduction of area. Should any of the tests not come up to standard, the pin is returned to the heat-treating department and the whole operation is repeated.

Figs. 7 and 8 show photo-micrographs of finished steel, and by comparing them with Figs. 1 and 2, one can see the changes effected in their grain structures by the heat treatment.

The following are a few results selected at random from a recently manufactured line of pins:

	1	2	3	4	5
Tensile strength, lb. per sq.in.	88,500	88,680	85,750	89,000	86,400
Elastic limit, lb. per sq.in.	55,700	54,100	53,400	58,250	52,610
Elongation in 2 in., %	23.5	28.0	24.5	21.5	23.6
Reduction in area, %	61.2	64.7	58.7	53.8	57.6

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Arizona's Mining Problems

The establishment of a United States Bureau of Mines' experiment station at Tucson, Ariz., is hailed with satisfaction throughout the state. In explaining that satisfaction the Arizona State Bureau of Mines' letter says:

It seems to be a general conviction that a state leaping forward at the rate that Arizona has in the production of metals can have but few unsolved problems, but an analysis of the situation will show that this it not the case. Over 95% of the copper yield of the state is produced by 13 companies, out of 400 producers. There are thousands of mines in the state waiting for commercially profitable methods of reduction. As it is at the present time, with no facilities for metallurgical research, the only hope of the smaller companies having unsolved problems is to sell out to the large corporation with sufficient capital to carry its own research. This is evidenced by the many recent changes of ownership. The Calumet & Arizona spent thousands of dollars to develop a process for the economical extraction of the ores at Ajo, although the mine at Ajo is one of the oldest in the state.

Arizona literally abounds with problems. Immense low-grade deposits of copper are awaiting an economical method of treatment. The leaching of the carbonate ores of copper will bring to the state many hundreds of thousands of dollars, hitherto unavailable. The finding of an economical separation system for the large orebodies of garnet associated with copper will cause some large producers to operate. The utilization of the smelter smoke in the manufacture of sulphuric acid through finding a use for the acid will relieve many farmers, as well as expand the mining-business profits.

Although the problem of separating lead and zinc sulphides has been partly solved in other states, the methods of solution are not available for the immense deposits of these ores in Arizona, and means must be devised other than those which involve cheap power. Metallurgical research on molybdenum affords one of the state's greatest problems of its undeveloped resources. The cyanidation of refractory ores is another difficulty but partly overcome.

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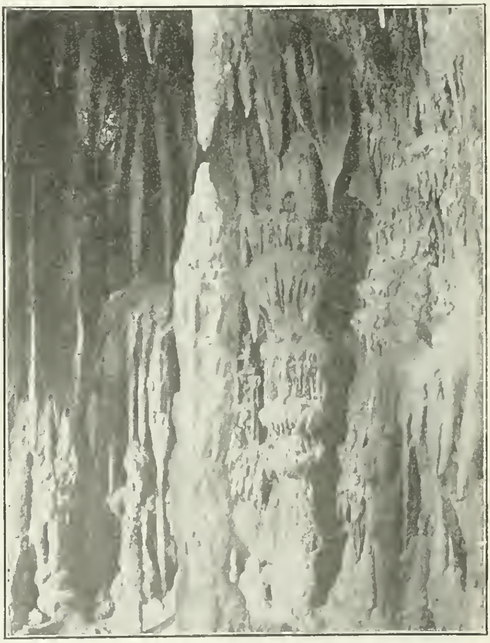
Copper Queen Cave in New York

By Walter L. Beasley*

In the course of mining operations at the Copper Queen mine, Bisbee, Ariz., a beautiful stalactite-lined cavern was recently broken into. Exploration proved this to be the entrance to a series of grottoes which contained a wealth of beautifully shaped and copper-tinted formations.

Fortunately for the preservation of such beauty to posterity, news of the discovery reached Dr. Edmund Otis Hovey, curator of geology at the New York Museum of Natural History. Before mining operations necessitated the destruction of the caverns, Dr. Hovey and three assistants visited Bisbee to attempt the preservation of at least a portion of the grotto formations.



REPRODUCED COPPER QUEEN GROTTO, NEW YORK MUSEUM OF NATURAL HISTORY

In the interest of science the Copper Queen company placed the caverns at the disposal of Dr. Hovey for the museum. The grottoes had an age estimated at 25,000 years based on the length of time required to form the slow-building stalactites. The chief feature of beauty of one of these grottoes was a great greenish-white stalagmite rising from the limestone floor nearly to the ceiling, a height of about 14 ft., its diameter at the base being about 15 ft.

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*69 W. 108th St., New York City.

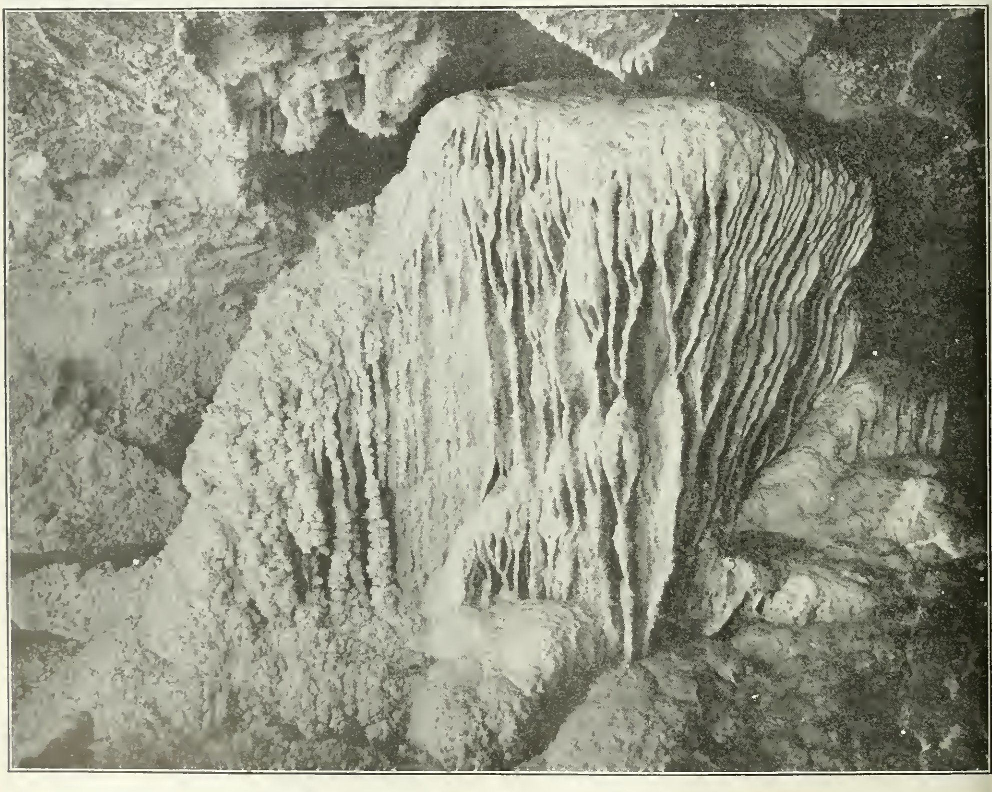
Stalagmite is of extremely slow growth, and even under the more favorable conditions of growth at Luray Cave, Virginia, where actual measurements have been made, such a 14-foot mass would have required more than 17,000 years to form. Hence it is safe to assume that this grotto in the Queen Hill is much older than 17,000 years, since the rainfall and consequent solution is considerably slower in Arizona than in Virginia, though evaporation and consequent deposition is more rapid.

Having decided to attempt the reproduction of a portion of the caverns for exhibition purposes at the New York museum, Dr. Hovey and his assistants spent many weeks in skillful and patient work in carefully dislodging their required specimens. Some idea of the care required is obtained from the statement that the stalactites and stalagmites weighed from one to 800 lb. each. Fifty boxes of the beautifully tinted blue and green formations were collected from the ceilings, walls and floor of the grottoes and shipped to New York.

So beautiful were the caverns in their outlines and tinted formations that the curators were continually impressed that their work was little short of vandalism as it progressed, even though done in the interests of science. The acompanying illustrations of the New York reproduction of the cavern, however, will show why they have ceased to harbor regrets.

This work of assembling and jointing the large number of stalactites to form this museum cavern reproduction was a feat successfully accomplished under the direction of William A. Peters, an artist of the museum staff, who personally accompanied the expedition to Arizona.

The final reproduction of the cavern at the New York Museum of National History occupies a space 14 ft. high by 10 ft. long. The outside of the cave is roughly finished in limestone blocks and the interior, portions of which are shown in the accompanying illustrations, is viewed through a large glass panel. The natural color beauty of certain of these stalactites has been heightened by the use of concealed electric lights placed in many sections of the cave.



CORNER OF REPRODUCED COPPER QUEEN GROTTO

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The Mines Development Act recently enacted by the Legislative Assemhly of British Columbia provided a fund of $200,000 as an aid to mining development in the province. When development work, either on lode on placer claims, has proved the existence of commercially available ore deposits, public money out of this fund is advanced for the construction of trails, roads and bridges. When private individuals have undertaken the construction of such trails for the development of their mineral resources, 50% of the cost of this construction may be refunded at the discretion of the Minister of Mines.

Diamond Drilling at Sudbury

By L. A. Parsons*

SYNOPSIS—Statistics relative to the drilling of 100,000 ft. of holes at a cost of $2.53 per ft. Carbon- and fuel-consumption factors applicable to this district are given. The importance of surveying drill holes at regular intervals during their progress is dwelt upon and the question of deflection is discussed.

The statistics presented here have been compiled from the results of over 100,000 ft. of diamond drilling done by the Canadian Copper Co. in the Sudbury District, Ontario, during the last 14 years. Except for a small amount in the early days, practically all the drilling has been done on contract, and consequently much of the information that would have been valuable is more or less a secret with the contracting firms, so that the statistics are rather incomplete in some items.

The country rock consists mainly of a fine-grained norite, somewhat mineralized with pyrrhotite; occasional diabase dikes, and some granite and greenstone. The orebodies are large lenses varying from practically solid pyrrhotite (with subordinate amounts of chalcopyrite) to mixtures of pyrrhotite with smaller quantities of country rock. The majority of the drilling was in slightly mineralized norite, with occasional intersections of the other rocks mentioned; about 20% was in more or less pure pyrrhotite.

The holes considered here were all drilled from the surface. The majority were vertical and varied in depth down to 1,500 ft., averaging about 800 ft. In the early exploration days, when little was known about the orebodies, the location of the holes was somewhat erratic and varied as indications regarding the shape and extent of the orebodies were discovered. Latterly a more systematic method has been employed, and surface holes have been drilled vertically from the corners of squares not greater than 200 ft. on a side.

Screw-Feed Machines Used

E. J. Longyear Co. Nos. 1 or 2 screw-feed machines have been used exclusively in recent years and probably for most of the work. A hydraulic feed was used for some of the first work done, but was discontinued, I understand, because it caused too great wear on the carbons.

Various types of bits, rods, etc., have been used from time to time, but the equipment in most general use is as follows: Bits, "E" standard, inside diameter, $\frac{31}{32}$ in., outside diameter, $1\frac{17}{32}$ in.; core, $\frac{15}{16}$ to $\frac{7}{8}$ in., according to setting; hole, about $1\frac{9}{16}$ in.; core barrel, "E," outside diameter, $1\frac{7}{16}$ in., inside diameter, 1 in., length, 10 ft.; rods, "E," outside diameter, $1\frac{5}{16}$ in., wall, $^{15}/_{64}$ in., weight per foot, $2\frac{3}{4}$ lb.

In 16,248 ft. recently drilled, the carbon consumption was 214 carats, an average of 0.0132 carat per ft. Against this there is a record of 3,413 ft., when drilling was just starting, requiring 66 carats, an average of 0.0495 carat per ft. What the exact reason for this discrepancy is I cannot say. The latter may be just an erratic high figure or may be due somewhat to a combination of hydraulic feeds and drilling unknown ground. If the latter has much bearing on the matter, it would indicate that in drilling a new country allowance should be made for a carbon consumption somewhat above normal until the drillers become used to the ground, or else especial care should be taken with the early holes. I believe that the first figure of 0.0132 carat per ft. is about right for this district under present drilling conditions.

The drilling of 16,000 ft. required 650 tons of bituminous coal, an average of 0.04 ton per ft. In 3,883 ft. of holes on which wood alone was used as fuel, 330 cords of wood was required, an average of 0.085 cord per ft. In 1,802 ft. of holes both wood and coal were used as fuel, which cannot be separated. The coal was 36 tons and the wood 65 cords, an average of 0.02 ton of coal plus 0.036 cord of wood per ft. Although not of much use in themselves, these figures serve as a check on the separate ones already given.

Supplies and Rate of Progress

Miscellaneous supplies include oil, waste, odd nuts, bolts, washers, etc., small pipe fittings; in fact, all supplies other than fuel and carbons, except parts of drill outfit proper and large repairs. Of these supplies 14,289 ft. required a total of $536, an average of $0.038 per ft.

The time required to tear down, move and set up is usually two days for a crew of 5 men—1 setter and a runner and helper from each shift. This makes a total of 4 shifts running time lost when drilling 2 shifts, which is the usual procedure. This, of course, is for conditions where the next hole is already laid out and reasonably close to the one finished—within 100 to 200 ft.

The number of feet per drill shift is calculated for the net running time, obtained by subtracting from total time that required to tear down, move and set up. Thus 19,455 ft. of holes required 1,728 drill shifts, an average of 10.4 ft. per drill shift. Maximum 939 ft. in 72 shifts, an average of 13 ft. per drill shift. Minimum, 868 ft. in 104 shifts, an average of 8.3 ft. per drill shift. Some of these holes were inclined, but most of them were vertical.

The amount of lost core is an important factor in diamond drilling. At one mine where the country rock was solid and moderately hard, without excessive fissuring or cleavage planes, 30 vertical holes aggregating 14,007 ft. showed 156 ft. of lost core, an average of 1.1%. For 16 inclined holes aggregating 3,296 ft. varying from 60° to horizontal, the lost core was 315 ft., or 9.5%. Three of these inclined holes aggregating 1,647 ft. showed a total of 284 ft. of lost core, or 17.1%. This extremely high loss is due to the fact that the holes were drilled down the dip of the orebody and therefore entirely in ore. For some reason these sulphides grind much more rapidly in inclined than in vertical holes. By subtracting these holes of high loss, the remaining inclined holes show a loss of 1.9%, which is much more reasonable.

At another deposit, where the country has a rather more distinct cleavage, 66 vertical holes aggregating 56,419 ft. showed lost core amounting to 1,392 ft., or 2.47%.

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*Mine engineer, the Canadian Copper Co., Copper Cliff, Ontario.

For eight inclined holes aggregating 2,974 ft., the lost core was 147 ft., or 4.95%. The inclined holes of both deposits quite consistently show more lost core than the vertical ones.

All holes here are surveyed for dip by the customary method of a glass tube and hydrofluoric acid. Surveys for strike are not practicable on account of the magnetic character of the orebodies. The following table gives the results for holes drilled in three different deposits here. Only the angle at the bottom of each hole is given, together with the distance from the collar, as intermediate readings would make the table too long. All the holes given were started vertically. In almost every case the deflection was gradual and cumulative, so that the total offset for the point given is considerably less than that obtained by calculating the curvature as a simple curve.

DEFLECTIONS IN DRILL HOLES

Deposit A		Deposit B		Deposit C	
Depth	Angle	Depth	Angle	Depth	Angle
200	89-30	400	86-45	333	87-30
400	89-30	400	84-30	400	83-15
400	88-30	550	51-00	600	89-30
400	88-30	600	81-30	600	89-45
600	88-30	600	68-15	791	84-30
600	90-00	600	80-30	820	87-30
600	88-30	668	89-15	1,000	83-45
600	85-00	716	77-30	1,000	87-00
600	83-15	731	82-30	1,000	85-15
800	90-00	762	85-00		
800	86-30	792	71 45		
800	88-00	794	65-30		
800	87-15	794	81-00		
800	90-00	800	86-15		
922	90-00	800	82-30		
931	86-00	800	82-00		
1,000	89-45	800	82-30		
1,000	81-15	800	78-15		
1,000	90-00	800	82-15		
1,000	88-00	809	86-00		
1,000	90-00	800	82-45		
1,000	89-00	800	83-15		
1,000	83-00	800	84-15		
1,200	87-15	800	83-15		
1,200	80-30	907	83-30		
1,200	86-00	924	83-15		
1,200	82-30	928	75-30		
		1,048	82-00		
		1,200	81-15		

Examples B and C are in ground much more difficult to drill straight than A. This is due somewhat to a more pronounced cleavage, but principally, I think, to the inclusion of numerous "bombs" of different rocks, offering to the bit glancing surfaces of varying hardness. These bombs were very well shown in the mine workings, and from their appearance in many places, I am surprised that many of the holes are as straight as they are.

The table illustrates some of the bad deflections that will occur under unfavorable conditions. In this connection I should like to emphasize the necessity for surveying holes at regular intervals as they are being drilled. It would almost seem as if this were too obvious to require mention—the fact that some holes deflect badly is common property—and yet a surprisingly large number of experienced men neglect this precaution only to find out too late that many of the holes have deflected so badly as to be in some cases almost worthless. In a new country with unknown ground it is particularly necessary. If holes start to deflect seriously, the usual remedies can then be tried before it is too late. And there is another advantage besides this—the regular measuring of the angle seems to have a good moral effect on the drillers, who take much more care where they know the hole is being checked. Ordinarily here, we survey at 200-ft. intervals, the first reading being taken after the first pull; that is, 10 ft. deep. If this reading does not check exactly the angle for which the hole was laid out, the machine is pulled off and the hole started again.

I do not know any rule for direction of deflection. In another district where a good deal of boring was done the inclined holes habitually deflected up. That is what one would expect from the mechanics of the thing; and yet here inclined holes habitually deflect downward for no apparent reason. When passing from a harder to a softer rock with an inclined contact, I should expect a hole to deflect away from the softer rock; yet here again they do the opposite. The only generality I can make is my first one: Don't theorize; survey the hole as it is being drilled and find out which way it is deflecting.

Nobody but the contractors know exactly what the costs here are. A typical contract would be $3 per ft. for the first 1,200 ft. and $3.50 per ft. deeper than that, contractors furnishing everything. I should analyze the probable costs somewhat as follows, based upon the prices obtaining before the war, instead of the more or less unstable conditions at present:

Assume one month of 30 days, 26 working days, of which 2 days are used for moving, giving 24 days, or 48 shifts, actual drilling time. Then 48 × 10.4 = 500 ft. drilled, for which the labor charge is: Setter, $150 per month; runner, 52 shifts at $3.50 per shift, $182, and helper, 52 shifts at $2.25, $117, or a total of $449, which is $0.90 per ft.

OPERATING COST PER FOOT

Labor per ft.	$0.90
Carbons, 0.0132 carat at $85	1.12
Coal, 0.04 ton at $5.50	.22
Other supplies	.04
Depreciation, repairs, water, etc.	.25
Total cost per ft.	$2.53

These costs of course are for a long contract. A contracting firm has many other expenses which cannot well be estimated, such as pay to employees between contracts, expenses for getting men and materials from their headquarters to the place of work to start a contract, unreasonable delay in being given the location for the next hole, etc. The item of water alone is quite variable and may easily amount to $0.25 per ft. or more.

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Iron and Steel in Canada

The production of pig iron in Canada, according to the statistics collected by the American Iron and Steel Association, was as follows, in gross tons:

	1914		1915	
	Tons	%	Tons	%
Basic	331,456	46.9	660,369	80.0
Bessemer	184,053	26.1	13,714	1.7
Foundry	174,346	24.7	125,769	15.2
All other	16,117	2.3	25.568	3.1
Total	705,972	100.0	825,420	100.0

Of the production in 1915 a total of 803,646 tons was made with coke and 21,774 tons with charcoal. In all 671,510 tons was converted into steel or otherwise used by the makers and 153,910 tons was merchant iron, for sale. As to delivery, 598,221 tons was delivered from the furnaces in molten condition, 180,770 tons sand cast, 46,410 tons machine cast and 19 tons made into castings direct from the furnace. Ontario made 450,774 tons and Nova Scotia 375,246 tons.

The raw materials used were 1,609,032 tons of ore, cinder, etc. (4,367 lb. per ton of iron made); 512,379 tons limestone flux (1,391 lb. per ton); 1,070,437 tons coke (2,632 lb. per ton); 1,314,357 bu. charcoal (108 bu. per ton). There are 17 coke furnaces in Canada, nine in Ontario and eight in Nova Scotia; and two charcoal furnaces, both in Ontario.

The production of steel for two years was as follows, in gross tons:

	1914	1915	Changes
Openhearth	556,910	884,736	I. 327,826
Bessemer	186,158	22,521	D. 163,637
Other kinds	284	5,498	I. 5,214
Total	743,352	912,755	I. 169,403

The total in 1915 includes about 5,000 tons of alloy steel. The direct castings included in the total last year were 39,490 tons.

The finished iron and steel made in 1915 included 209,752 gross tons rails, 111,829 tons structural steel and wire rods, 328,737 plates, sheets, bars and merchant iron; total, 653,318 tons, a decrease of 6,201 tons from the previous year. The production of nails in 1915 was 1,636,000 kegs of 100 lb. each, an increase of 492,000 kegs over 1914. The production of splice bars and rail joints was 9,406 tons, the smallest for several years. The iron and steel forgings made were: Iron, 323 tons; steel, 21,775; total 22,098 tons, an increase of 13,960 tons over 1914. The production of cast-iron pipe in 1915 was 53,700 net tons.

Selling in South America

By Mark R. Lamb*

American manufacturers think the Canal is going to make it easier to market goods on the west coast of South America. It is, but the Canal is really a minor factor. The same people here will buy the same amount of the same things after as before the opening of the Canal. There are other factors that will have more influence in trade than the Canal opening.

Keep your traveling salesman away from Chile, Bolivia, Peru and Ecuador until he is entirely restored to health after his tongue has been operated upon for such words as "native," "Indian" and phrases like "We don't do it that way in the States" and "South Americans are terrible grafters." To the South American the North American who chews tobacco or eats cigars and says "Amurican" every minute is not a business man. He is given about as much consideration as is given to a Yogi in the States. He is a curiosity. He is courteously treated, but he goes home positive that there is no business for his house on the West Coast. His Masonic, Elk or Shriner button will be examined with respectful curiosity—and will as effectively bar him from business with conservatives as though he had cursed the Pope. Lord Chesterfield has said that it is impossible to protect a fool from the results of his folly. It is equally impossible to teach a provincial man to conform to new customs. That is why so many traveling men from the States insist upon having breakfast at hours unheard of here. He cannot eat the food indigenous to the country, and as though this were not enough, he talks about it all the time.

The other side of the picture is much pleasanter. The traveler with tact, experience and a knowledge of Spanish goes back with his book full of orders. Go into the hardware store to buy tools. The clerk shows you several grades of the same tool. "This is the genuine American, that is the English imitation and the other is the German imitation." The same happens with shoes, staple groceries, shoe-manufacturing machinery, and to a less extent with agricultural machinery, which is considered better while it lasts, but is cheaper and less strongly built than English lines.

Nowhere along the coast is there any organization resembling R. G. Dun. Credits must be investigated personally. The large trading firms have private credit departments—usually consisting of old employees who know the important stores, farms, mines and factories. The much-talked-of credits allowed here are the same as those granted the Kansas farmer or the country storekeeper on mortgaged crops or stocks of merchandise. American manufacturers can give these credits in South America when they have their men on the ground—not before.

Competition from Various Sources

German and English competition is real but not alarming. German and English manufacturers are just as anxious to show a profit as are Americans. Usually they do not give credit to poor-pay people purposely. Two manufacturers of articles sold on the installment plan have their own staff in Chile, and both managers have told me that their collections average better than in the home offices.

The usual remark one hears about electrical machinery is that the German leads in quality and sells at a lower price. This is perhaps due to the fact that German companies control most of the power plants in Chile, and they naturally prefer and favor German products and recommend to their power customers the purchase of German motors. The business is not a monopoly, however, and methods are fair and aboveboard. It is merely a question of salesmanship. In ships, large engines and niter-mining plants, English products are favored because most of the nitrate companies are English-owned. There is but one American company in 150.

Credits need careful handling. The West Coast buyer considers the subject in a very different light than do Americans. As an example, he may promise to pay on a certain date and then peremptorily decline to do so, though he finally pays in full and with interest and has no intention of avoiding payment. This is fatal to credit, according to American ideas, yet the buyer is a good customer and worthy of credit. The South American business man is as suspicious of his own countrymen as he is of foreigners, and my own experience is that his suspicions are not well founded.

Selling through agents is a good or bad plan, depending solely upon the agent. A manufacturer of Boston garters, for instance, cannot afford a branch office, yet he could do better than he is doing now. So far I have not found the 25c. kind at less than 75c. per pair.

The general wholesale cloth merchant, however big or old or influential, is not a good agent for assay balances or microscopes. There are suitable agents for every line and some are so suitable that they represent every manufacturer of a given line of goods, thus making a profit whichever article is bought and not pushing any particular product.

Other agents seem to get orders only when the buyer holds the order in one hand and a gun in the other. One noted manufacturers' agent expects his salesmen to sell kerosene, ready-made suits, locomotives, barbed wire, battleships, house paint, smelters and shoes. The salesmen attempt it.

Commercial travelers from the States are canvassing this territory with increasing frequency lately and their complaints, when they have them, have a curious sameness. "Our agents don't know our line." "Help us find a suitable representative." "I sold more in a week than our agents sold in a year."

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*Allis-Chalmers Co., Santiago, Chile.

The problem is the manufacturer's as much as it is the traveler's. The manufacturer must choose between giving his business to an agent already overloaded with agencies and picking his man. Then in exchange for a little judicious encouragement in the way of expense money or consigned stock, insist on personal selling endeavor. It is all a question of choosing the man. I know a man who sold an automobile "from a catalog" immediately after getting the representation. He will probably go right on doing it, but he would sweep the field with a few consigned machines.

Where the manufacturer's line is large enough, he should have his own representative attending to the line exclusively. For the reason for this, put yourself in the place of the agency. When the competition is keen, he asks for a special discount to meet it. Then he gets the bad habit of always expecting a special price. When shipping, boxing and loss-in-transit difficulties arise, the agent is not nearly so sympathetic with the shipper as he is with the buyer; but your own man can see your side of each misunderstanding.

Your own man knows your factory, customs and goods. You are used to meeting this real competition in the States, but it is a rare thing to find a man from the factory here. When he does comes regularly, he gets more than his share of the business, because "agents" have little or no chance to compete with him.

The cultivation of trade along the West Coast requires the same methods and system that the Hudson Bay Co. used two centuries ago. If you, a Boston manufacturer of carpets, planned to open a market in the far West—say San Francisco, Chicago or Pittsburgh—you would not appoint as agent a fruit grower or a boiler maker or a miller. You would not expect credits, packing and price conditions to be the same as in Boston. You would find out just what the conditions were and conform to them, as much as necessary.

Rough Handling South of Panama Requires Heavy Packing

The American manufacturer is much blamed for the condition in which his goods arrive in Chile, Peru and Ecuador. He is not to blame—and he is. Loading at New York is normal and the goods are not mistreated. Unloading and loading at Colon is normal. But with the unloading and loading at Panama trouble begins. Photographs are useless for demonstration purposes. Only a moving picture could give a correct idea. Imagine a piano, cases of bottles or kerosene tins as forming a working platform in the ship's hold. A rope net is filled with kegs of nails, spools of barbed wire, tinned peaches and glass in cases. The sling load is run out over the hold and with a few bangs against the ship's side is lowered until it reaches the platform in the hold. As the stevedores are in a hurry, the sling is not lowered gently, so something is smashed a little. Also, on account of the hurry the net is not unloaded by hand, but instead, one corner is hooked to the line and the net is jerked to the wharf. If a spool of wire or a case gets caught in the net, what of it? Just shake it loose—and down it goes and something has to "bust" After this happens a few times, the kerosene tins are shifted so that the stevedores will not get oil on their feet—or they move the cases of glass to save their feet from being cut.

This is the beginning. Cargos are frequently unloaded at Callao into barges swinging and banging against the ship's side and loaded onto other ships bound south, though by waiting a day longer the goods could go on a through ship.

The unloading at Mollendo for southern Peru and Bolivia is simply horrible. At Antofagasta it is somewhat better and at Valparaiso better still. But nowhere is the ship or the captain at all interested in delivering the goods to the shore. The captain's troubles end as soon as the goods are overboard, whether into barges or into the sea. I have stood at the rail with a captain and seen three big barrels of crockery slip from slings one after another into the sea, while the captain did not even change the subject. The barrels floated slowly away and were twenty minutes sinking, and no one bothered them. I have seen borax loaded at Antofagasta in sling loads of ten bags each. The load was dragged over a ragged plate, and two bags out of each of 48 slings were torn open and lost before any attempt was made to cover the plate. The owner lost. The captain never even knows of it, much less cares.

Some of the handling will be avoided with the Canal open, but the worst of it will still remain. The "answer" is to always bear the handling in mind while packing. It does no good to say that the goods should not be handled so roughly. Of course they should not, but they are. Then make your cases so strong that they break the other fellows. This amounts to considering everything else as protection for your goods.

The Lure of Liquor

This does not apply to liquors, which cannot be packed so that they will not break. A convenient way to break a case of liquor is to notify the winch man when liquor is being unloaded; he can drop it quite hard when he tries. In case this fails to break a bottle, lift the case over your head a few times and drop it to the bottom of the barge or ship. This will break one bottle, after which the rest is easy. After all have had what they want from the dripping case, set the case cornerwise over a bucket under the forward hatch.

Pack light loads in heavy boxes and do not make them of unusual or inconvenient shapes. Practice packing, using enough strap iron and heavy lumber so your cases can be dropped to a cement floor say five times from a distance of ten feet.

Crates are of course merely a waste of good wood. On fragile shipments use double cases with big jute-padded corners. The customer expects, offers and begs to be allowed to pay for special packing. It is better to put the special cost of packing in the quoted price .

Do you realize what it means to say that all of the unloading from Panama south is done into boisterous, bobbing boats and not to wharves? I saw ten tons of tin concentrates worth $10,000 sink at the ship's side in rough weather because the captain would not take it. It had been splashed with sea water and made heavier than the bills called for. Conditions will be a bit better with the Canal open, but unloading will always be difficult and cases should always be small and as strong as possible.

But the one thing that will help more than anything lse is to insure against all risk to destination and then old the receiving steamship and the insurance company trictly to account for losses. Do this insurance for our account instead of for customer's and if you are ot big enough to handle the fight, combine with other hippers. The insurance company can recover from the teamer, and you can do the same. Concerted action on he part of the shippers would work a wonderful change. The unfortunate buyer, no matter how big, has little hance or skill in recovering from the insurance company nd will frequently not try, contenting himself with elling all his friends and clients how unbusinesslike Americans are.

It seems easy for us on the ground to realize that what articularly interests the buyer is the receipt of the oods in good condition. All of this may be condensed nto a few words:

Regular price		Higher price
Ordinary packing		Strong packing
Rough handling	vs.	Rough handling
Broken cases		Sound cases
Dissatisfied buyer		Joyful buyer
No repeat orders		New friends

Miami Reverberatory Furnaces*

In constructing the reverberatory furnaces at the Inernational Smelting Co.'s Miami, Ariz., plant, the folowing method of bottom construction was followed to liminate any possibility of trouble in starting.

Broken slag was brought in railroad cars from the ld Dominion smeltery and melted in a small blast furace obtained by setting up a number of discarded furnace ckets and a motor-driven blower on the site for the everberatory furnaces. The molten slag thus obtained as conducted in launders to the foundations of the reverratory furnaces. Heavy concrete beams and struts were rovided between the furnaces for taking the thrust from e lower ends of the buckstays. Later, the spaces been the concrete struts and the beams were filled in ith molten slag obtained from the regular operation of e reverberatory furnaces. The slag bottom was covered rst with a 4-in. layer of fireclay and then with a 27-in. yer of silica (94% SiO_2) crushed to minus $\frac{1}{4}$-in. These ottoms gave no trouble whatever in starting up.

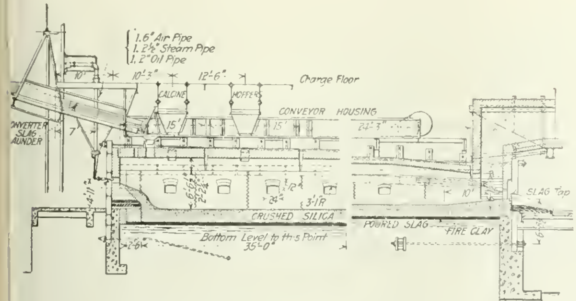

FIG. 1. SIDE ELEVATION OF FURNACE, SHOWING METHOD OF SIDE CHARGING WITH CONVEYORS

The method of side charging, instead of fettling only, ong the side walls of reverberatory furnaces, now so successfully used by the Canadian Copper Co. and the Anaconda Copper Mining Co., was developed after the construction of this plant was well along. The plant had been laid out for charge tracks running at right angles to the furnaces near the firing end. In order to distribute the charge along the sides of the furnaces, charge hoppers were placed, as shown at the left of Fig. 1, under the charge tracks directly over the side walls of the furnaces. Drag-chain conveyors were installed, one over each side of each furnace, which received the charge from the charge hoppers. Under these conveyors, approximately every 30 in., suitable down-spouts with gates were provided, as shown in Fig. 2, so that the charge may be distributed along the side walls of the furnaces throughout their length. The bridge-wall and side walls at the firing end of the furnaces are charged by drawing directly from the hoppers through suitable spouts. The floor over the charge tracks around the skimming end of the furnace was paved with firebrick.

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*Excerpt from "Features of the New Copper Smelting ants in Arizona," a paper to be presented at the Arizona eting of the A. I. M. E., September, 1916, by A. G. McGregor, arren, Ariz.

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War Importance of Platinum

Soon after the great European conflict began, and Russia, France and England had declared an embargo prohibiting the export of platinum, its price began to soar. From about $40 per oz. just before the war the price jumped to about $100 for a short time, but declined in recent months to from $65 to $85 per oz.

It is generally known that Russia produces 95% of the world's supply, which totaled some 300,000 oz. annually before the war, but decreased to 240,000 oz. in 1911 and to a little over 200,000 oz. in 1915. The domestic production of this country is comparatively insignificant, totaling only 400 oz. in 1900 and about 700 oz. in 1915.

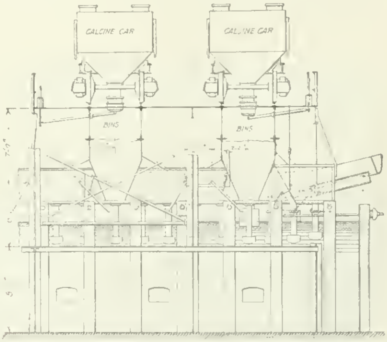


FIG. 2. LONGITUDINAL SECTION, SHOWING CHARGING ARRANGEMENT

It is commonly thought that the great increase in price resulted from the Russian embargo, along with its one-third curtailment of production, the popular idea being that platinum is used mainly in jewelry and electrical machinery with insignificant quantities employed in the chemical laboratory and in the manufacture of chemicals. As a matter of fact, the declaration of war brought the chemical manufacturing business to the highest pinnacle ever attained in its history. And for reasons now to be detailed, the demands upon the chemical industry led to an unprecedented use of platinum.

Platinum in late years has become indispensable in the manufacture of sulphuric acid so necessary in the production of enormous quantities of guncotton—smokeless powder and other high explosives. Some idea of our vast domestic production is obtained from the fact that in 1915 the United States produced 3,868,150 tons of sulphuric acid, valued at nearly $30,000,000. Of this amount, 1,056,830 tons, having a value of $7,042,126, was produced as a byproduct at copper and zinc smelteries. While formerly the bulk of the acid production was made in the well-known lead-chamber process, in recent years the so-called contact process, employing platinum as a catalytic agent, has revolutionized the industry.

While the catalytic property of platinum was discovered in 1831 by Peregrine Phillips, an Englishman, it remained for Germans in recent years to seize upon the idea of utilizing it in sulphuric-acid manufacture and build up an immense and extremely profitable business. Today, the contact process is known and used in all countries. It consists simply in passing a mixture of SO_2 gas and air over finely divided platinum heated to about 450° C. In contact with this hot platinum the oxygen of the air unites with the SO_2, forming SO_3 in long crystalline fibers, which readily dissolve in water to form sulphuric acid.

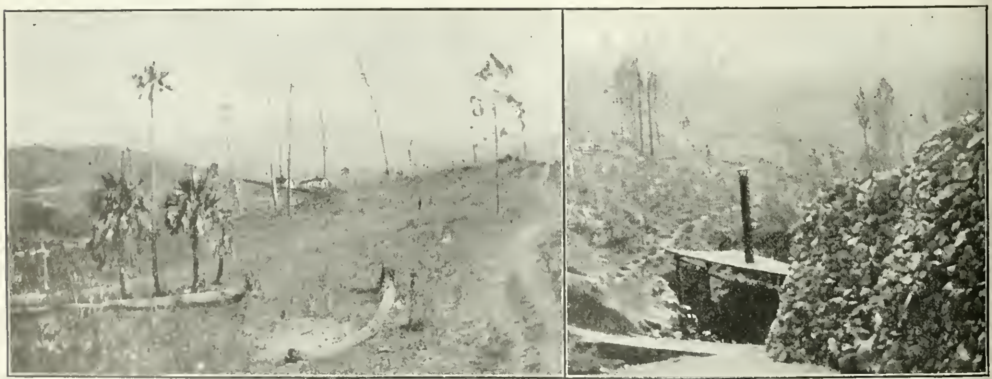
More Copper Mines in Cuba

Following the development of the rich Matahambre mine in the Province of Pinar del Rio in western Cuba, there has been much prospecting going on in this part of the island with the result that several rich copper deposits have been disclosed.

About 25 km. southwest of the Matahambre mine, the Candida mine has been opened by Cardenas & Co. and Benigno Prida in partnership with Gen. José Miguel Gomez, ex-president of Cuba. This new copper property comprises about 300 hectares in the foothills of the Sierra de los Organos, which runs nearly the length of the Province of Pinar del Rio in a northeasterly direction. The first shipment of 1,500 tons from the Candida mine was sent to New York early in the summer and averaged 15½% Cu, 6.25 oz. Ag, 32% Fe and 34% S. The ore was taken from a 30-ft. winze, sunk at the end of an adit that extended into the hillside about 75 ft. At the bottom of the winze a crosscut was run 15 ft. in each direction without getting out of the orebody, though one side was in low-grade ore. About 8,000 tons of ore of various grades have been mined, but to date the extent of the orebody has not been determined. The work has been in charge of Roberto Yrizar, a Columbia School of Mines graduate of 1895, lately manager of the Santa Ana mine, Catorce, San Luis Potosi, Mexico.

There is considerable prospecting still going on in this part of the province. Cardenas & Co., of Aguiar 116, Habana, together with Benigno Prida, control about 2,700 hectares along the northwestern slope of the sierra. These lands are supposed to contain copper and other minerals. It is noteworthy that while the ore from the Matahambre mine does not contain much silver, the ore from the Candida mine has a substantial amount of this metal. Of the area controlled by Cardenas & Co. and Benigno Prida, 400 hectares southwest of the Matahambre mine have been made the basis of a development operation known as the Sociedad Minera Nieves. This company is capitalized at $500,000 and has offices at Amargura 23, Habana, its president being Ramon G. Mendoza, a prominent lawyer. Preliminary work is being undertaken at this property, also under the direction of Mr. Yrizar; a shaft is to be sunk on the opposite side of the hill from the Matahambre mine.

To the north of the Matahambre, Maximilian Paetzold, Austrian consul at Habana, has been developing the Constancia mine near Viñales and has opened a new lens of high-grade sulphide ore. This mine was formerly operated by the McLaughlins and produced considerable ore, but was abandoned by them as being worked out. Mr. Paetzold controls a number of other properties in western Cuba and some of these are now being investigated by the newly formed West Indies Mines Development Co., of 25 Broad St., New York, which will develop some prospects in Cuba and in Haiti.



CANDIDA COPPER MINE, A NEW SHIPPER IN WESTERN CUBA

Prospecting is also in progress farther to the east in Cuba in Santa Clara Province. Near Fomento, a copper-zinc deposit has been opened by an 800-ft. adit and a shaft is now to be sunk by the Cia. Minera y de Fomento Watkins, of Lonza del Comercio 205, Habana, to determine whether copper or zinc is to predominate at this operation. Still farther east or rather to the southeast, the Cuba Copper Co. near Santiago continues to make a steady production from El Cobre mine—the first copper mine operated by white men in North America.

Details of Practical Mining

Shanking Drill Steels

By Charles C. Phelps*

The methods employed in shanking and sharpening drill steel have been undergoing a decided change recently. This is due to the fact that hammer drills are used to uch a large extent. Every blacksmith has his own pet way of doing his work, but there are certain general principles and methods which, if followed, would produce much better results. Less attention is also being paid to he shanking than the sharpening, although shanking is lmost equally important.

Shanks on drill steels are of three general types—plain, collared and with lugs. Plain shanks are used principally with hammer drills, which employ an anvil block to transmit the force of the blow from the piston o the steel. There is little to be said about this type f shank except that it should be dressed up square with orrect dimensions and should receive the proper degree f temper to suit the conditions under which it is to perate.

Correctly made and treated shanks will result in a ower maintenance cost for both steels and drills and will produce better drilling results, hence careful consideration of this matter will be amply repaid.

Fig. 1 gives the correct dimensions for shanks for ackhamer and No. 26 Leyner-Ingersoll drill steels. Here he shank is hexagonal with a round collar.

Figs. 2 and 3 give correct dimensions for No. 18 Leyner-Ingersoll shanks on $1\frac{1}{8}$- and $1\frac{1}{4}$-in. round steel espectively. Two lugs on the shank retain the steel in he chuck. It is absolutely necessary that shanks should e made of the correct size. If the shank is too long, he power of the blow will be reduced, and if too short, he front head will be compelled to take part of the blow. The shank lengths specified on the illustrations provide or inevitable wear, but this should not be permitted to roceed too far. In the case of the No. 18 Leyner-Ingersoll shank, for instance, it is unsafe to use a steel fter the length of the shank, from the lug to the end, as been reduced by wear from $3\frac{13}{16}$ to $3\frac{9}{16}$ in. The correct diameter of shank is of equal importance, as too oose a fit will permit side play. The same effect is roduced by permitting the front chuck bushing to wear o too great an extent before replacing. The striking ace of a hammer-drill steel should be smooth and true. f this is overlooked, the piston will not strike the shank quarely and will soon start to chip. It is hardly necessary to refer to the injury that may be done to the nterior of the drill by such chips of metal. The end f the shank may be trued by grinding on an emery heel after hardening, or if this is not convenient, it may be filed before hardening. The edge of the striking ace, should also be beveled off, to prevent subsequent urring of the metal. In squaring the shank end it is ot safe to depend on the eyes unaided, but the use of a small metal square, is recommended. The end of the piston may also in time become worn somewhat concave. Should this occur, a square shank will tend to chip it, as in Fig. 4. The obvious remedy is to grind the piston off square, should it become belled on the end.

In the case of hollow steels for water-feeding drills, particular care must be taken to see that the hole is enlarged sufficiently to permit the entrance of the water tube without danger of breaking the latter. The enlarged section must be central and must be carried for a sufficient distance. Fig. 13 illustrates a gage which is convenient for proving up the diameter and concentricity of the enlarged hole.

Collars Formed by Hand

The first operation in forming collars on jackhamer and No. 26 Leyner-Ingersoll steels is to heat the steel to a cherry-red (1,500° F.) for a distance of 5 in. from the end; then cool the end by immersing in water to a depth of 3 in. The remaining 2 in. of heated steel is then upset by bouncing on an iron plate. The shank is reheated to cherry-red, a center punch is driven in the end of steel to enlarge the hole and prevent it from closing during forging. The steel is then placed between bottom and top collar swages shown in Figs. 15 and 17 and the collar is formed by hammering the latter, rotating the hexagonal steel between blows.

After a third heating to cherry-red, the punch is again inserted and the shank is swaged with the shank swage, Fig. 19, until the gage, Fig. 14, will slide over the shank. After again heating as before, the shank end is marked with the aid of the shank gage, and is cut off as in Fig. 12, employing a chisel of the type shown for the purpose. The shank end should be dressed up square and smooth with a file at this stage, unless this is to be done later by grinding. The shank is then ready for hardening.

Forming Lugs by Hand

The same general rules apply to the formation of lugs on shanks for No. 18 Leyner-Ingersoll drill steels. There are a few differences, however, as will be explained. The steel is heated to a cherry-red (1,500° F.) for each operation. The first heat is for 5 in., after which 3 in. of shank is cooled in water. The heated part is then upset. After the second heat the bottom swage, Fig. 18, and the lug-side former, Fig. 20 are employed. On the next heat the lug-diameter former, Fig. 21, is struck with the hammer while the steel is held in the other part of the bottom swage. On the same heat the lug-side former is again applied. During these operations the hole is kept open with the center punch. On the next heat the top swage, Fig. 22, is applied on both sides of the lugs to finish the ends of the lugs and round up the shank. Fig. 16 shows the shank gage used with these steels. After reheating, the steel is cut in the same manner as previously indicated, using the gage as a guide. The shank-end former, Fig. 23, insures the end being th correct diameter, with the hole central and of the correct size. It also helps to square up the end and round off the edges.

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*Ingersoll-Rand Co., 11 Broadway, New York City.

The following table gives the dimensions that are missing in the accompanying tool illustrations:

TABLE OF SIZES

Size Shank	A	B	C	F	G
1⅛	1⅛	1¾	⅜	1 5/32	25/32
1¼	1¼	1⅞	11/32	1 9/32	27/32

After the sixth and final heat, the shank should be hardened.

If the steel is heated and collared in a shank-forming appliance in one operation, the result would be likely to develop a "cold shut," as illustrated in Fig. 5. Here it is apparent that the hole tended to enlarge more rapidly in proportion to its size than the collar, leaving

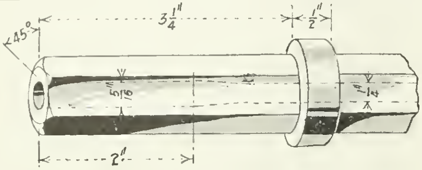


FIG. 1

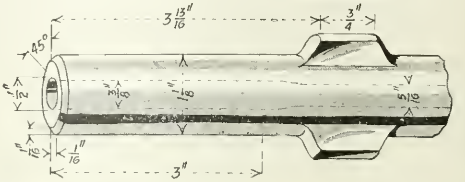


FIG. 2

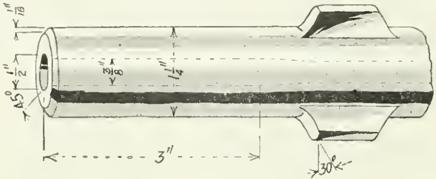


FIG. 3

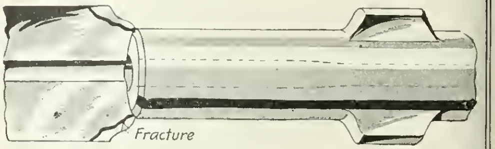


FIG. 4

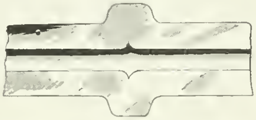


FIG. 5

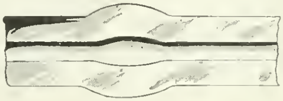


FIG. 6

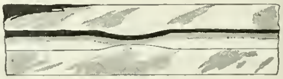


FIG. 7

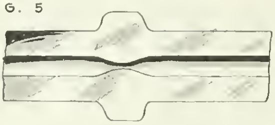


FIG. 8

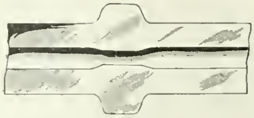


FIG.

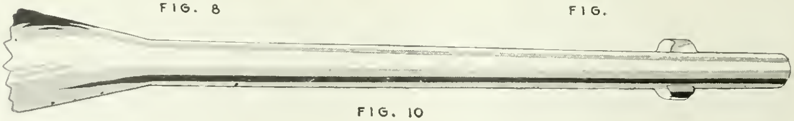


FIG. 10

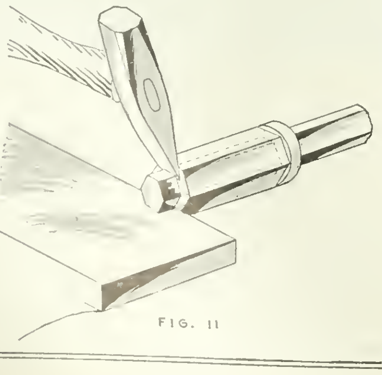


FIG. 11

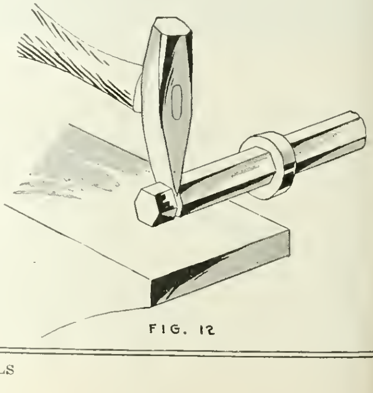
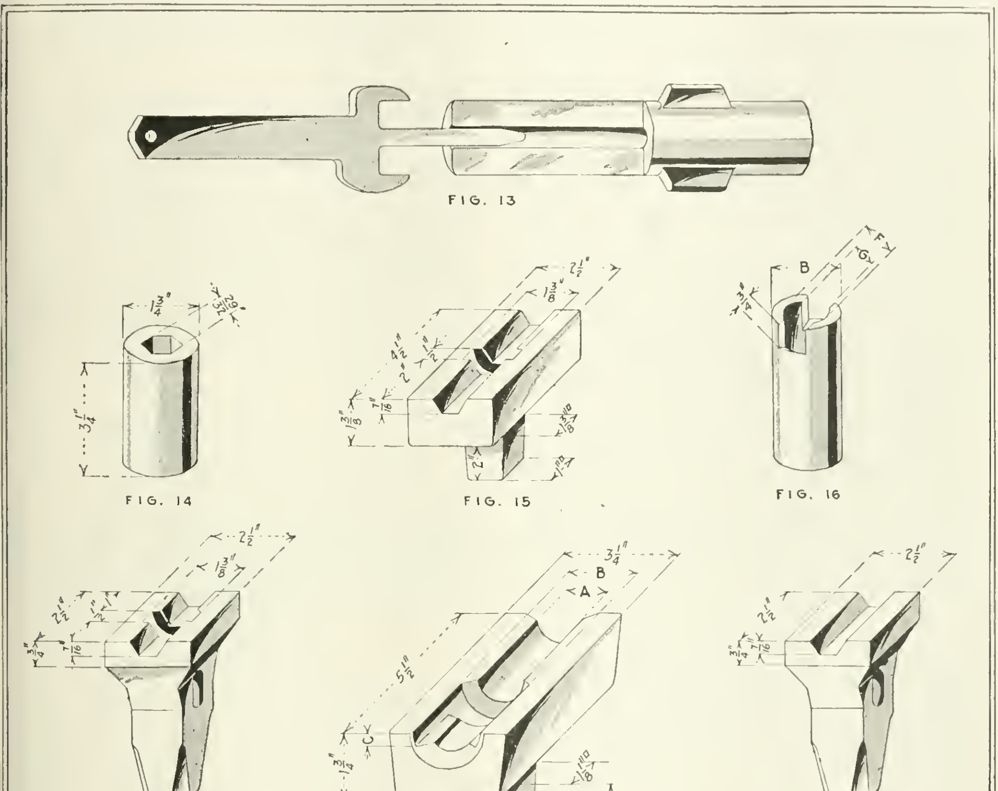


FIG. 12

SHANKING DRILL STEELS

the metal folded down on itself. To obviate this condition, the steel is partly upset until it assumes the form shown in Fig. 6, in which the hole is considerably enlarged and the collar but slightly formed. The next operation is to form the steel down to its original section, as shown in Fig. 7. This leaves the hole almost closed and the stock considerably upset at the point where the collar is to be formed. With the hole in this condition, it cannot enlarge as in Fig. 7, but on the contrary, when the steel is placed in the machine and upset, the hole takes the form shown in Fig. 8. By the use of the drifting pin the hole is formed as shown in Fig. 9.



GAGES AND SWAGES

All dimensions are taken care of by the standard equipment. When a shank-forming appliance is used, a pin-puller which bolts on the side of the machine will be found of great assistance in removing the steel pins which it is necessary to insert in the hole of the steel during the several forming operations. The pins are removed from the steel by resting the end of the shank against the face of the pin-puller, clamping the pin by bringing down the small lever and forcing the pin out by throwing over the long lever.

Harden Shanks Carefully to Avoid Breakage

One of the most prolific sources of shank breakage is improper hardening. Plunge-tempering is more rapid than draw-tempering, and it is considered more practical in every way. It is recommended to heat the shank slowly and evenly to a cherry-red (1,500° F.) considerably beyond the collar or lugs; a total distance of 7 in. gives good results. Collared steel should then be quenched in soluble oil, which will impart a suitable degree of temper. Steel with lugs should first be dusted by throwing a small handful of powdered yellow prussiate of potash on the shank and especially around the lugs; this increases the hardness of the metal on the surface and greatly improves its wearing qualities. The shank is then quenched in soluble oil.

Fish oil and lard oil are recommended for this purpose, and it is advisable to keep the oil cool, which can be done conveniently by placing the can of oil in cold water. Shanks should never be quenched in water for it makes the steel entirely too hard, which tends to cause fracture of the drill piston. On the other hand, should the heat treatment not be such as to give the shank sufficient hardness, the end will become upset and will in time cut off the water tube.

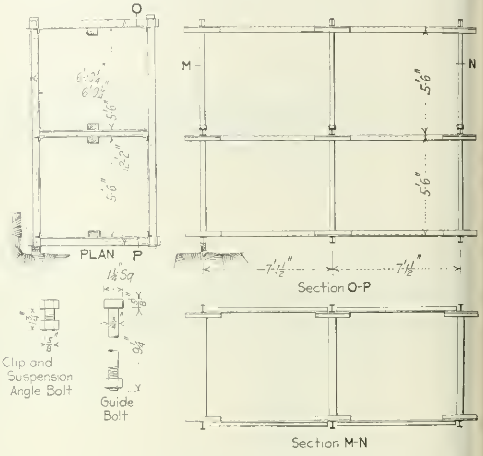
Precautions In Using Steel

When drilling or when sharpening steels, care should be taken not to set them aside with the shank ends in the earth, as dirt or pebbles will enter the hole in the steel or lodge on the end, resulting in extra wear or perhaps even breaking a water tube. It is much safer to stand the steels with bit ends down or place them flat. The drill runners should always make sure that the shank end is clean before inserting a new steel in the chuck.

The piston, chuck-bushing, chuck keys and other parts subject to wear should be inspected at regular intervals. The proverbial stitch in time applies with full force to rock drills. Proper lubrication is a subject which principally concerns the drill, and a drill properly lubricated will keep the shank and chuck in a sufficiently well-lubricated condition to keep down wear of these parts as much as possible. The blind starter, Fig. 10, is most useful for squaring the rock before starting a hole. If it were used to a greater extent for this purpose, it would eliminate subsequent delay and difficulty in many cases, for it is a well-known fact that a hole can be started much quicker against a flat rock surface and the hole will be more likely to remain in line. With reduced rifling tendencies, there is less strain on the steel and chuck parts and less time wasted through having the drill hung up. "Tending chuck" with a bar is also reduced with its attendant injurious features. The reduction of lost time in drilling is a factor not carefully watched in the average mine.

Steel Shaft Sets*

In the construction of San Francisco shaft No. 2 of the Compania de Santa Gertrudis at Pachuca, Hidalgo, Mexico, steel shaft sets were used instead of timber to support the walls where needed. The members were bought cut to the proper lengths, but were fabricated locally. Five-inch I-beams were used for wall- and end-plates, while channels were used for dividers and posts. The illustration shows the method of fabrication No. 18 galvanized corrugated sheet lagging was used where necessary. This steel support cost $20.33 per ft



SANTA GERTRUDIS STEEL SHAFT SETS

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A Prospector's Stove

For muleback transportation to a permanent camp sit the following adaptation of a household wash boiler prove so successful that others might find it of similar use.

A camp was to be established for the summer work i a region that was difficult to pack material into. A sectionalized iron stove was unavailable, and the single-piec iron stoves in stock at the outfitting point were too cumbersome and heavy. An ordinary tin wash boiler, ellip tical in shape, was bought, together with one 2-ft. lengt of 6-in. stovepipe and one quarter-bend. The pipe an bend were packed with provisions and then put insid the boiler, which was filled with stores and given a plac on the pack saddle.

Upon arrival at the camp site the boiler was unpacke and a 6-in. diameter hole was cut in the bottom of on end, the sections being bent at right angles to the surfac to admit the quarter-bend. Two lid holes were cut in th bottom of the boiler, and a rectangular hole was cut i the other end. The boiler was then set bottom side u on a rock and the smoke pipe wired in place. Two lid were made of flattened tomato tins and a front door wa made from the original lid of the boiler. Wood wa used for fuel. This stove worked satisfactorily for th camp cooking for four men and lasted out the summe without burning through.

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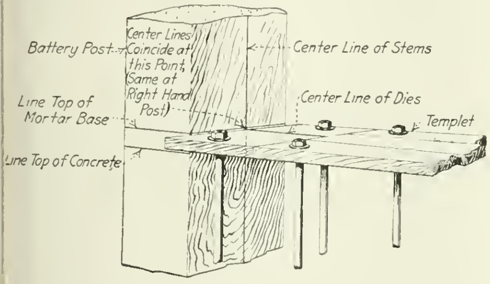
*Excerpt from article by Hugh Rose in August, 1916, Bulletin, A. I. M. E.

Details of Milling and Smelting

Replacing Mortar Blocks

By Charles Labbe*

The mortar blocks in stamp mills were formerly made of planks bolted or spiked together; but nowadays concrete has replaced lumber for many reasons, among which the high first cost and short life are the chief factors. It is safe to assume the average life of wooden mortar blocks to be eight years. This may be considered to be nearly the life of the first stage of the mine, but many mines last much longer. Wood will age and rot whether the mill is in operation or not. In most of the mortar blocks replaced the trouble was found to have started from the bottom. On account of the sidehill location of the mills the pits were practically a drain for the surface water and mill water, which soon caused the wood to rot. Wood preservatives, when used, prolong the life of the wood, but their use not general. In some blocks where the planks were put lengthwise with the mortar, the outside rotten planks may be changed, but it is noticed that the block needs repairing within a very short time. Taking all factors into consideration, concrete mortar blocks are he most serviceable.



LINING UP STAMPS WITH A TEMPLET

Getting Ready for the Concrete

The first thing to do toward placing concrete mortar blocks is to get the mortar out of the way. The stamps must be raised as far as posible and held firmly. This may be accomplished by loosening the tappets and sliding them on the stem, or by putting a block on the finger jack. In many cases they will not be raised far enough, and the mortar will have to be moved away by taking the stamps out and putting them on the camshaft floor. The mortar s raised off the bolts with wedges and crowbars helped with chain blocks tied to the camshaft or battery girts. As this work always takes place after a clean-up, it is dvisable to make the mortar as light as possible and to keep the dies and liners out.

To take the mortar away a strong cribbing is made of timbers not less than 4x6 in., with two heavy pieces (about 6x8 in. or 8x8 in.) laid lengthwise on the top, horizontally. On the top of the two heavy timbers lay bars of ½x3-in. flat iron, extending all the way under the mortar to keep the rollers from sinking into the wood. Do not forget that a five-stamp mortar weighs about three tons. With the mortar raised entirely clear of the bolts, place rollers made of 1-in. or 1½-in. round iron the entire length of the mortar. Then roll the mortar block away on the cribbing with the help of rope or chain blocks, helping and guiding the crowbars. Raise the mortar block as far as possible until it touches the girt, and hold it there with strong dependable chains tied to the girt and camshaft. This avoids the trouble of moving the mortar away and gives ample room for working in most cases. The next step is to take out the old wooden blocks. At first this seems easy, but any millman who has done it once will think differently. The planks extending above the floor are handled easily enough, but after that part has been disposed of the wood for a depth of 6 to 8 ft. has to be removed. Recalling several instances, I remember blocks set in solid concrete which had to be drilled and blasted just as in sinking a shaft. Augers were tried, but they did not work well in wet wood. The best results obtained were with holes 12 to 16 in. deep loaded with one-third of a stick of ⅞-in. 40% dynamite.

In another case the block was set with concrete on one side, solid rock on the other. After we had blasted 2 ft. of the block (this block rotted from the top) the wood was so fibrous that more holes for blasting were impossible; so we sunk a small shaft next to the block in the rock, which was easier to drill than the concrete, and got at it from the side. As quickly as the bottom is reached in any small place, the rest is quickly taken out and the most difficult part of the work has been accomplished. In an old 10-stamp mill the blocks looked very good from the outside; but when the mill was started up after years of idleness, the blocks sank at the rate of an inch a day. When taken out they were found to be sound for the first 6 ft., but the remaining 6 ft. was dug out with a spade.

The next step consists of putting in concrete blocks. The place is well cleaned of all wood and loose rock. According to the size of the rocks to be put in and the nature of the ground, it would seem advisable to bore holes in the rock on the bottom and sides and cement in rods or pipes for the purpose of anchoring the block to the rock.

Lining Up the Shoes and Dies

Two lines are drawn horizontally on the battery post—one to mark the top of the concrete, the other the top of the mortar base (sole plate). A templet is made of 2-in. boards, the holes traced and if possible bored from the mortar. The center line of the stems is extended to the bottom of each battery post, while on the templet is traced the center line of the dies. To be sure that the shoes will strike exactly on the dies, the center line of the die stems produced should be coincident with the center line of the shoes as marked on the templet. The templet holding the mortar bolts in place is leveled and held firmly to the battery posts, the bottom of the nuts on the same elevation with the line of the mortar-base top.

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*Mechanical engineer, Nelson, Nev.

The concrete is now ready to be mixed. A large pile of rock is wheeled near-by. The mixing platform has been erected as near as possible, so that the mixed concrete can be shoveled from the platform directly into the hole. The mixture should be 1-3-5 for the lower part with coarse rock; as the height is increased, the mixture is made richer; 1-2-3 in practice has proved very good for the upper part. The concrete must be well rammed until the water comes to the surface, and reinforced with iron rods or old steel cable. I have used tailings of 20 to 40 mesh, free from slime, for sand with very good results; and crushed stone from the waste dump or sorted from the crusher that has passed a 1-in. screen has proved satisfactory for the rock. The mud-sills and battery posts can be concreted in with the mortar blocks. The same anchor bolts are used for the mortar, anchored into the concrete with an iron bar or a large rail, one for every two bolts with large square cast-iron washers. The top of the mortar block is finished with a mixture of one part cement and two of sand, ½ in. thick.

This finishing must be done the day after the concrete has been put in, to remove the chances of the finish scaling off after the mill is put in operation, due to an imperfect bond. To straighten and level the top before it gets too hard, use a piece of square steel about 5 ft. long (a bar of heavy pick steel is very handy, as it is straight and the edge is sharp) with a level on top. The bar is used as a scraper to shave off the high spots.

Ample time is given the concrete to set. It requires two weeks for a block of such size to harden. It would be disastrous to try to save a few days and have the block crack. In dry weather it is advisable to cover the concrete with gunny sacks and to keep them wet for four or five days, thus preventing a too rapid setting of the outside portion. The forms are taken off 10 days after the concrete is put in, as there is less danger of breaking a corner when the concrete is still green.

If not damaged, the same rubber pad used on the wooden block is used for the concrete. The purpose of it is not to act as a cushion, but as packing to cause a true fit of the mortar. The mortar is set in about the same manner as it is taken out, and repair work is done to the battery if needed.

Put in a Concrete Floor at the Same Time

The cost of exchanging the wooden for concrete mortar blocks in a 10-stamp mill was as follows:

Labor.		Hr.
Raising mortar and tearing out old floor		16
Taking off wooden blocks and drilling holes for anchor bolts		60
Screening dump for rock, sand, tailings wheeled to mill		72
Mixing and pouring concrete		96
Replacing mortar on new blocks and readjustment of batteries		24
		268
268 hr. at 47c		$125.96
Material:		
Reinforcing rods (from scrap pile)	....	
Lumber for forms (borrowed and returned to mine pile)	....	
[illegible] sacks cement @ 60c	$18.00	
Freight, 3 tons @ $20	60.00	
		$108.00
Total cost		$233.96

While you have everything handy for mixing concrete and while your back and muscles are trained for this sort of work, put in a concrete floor for the tables, if you have not one already, as it is a great improvement over the warped and leaky planks usually found in floors. Six to 8 in. of concrete on a well-tamped ground with 1 in. of fine to finish will make a good floor. It can be inclined to drain all to one place. This floor should not touch the mortar block or battery post. About a 2-in. space should be left and filled with sand to prevent the transmission of vibrations to the tables, which would cause the floor to break in many places.

*

Flow of Air in Lead Blast Furnaces*

Toward the end of 1911 some experiments were carried out at the Cockle Creek smelting works of the Sulphide Corporation, Ltd., in New South Wales, Australia, to ascertain the behavior of the air entering the tuyeres of the lead blast furnaces. The furnaces at this plant originally had a height of 18 ft. from the feed floor to the tapping floor and were operated under a blast pressure of 8 to 10 oz. per sq.in. In 1900, Huntington-Heberlein pots were introduced, and the furnaces were built with a higher shaft, until at present a height of 36 ft. from tapping to feed floor is not uncommon. To give the increased blast pressure necessary for the higher stacks, piston blowers were substituted for the rotary blowers previously used.

Diameter of Tuyeres Studied

The diameter of the tuyere openings was the subject of some controversy between the metallurgical and engineering staffs. It was held by some of the metallurgists that a tuyere whose interior was conical in shape, having a comparatively small aperture at the furnace end, produced a better result than a similar tuyere with a large aperture, of, say, double the diameter. The idea was that the small opening produced a more intense or jet-like action to the entering air and therefore tended to improve the combustion. A consideration of the facts, however, from a scientific point of view hardly bore out this theory. The air pressure at the tuyere was presumably practically that in the blast main; and if the interior of the furnace carried no greater pressure than that of the outer air, o at any rate very little more, as was claimed by the advocates of the air-jet theory, the quantity of air delivere to the furnace, due to the difference of pressure, woul be infinitely more than the blowing engines were capabl of pumping.

On the day the experiments were made the pressure i the main blast main was 46 oz. per sq.in. The reading of the mercurial gage showed that the actual pressure i the tuyere was from 40 to 41 oz.; at 6 in. beyond th tuyere in the furnace the pressure varied from 35 to 4 oz. These tests were made with tuyeres having 3-in openings into the furnace. The volume of air delivere to the furnace at the time, through the tuyeres, was 6,34 cu.ft., as ascertained by the displacement of the piston in the cylinders of the blowing engines. Other tests wer made with the noses of the tuyeres closed to 2-in. diamete by inserting annular pieces in the nose. It was foun that to produce the same conditions of pressure in th smelting zone necessitated the raising of the blast pres sure to 51 oz. in the blast main, or, in other words, it required 5 oz. more pressure per square inch, or an increase of 9% in the blast pressure, to force the same volume of air into the furnace.

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*Abstract of a paper by A. W. Tournay-Hinde, read befor the Engineering Association of New South Wales; reprinted i "Min. and Eng. Rev.," June 15, 1916.

Large-Diameter Tuyeres Chosen

As the amount of smelting performed and the intensity f the temperature in the furnace depend upon the rapidity with which the coke fuel can be consumed, it follows that the method that permits the freest ingress of air at the lowest pressure is the most economical when the cost of power to operate the blowing plant is taken into consideration. Therefore, the large-diameter tuyeres carried he day. The experiment clearly proved that most of the inetic energy in the air was dissipated in overcoming he resistance through the charge in the upper part of he furnace and that only about 2 to 3 oz. per sq.in. was xpended in actually forcing the volume of air into the smelter. It should be noted that in arriving at the results mentioned the mean value of a number of readings vas taken.

The sizes of tuyere openings during the experiments vere 3 in. and 2 in. in diameter respectively, as has aleady been stated. Theoretically, at any given air presure a 2-in. opening should deliver approximately about half as great a volume of air as a 3-in. opening. But he placing of an annular stopping or nozzle in the nose f the tuyere introduces other factors that modify the heoretical discharge. The air is supplied to the tuyere hrough a comparatively long pipe from the bustle pipe r air main surrounding the furnace. In the case under otice these tuyere pipes were 4½ in. in diameter and ft. 6 in. long. As the air in this pipe is traveling at a igh velocity, there is a relatively greater drop in pressure n the length of the pipe when the tuyere opening is 3 in. han when it is 2 in. in diameter—that is, with any given ressure in the blast main. The actual pressure per square nch in the tuyere with the 2-in. opening is therefore lightly higher than in the case of the tuyere with the -in. opening, and therefore the 2-in. opening passes ather more air than half the quantity that a 3-in. uyere would.

From 3- to 5-oz. difference of pressure per square inch, etween that in the tuyere and that in the furnace itself, ould appear both by calculation and experiment sufficient o force the requisite quantity of air into the furnace. uppose that the furnace was operating at 45 oz. per q.in. and that it was desirable for some metallurgical reaon to increase the blast pressure to 55 oz. This does not ean that there will be 10 oz. more pressure forcing air nto the furnace, or that proportionately more air will ow, for the interior pressure in the smelting zone will ise proportionately with the increase in the external presure. There will of course be a slightly higher difference f pressure between that in the tuyere and the smelting one, and slightly more air will be forced in. So far as was possible to ascertain, an increase of 10 oz. in the last pressure produced an increase of only about 0.5- 1-oz. effective difference of pressure for forcing air into e furnace.

To summarize the foregoing data, it may be postulated at:

1. The volume of air delivered to a blast furnace at ny given pressure virtually depends entirely on the resistance offered by the condition of the charge in the smelting zone and shaft.

2. The pressure of the air in the smelting zone of the furnace with any given blast pressure is dependent on the tightness of the charge in the shaft and is independent of the size of the tuyere opening, so long as the tuyere area available will permit sufficient air to pass into the furnace for smelting.

3. The pressure in the smelting zone is usually only 2 or 3 oz. and should not be more than 5 or 6 oz. below the pressure at the tuyere, as these differences of pressure are ample to pass into the furnace all the air required.

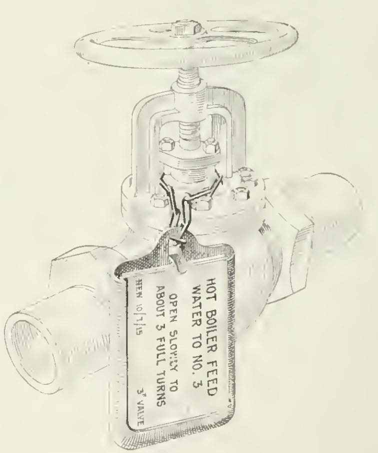
4. Variations in the pressure of the air in the blast main cause almost equal variations in the pressure of the air in the smelting zone.

5. Variations in the size of the tuyere opening only vary the amount of energy required to force a given volume of air into the furnace and do not materially vary the conditions of volume or pressure or smelting within the furnace.

⁂

Identification Tag for Valves

The frequent changes of help in our main plant caused much confusion and resulted in many mistakes in operating valves on the maze of small piping, says M. A. Saller, *Power*, Aug. 1, 1916, so we purchased a lot of aluminum tags with protected white writing spaces. These were attached, by light chains, to the bodies of the valves throughout the plant, with an inscription on the tag as to the service of the valve, its size, make, date installed and any special instructions thought necessary.



INFORMATION TAG ATTACHED TO VALVE

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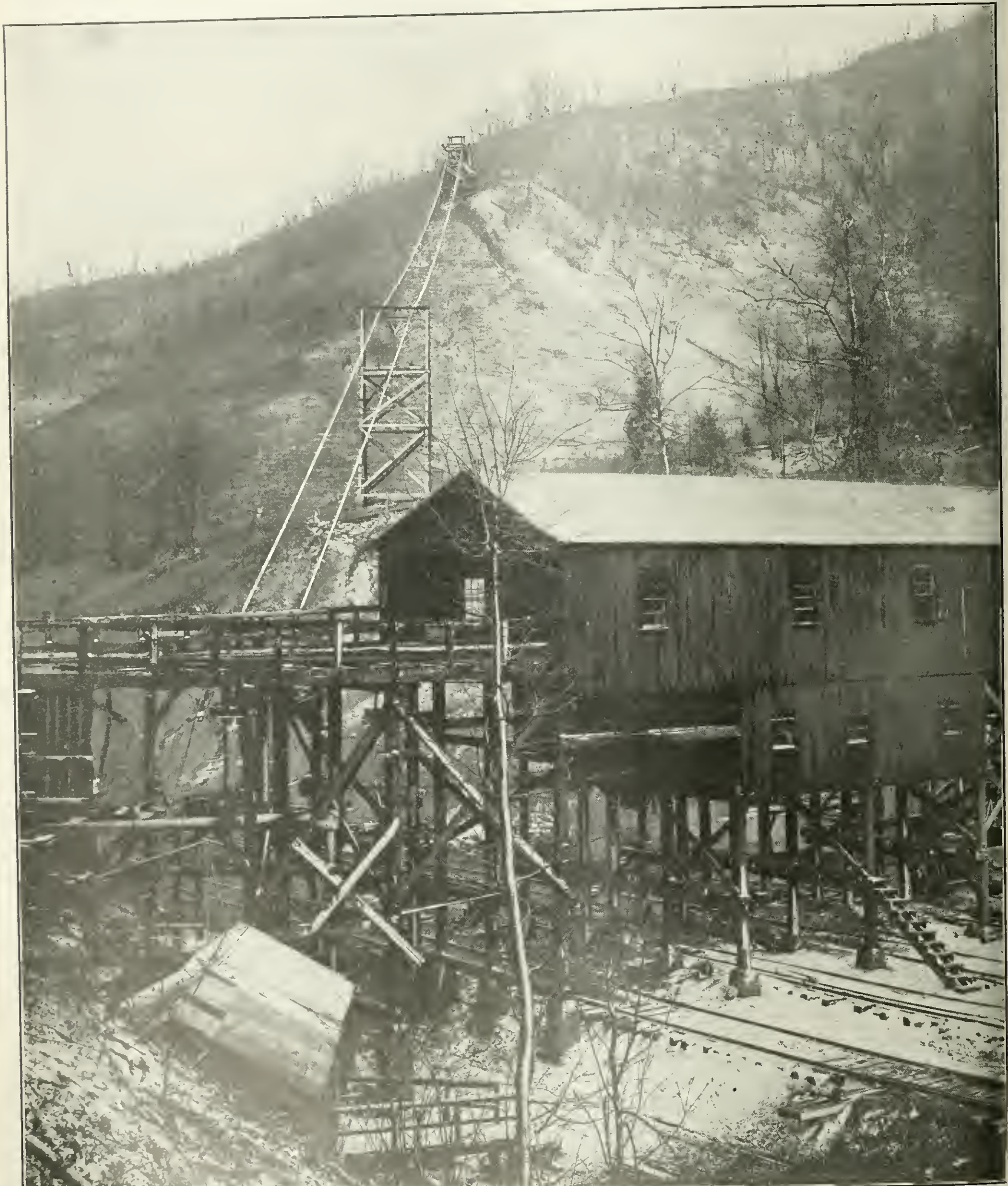
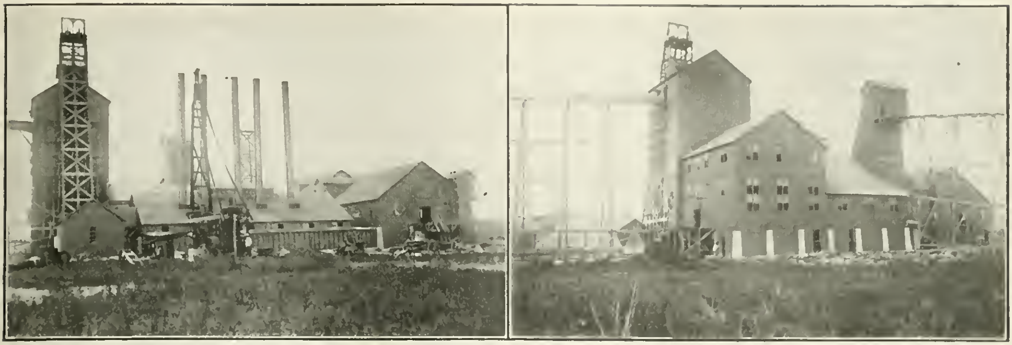
A Plant for Cleaning Cement Bags by machinery has been installed by the Cleveland Railway Co., according to "Engineering and Contracting." The cleaning machine consists of a polygonal drum 12 ft. in diameter, whose periphery is wire screen of 1-in. mesh. The bags are placed inside the drum, which rotates 12 times per minute. The bags are cleaned 500 to 1,000 at a time, and two men can clean 1,000 bags per hour. About 700 lb. of cement is recovered from 1,000 bags, or over seven bags of cement. A saving of 700 lb. of freight for each 1,000 bags returned to the mill is made. Previous to installation of plant, three men were employed, whipping bags at a cost of $2,000 per year for wages.

Photographs from the Field



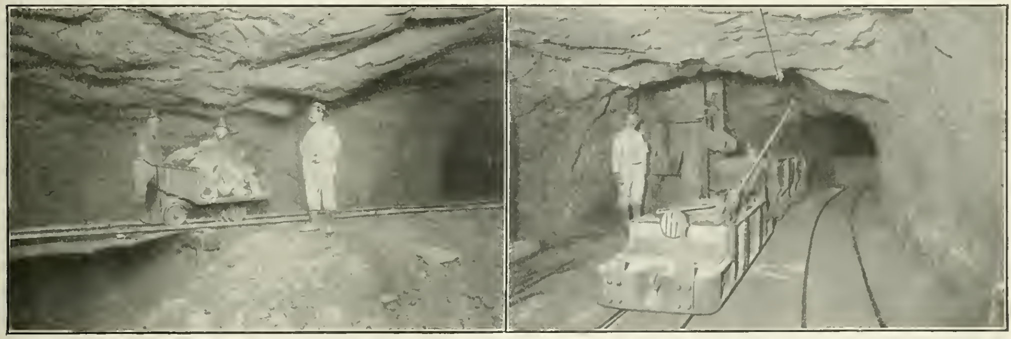
AN AËRIAL TRAMWAY THAT WORKS UPHILL

Owing to the lack of dump room at the Elkhorn mines in Kentucky, it is necessary to convey the waste over the cres of the mountain into the next valley. There are four double reversible aërial tramways, with American Steel and Wir docked-coil track cables, $1\frac{1}{2}$ in. diameter, and $\frac{9}{16}$-in. crucible-steel traction ropes. The tramways vary from 550 to 1,035 ft in length; each has a capacity of 30 tons per hr. Power is furnished by electric motors, direct connected



TWO VIEWS OF THE COAHUILA COMPANY'S NEW 1,000-TON MILL AT DUENWEG, MO.

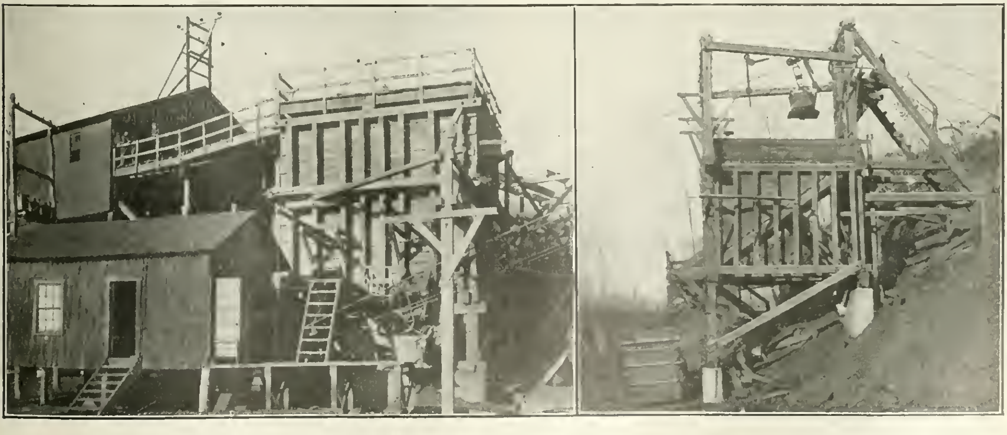
One of the newest mills in the Joplin district; completed in August; numerous windows provide better lighting than in most Joplin mills. Note headframe at left



ROCK AND SAND FILLING AT THE CHAMPION COPPER MINE IN MICHIGAN

Rock filling was initiated at the Baltic mine by F. W. Denton and was generally adopted by the amygdaloid mines of the district to save timber

Sand filling is now used in conjunction with rock filling. This view shows the sand cars and chute at the fourth level, "E" shaft, Champion mine



LOADING AND DISCHARGE TERMINALS OF AN UPHILL AËRIAL TRAMWAY IN KENTUCKY

Bucket in front of loading chute at one of the Elkhorn mines, Jenkins, Ky.

Tramway bucket at discharge terminal; about to engage tripper that relases contents

Pig-Iron Production in 1916

The production of pig iron in the United States for the half-year ended June 30, 1916, is given by "Bulletin No. 5 of The American Iron and Steel Association," just issued, at 19,619,522 gross tons, which is an increase of 1,937,100 tons over the second half of 1915, and of 7,385,731 tons over the first half.

Taking the second half of 1915 and the first half of 1916 together, the production for the year from July 1, 1915 to June 30, 1916, was 37,301,944 tons, which is the greatest ever reported in a single year.

Of the iron made in 1916 there was 19,347,935 tons made with coke, 79,591 tons with anthracite and 191,996 tons with charcoal. Most of the anthracite furnaces use some proportion of coke mixed with the coal.

The production for the half-year, according to the grade of iron was as follows, in gross tons:

Grades	For Sale	For Maker's Use	Total	%
Basic	1,244,907	7,585,178	8,830,085	45.0
Bessemer and low phosphorus	801,592	6,037,585	6,839,177	35.0
Foundry, including ferrosilicon	3,037,646	48,764	3,086,410	15.7
Malleable	460,839	....	460,839	2.4
Forge or mill	87,595	81,711	169,306	0.8
Ferromanganese	23,510	76,411	99,951	0.5
Spiegeleisen	74,886	14,209	89,095	0.4
All other grades	29,410	15,249	44,659	0.2
Total	5,760,385	13,859,137	19,619,522	100.0

Of the total iron made 72.7% was for makers' use and 29.3% was merchant iron for sale.

The production for the half-year by states was as follows, in gross tons:

	First Half of 1915	Second Half of 1915	First Half of 1916
Massachusetts and Connecticut	3,087	4,715	4,700
New York and New Jersey	921,566	1,183,214	1,214,037
Pennsylvania	5,199 421	7,591,247	8,286 076
Maryland	85,673	165,875	243,895
Virginia	105,244	146,102	202.777
Alabama	868,341	1,181,112	1,366,728
West Virginia, Kentucky and Mississippi	79,228	211,812	268 859
Tennessee	82,992	94,737	162,009
Ohio	2,964.211	3,948,751	4.250,790
Illinois	801,951	1,645 269	1.938,152
Indiana and Michigan	854,375	1,132,403	1,073 768
Wisconsin and Minnesota	130,514	242.452	417.542
Missouri, Colorado, Oregon	137 188	134,733	190,189
Total	12,233,791	17,682 422	19,619 522

The number of furnaces in blast on Dec. 31, 1915, was 310. On June 30, 1916, there were 344 in blast, leaving 102 idle out of a total of 116 stacks reported.

⁂

Frederick Folger Thomas

SPECIAL CORRESPONDENCE

In the death of Frederick Folger Thomas, which occurred at his residence, 2719 Dwight Way, Berkeley, Calif., on Aug. 6, the mining profession loses one of its most eminent members. His death followed an illness of only a few hours. He had been in San Francisco among his friends and associates on the day before, when he was suddenly taken ill, dying the next morning.

Mr. Thomas was a native of New York and was 73 years old. He graduated from Yale University with the Class of 1863. His first professional work was as assayer and chemist for the old Pittsburgh Silver Peak Mine at Blair, Nev. Two years later he returned to his Alma Mater as instructor in chemistry in the Sheffield Scientific School. Two years later he went to California to engage in his profession as a mining engineer. He was a familiar figure all along the Mother Lode of California, having been connected, in a constructing or advisory capacity, with practically every mine of note among the southern and northern mines of the Mother Lode. He was known in the profession as "The Father of Deep Mining on the Mother Lode." He opened the famous Trinity mine near Jackson, Amador County, Calif., but probably his greatest achievements were with the famous Gwin mine in Calaveras County and the equally famous Kennedy mine in Amador County, both of which he was connected with and financially interested in at the time of his death. It was while general manager of the Gwin mine, in association with David McClure, as superintendent, that he projected and successfully sunk the first vertical shaft on the Mother Lode. While others of the profession predicted failure, Mr. Thomas lived to see his work in this respect imitated at the other great mines along the Mother Lode.

In 1885 Mr. Thomas reöpened the famous Kennedy mine, and as a testimony of his ability that property has been successfully operated for 31 years.

Mr. Thomas was a pioneer at Jerome, Ariz., being connected with the United Verde Mine in its early days. He was also a pioneer in the copper mines at Ely, Nev. He was one of the first engineers to operate in the Broken Hill district of Australia. He was a man of sterling character, stanch and loyal to his friends and associates and of unquestionable integrity. Many friends mourn his loss. He is survived by his widow, Nora Peck Thomas, and five children: Frederick Folger Thomas, Jr., a prominent attorney of San Francisco; William Shepard Thomas, John Hudson Thomas, Maude Angeline Thomas, and Mrs. William C. Brady, of Berkeley.

⁂

Dust Losses in Copper Smelting

BY L. D. RICKETTS

In response to an inquiry concerning our Cottrell treaters, C. E. Mills, general manager of the International Smelting Co., at Miami, sent the following reply:

> Plant consists of 1,008 13-in. by 16-ft. tubes, 240 over driers and 768 in a separate structure at converters. There are 10 General Electric transformers for 50, 75 or 100 thousand volts; 10 motor-generator sets with rectifiers on same shaft; 2 motor-generator exciters and necessary switchboards. The cost of this plant installed, excluding royalty and foundations, was as follows:
>
> COST OF COTTRELL PLANT
>
> | | |
> |---|---|
> | Steel structure | $55,017.78 |
> | Motor-generator equipment | 7,126.48 |
> | Switchboard | 3,124.68 |
> | Transformers | 10,667.17 |
> | High-voltage wiring | 8,546.55 |
> | Low-voltage wiring | 953.47 |
> | Cottrell tubes and shaking equipment | 28,456.09 |
> | | $113,892.22 |
>
> For the driers 45,000 cu.ft. of gas at 80° C. per ton of charge is produced. Tons of charge per 24 hr. is 1,100. The gas is handled by 200 tubes. The dust recovered by these treaters is not determinable, as it is collected with the dust that settles in flues. The total dust produced and recovered at this plant is 0.70% of dry charge treated.
>
> About 270,000 cu.ft. of gas per min. at 150° C. is handled at the converter plant when producing copper at the rate of 300 tons per day; 2.3 tons of dust with 35% copper is recovered. To make the gas entirely colorless—that is, recover everything—it would be necessary to reduce the velocity in tubes to 3 ft. per sec. and cool to 80° C. This extra fume recovered would not have a commercial value.
>
> Power consumption, average for three months, is 27,000 kw. per month.
>
> Direct operating expenses per month are, for operating labor, power, supplies and expense, $1,188.79.
>
> Voltage at treaters is from 50,000 to 60,000; current, about one-half ampere.

It is apparent that the loss of copper at this smelter from the Wedge furnace gases is nil, and the loss from the converter stack is negligible. The reverberatory gases, after passing the waste-heat boilers, go to the stack without the intervention of dust chamber or Cottrell treater. As far as we can make out, the loss from this source—high because of our charging method—is about 0.185% of the total copper charged to the reverberatory.

The unaccounted loss is heavy, amounting to 0.7% of the total copper, or something over two tons of copper a day. Exceptional precautions were taken to provide tight cars, to unload under cover and to protect all belt conveyors and spreading beds from the wind. Mr. Wallace thinks much of this loss comes from two sources—from dust created in charging and discharging the calcine cars, and from dust blown into the air below the hoods in turning the converters down and up. The saving of this dust is most important, but the reverberatory and converter buildings cannot be tightly housed in on account of the health of the men. Possibly investigation along the line of using suction fans through hoods over points where the dust is made, with (possibly a settling chamber and) Cottrell treaters, would lead to a remedy for dust formed in charging and discharging the calcine cars.

If upon investigation it proves, as we think, that the loss from the converters is serious, it would seem an argument in favor of a long barrel converter with a discharge in one end, which would permit the taking of all gases through a smoke box without the introduction of much air and without a chance for the gas to be deflected through a wide angle away from the hood in turning the converters down and up.

When we have a market for sulphuric acid, such a converter would yield a very rich, hot gas, and therefore a gas giving the maximum weight of sulphuric acid per cubic foot of chamber capacity in an acid plant. This market approaches with the coming treatment of our oxidized ores.

The results that have been collected demonstrate that the electrostatic method of precipitating dust has come to stay. When I build new plants, even on such lean ores as Cananea produces, I shall not have a bedding plant in the open air, but will have such a plant completely housed in, with a separate building for each bed. Where possible, ores and mixtures should be handled under cover. They should not be allowed to drop through a space exposed to the wind.

If other large companies would compare our data with theirs and publish them in the *Journal*, it would be to the mutual advantage of all of us.

The Australian Zinc Producers' Association

The Zinc Producers' Association Proprietary, Ltd., has been formally registered in Australia. The nominal capital is £100,000 in shares of £1 each. These will be divided between the mining companies interested in proportion to their output of zinc concentrates over a term of years prior to the formation of the central organization. The names of the companies comprising the Zinc Producers' Association are: The Amalgamated Zinc (De Bavay's), Sulphide Corporation, Zinc Corporation, Broken Hill Proprietary, Broken Hill South, North Broken Hill, Block 10, Block 14, British Broken Hill, Junction North, Broken Hill Junction, Associated Smelters, Electrolytic Zinc Company of Australia, Mount Lyell, and the Burma Corporation.

The Australian output of zinc concentrates—estimated at from 100,000 to 150,000 long tons per annum—will be "pooled" upon the basis of the value of the concentrates produced by each company. For instance, a company which produces, say, a 49% zinc concentrate will receive a larger monetary return than a company producing a 46% zinc concentrate. The profits of the organization will be divided among its members—the companies mentioned—upon coöperative lines.

One of the articles of association provides that no person who is a subject of a country with which the British Empire is now at war shall at any time hold office as a director, manager or secretary, or shall be allowed to hold shares in the Zinc Producers' Association Proprietary, Ltd. The company will control the whole of the zinc concentrates output of Australia and the marketing of this product. Provision is also made for control over the treatment of the concentrates.

Rights Under a Void Lease

One who has developed mineral lands under a lease purporting to have been executed by a corporation owning the lands, but not authorized or ratified by that company, can be compelled to account to the corporation for the proceeds of ore sold from the land, according to the holding of the Arizona Supreme Court in the case of Franklin vs. Havalena Mining Co., 157 Pacific Reporter, 986. He is, however, entitled to have returned to him any payments called for in the lease and also amounts expended with reasonable necessity to preserve the title to the property while in possession; it appearing that he was ignorant of the fact that the lease had not been authorized by the corporation.

NEW PATENTS

United States patent specifications listed below may be obtained from "The Engineering and Mining Journal" at 25c. each. British patents are supplied at 40c. each.

STRAINER—Acid-Resisting Strainer for Smelters. Donald M. Cameron, Lowell, Mass. (U. S. No. 1,190,512; July 11, 1916.)

ZINC—Recovery of. Charles H. Fulton, Cleveland, Ohio, assignor to David B. Jones, Chicago, Ill. (U. S. No. 1,193,680; Aug. 18, 1916.)

EXPLOSIVE and Method of Manufacturing Same. Giovanni Spica, Venice, Italy. (U. S. No. 1,194,561, Aug. 15, 1916.)

FILTER. Charles D. Burchenal, New York, N. Y. (U. S. No. 1,194,949; Aug. 15, 1916.)

GRINDING MILL. John W. Cover, Tacoma, Wash. (U. S. No. 1,194,717, Aug. 15, 1916.)

GRINDING MILL. Thomas J. Lovett, Chicago, Ill., assignor to Copper Process Co., Chicago, Ill., a Corporation of South Dakota. (U. S. No. 1,194,757; Aug. 15, 1916.)

HYDRAULIC CONCENTRATOR or Classifier. Frank F. Wagner, Denver, Colo. (U. S. No. 1,193,953; Aug. 18, 1916.)

NICKEL—Recovery of Nickel From Its Ores. Henry Livingstone Sulman and Hugh Fitzalis Kirkpatrick Picard, London, England, assignors to The Madagascar Minerals Syndicate, Ltd., London, England. (U. S. No. 1,193,734; Aug. 18, 1916.)

ORE CONCENTRATOR. Louis David Chevalier and Henry Charles Reche, Dubuque, Iowa. (U. S. No. 1,194,477; Aug. 15, 1916.)

SEPARATION—Process of Separating Metals. Albert H. Sherwood, Oroville, Calif. (U. S. No. 1,192,945; Aug. 1, 1916.)

SILICO SPIEGEL—Process of Making Silico-Spiegel. Harry Schagrin, South Bethlehem, Penn. (U. S. No. 1,190,678, July 11, 1916.)

SODIUM AND POTASSIUM—Separation of. Harry P. Bassett, Catonsville, Md., assignor to the Spar Chemical Co., Baltimore, Md., a Corporation of Maryland. (U. S. No. 1,194,165 Aug. 15, 1916.)

STEEL—Process of Tempering or Hardening Steel. John B. Moore, Latrobe, Penn. (U. S. No. 1,190,937; July 11, 1916.)

TUNNELING MACHINE. William F. Wittich, Erie, Penn. (U. S. No. 1,191,864; July 18, 1916.)

Editorials

The Railway Situation

As we go to press this week, the railway situation remains unsettled, in spite of the intervention of the President. The developments of the last week have, however, sharply crystallized the issue and have produced a deadlock that can be broken only by one side or the other backing down, or so it looks. The position is substantially as follows:

The Brotherhoods—They have yielded in their demand for time-and-a-half overtime, but stand firmly on their demand for an eight-hour day. Failing to get that, they will strike.

The Railways—They have stated their willingness to submit the whole matter to impartial arbitration and abide by the result. The brotherhoods, however, do not want any arbitration. Heretofore they have been winners by arbitration, but now they feel sure that they have got the railways in the position of "hands up."

The President—He tells the railways to give the men the eight-hour day, which he considers to be a right of labor in modern civilization. He suggested the reference of some subordinate questions to a commission.

Thus the matter stands. The labor leaders retired to the background. There was no need of their remaining in the foreground, for the President of the United States had taken up the advocacy of their claims. The repudiation by the President of the principle of arbitration in industrial disputes drew out some adverse comments from the public, and in a subsequent communication he endeavored to smooth over that sacrifice of fair play.

It is ignored that the railway men do not really want an eight-hour day, but want an eight-hour day simply as a basis of payment. In other words, they are asking for an advance of 20 to 25% in wages under the guise of demanding an eight-hour day. The railways say they cannot stand it unless they are permitted to increase rates, as to which they have no assurance. Upon a former occasion when they requested of the Interstate Commerce Commission the right to raise rates on the ground that they had been obliged to advance wages, the commission told them in effect that they had no business to do so; that in doing so they took all the risk, had no reason to look for indemnification at the expense of the public, and could not have it.

Throughout this labor dispute it has looked until lately as if the public would be the goat—that is, the men would be granted their increase and the Interstate Commerce Commission would be inspired to permit the railways to raise rates as part of the deal. The present outlook is that the railway stockholders will be the goat. If the engineers, conductors, firemen and brakemen obtain what they want, somebody has got to pay for it. That somebody is either the public or the stockholders. According to the modern theory of class legislation it will be quite in order to put the burden on the stockholders, for they are fewer in number than the public.

Revision of the Mining Law

The memorandum outlining some main points for a revision of the mining law of the United States that was adopted by the New York section of the Mining and Metallurgical Society last spring has excited a good deal of discussion. In the main the criticisms have been directed toward details rather than toward principles. As for the latter, the adverse comment appears chiefly to be that what is proposed is nothing but patchwork legislation. That will be conceded by everybody. With things as they are, probably nothing but patchwork is possible. The most important thing is to have good patchwork. Everybody knows how the present laws work and appreciates certain serious defects in them. It will be undoubtedly far better to correct those defects and repair things generally than to throw away the old machine and try something of an entirely new design, as to which nobody can know how it is going to work until it has been tried.

We do not think, therefore, that it would be advisable to contemplate the introduction of any new principles of sociology or welfare, such as governmental retention of mineral rights, a leasing system, a segregation of surface rights and mineral rights, or any experiments of such kinds. Most of those systems are in effect in other countries, but it ought to be borne in mind that in general the other countries grew up with them, that conditions abroad are different from what they are in the United States. It is well to bear in mind also that after the Louisiana Purchase the United States came into possession of important areas of lead-bearing lands in the Mississippi Valley, that ownership thereof was retained by the Government and a trial of their exploitation by a leasing system was made. After more than 40 years of this, during which time the system proved to be a miserable failure, Congress in 1847 decided to sell the national lead lands in the Mississippi Valley. On the other hand, the great mineral wealth of the region west of the Rocky Mountains has been successfully developed by the present system, and it will be best, without any doubt, to preserve that system.

Moreover, it ought to be remembered that since 1872 our existing mining laws have been the subject of a great deal of litigation. That very fact is a prime reason why they ought to be amended. On the other hand, that litigation and the court decisions have in the main established a precise understanding of the language of the present laws, the principles of their administration, etc. It would be foolish to throw away the wealth of legal definitions that have been obtained at such great cost, and substitute a new language—a new phraseology—that would have to be interpreted all over again. We think it is a sound argument that the principles, the phraseology and the practice of the present laws ought to be preserved to the maximum possible extent.

With regard to principles there are three fundamental ones that ought to be changed. As to this, mining men appear without any doubt to be substantially in agreement.

There is a consensus of opinion that extralateral rights ought to be abolished in so far as claims hereafter located are concerned, that discovery as a prerequisite to location ought to be abolished, that the performance of annual assessment work ought to be regularized, and that there ought to be a means of appeal from decisions of the General Land Office. There is another principle that ought to receive more consideration than it has heretofore. This relates to the scope of the mining law. It was the intention of the framers of the existing laws to have them cover all kinds of valuable mineral deposits other than coal, but that manifest intention has been defeated to a greater or less extent by decisions of the General Land Office. In enacting a new law, if the intention be to have it cover all classes of valuable mineral deposits other than coal, that intention ought to be defined so clearly that there will be no misunderstanding of it.

While there is a general agreement that the prerequisite of discovery should be abolished, there is not an agreement, or perhaps we should say not a good understanding, as to how that may be effected. If the discovery prerequisite is to be abandoned, there must be some restriction upon prospecting rights, for the Government would probably not permit indiscriminate location.

1. A simple form of restriction would be that (*a*) the new law authorize mineral locations *without discovery* in any part of the public lands officially classed as mineral; (*b*) that the new law authorize mineral locations *upon discovery* in any part of the public lands whether officially classed as mineral or nonmineral. The second provision would preserve to the prospector every right that he has now. The first would give him rights that he has not now, but ought to have. By the second provision the prospector might go upon a forest reserve, and if he found there a valuable mineral deposit, he might locate a claim upon it and hold it as long as he did the legal assessment work.

Other debatable questions pertain more to matters of detail. Some of those that have been raised are the following:

2. Shall mineral claims hereafter located be 660 ft. square; that is, 10 acres in size and square in form?

3. Or shall they be 1,320 ft. square; that is, 40 acres?

4. When the proposed square claims are located on surveyed land, shall they be required to be subdivisions of the surveyed sections?

5. If not located on surveyed land, shall it be required that the boundaries run north and south and east and west?

6. Shall the number of claims locatable by one person or association be limited or unlimited?

7. If limited, what shall be the limit?

8. Shall existing regulations concerning the marking, notice and record of location be continued?

9. Shall there be the additional requirement that one year after the date of location, record thereof shall be made in the United States Land Office of the district?

10. Or shall the time allowed for recording be more or less than one year?

11. Shall the annual assessment work be at the present rate—$100 per 20-acre claim, or $5 per acre?

12. Shall it be provided that an equivalent sum of money *may* be paid into the United States Land Office in lieu of the performance of assessment work?

13. Shall a person or association holding a group of contiguous claims be permitted to do the assessment work upon one claim and thereby hold the group, the amount of such work to be equivalent to $5 per acre for each claim of the group?

14. Shall a person or association doing assessment work in any one year to the value of more than $50 per 10-acre claim be given credit for the excess in succeeding years, provided, however, that no fractions of $50 shall be considered for this purpose? (If the claim unit be 40 acres, these figures would be raised to $200.)

15. Shall it be provided that in performing assessment work labor shall be reckoned at the current rate of wages for miners in the district? Or at some other rate; and if so, what?

16. Shall it be required that every holder of a claim shall file annually a record of his assessment work, accompanied by vouchers, in the Land Office of the district?

17. Shall proceedings for patent remain as now?

18. Article V of the memorandum adopted by the New York Section reads as follows:

> Subject to the existing extralateral rights of mining claimants or patentees, the holder or patentee of a mining claim located hereafter to have the exclusive right of possession and enjoyment of the surface held by him and of the minerals under it, bounded by vertical planes passing through surface boundaries of said land, but not the right to follow any mineral deposit beyond said planes. And the holders or patentees of claims heretofore located to have similar exclusive possession of all the mineral in said claims that is not covered by any existing extralateral rights.

The article mentioned abolishes extralateral rights in so far as any claims hereafter to be located are concerned. The extralateral rights of existing claims may not be taken away, however, wherefore any new location and grant of patent may be made only with the reservation of such rights. The rights of existing claims having been thus expressly preserved, the last sentence of this article confers upon previously located claims the rights to everything comprised within the vertical projection downward of their side lines that is not legally claimed by anybody else, this being thus an addition to the original extralateral rights. This article has received general approval with scarcely any criticism.

19. Shall notice of location of all mining claims, hereafter made, be filed for record in the Land Office of the district within one year after date of location? Shall the time be more or less than one year; if so, what?

20. Shall it be provided that final entry and payment be made for such claims within seven years after date of location, exclusive of the time covered by pending adverse claims? Shall the time allowed for this purpose be more or less than seven years; if so, what?

21. Shall the new law provide for appeals from decisions of the General Land Office to a court of competent jurisdiction?

A good many of the foregoing points are not vital. Some of them are just as they are now, namely, Nos. 6 and 13. Others suggest the retention of present provisions, as Nos. 8, 11 and 17. One very important matter in our judgment pertains to the size and shape of claims and the method of laying them out. There seems to be a unanimity of opinion in favor of square claims. There is strong opinion in favor of laying them out in coincidence with the lines of surveyed land, but north-south and east-west anyhow. This is to avoid the crazy-quilt confusions of our existing mining districts. If such a plan be adopted, it will be impracticable, or anyway very undesirable, to have claims larger than 10 acres. On several grounds the 10-acre unit seems to be the best.

It is hoped that these matters will receive very full discussion. We invite our readers to express themselves specifically with respect to the 21 questions that have been formulated herein.

BY THE WAY

If the high price for print paper leads to an abolition of the Sunday supplement of the daily press, it will not be an unmitigated evil.

* * *

The Tom Reed Gold Mines company hereafter will supply water to its former patrons in Oatman. It has been advised by the Arizona corporation commission, according to the *Mojave Miner,* that it is its legal duty to do so. This is regardless of the fact that it must have additional water for its extra ten stamps at the mill. The company will have to get water from some new source to fill both of these pressing demands.

* * *

The Chicago *Tribune* vouches for the following sign in a hotel in Miami, Ariz.: "When the handles are off the faucets, it means that the water is not to be used. The landlady will provide baths on Saturdays and Sundays. Use no wrenches." After which the garrulous *Tribune* editor says of a recent experience there. "My sister, had said, 'You will be crazy about Arizona,' so I wired her from Miami this message: 'We were just about to be crazy over Arizona when we found two hairs in the soup.' The telegraph operator smiled when he ran his eye over my offering. 'Say, that's the first code message ever went through this office!' said he."

* * *

A long, hungry, green-looking, young Texan had been hanging around the repair shop of an Arizona mine for several days looking for a job. The repairman at last got tired of the drawl and the family history of the boy just from home, so he told him there was a job on the "pipe stretcher" in the machine shop, and suggested that he see the machine-shop foreman about it. The foreman, who hated himself and everybody else, particularly that repair man, when the Texan spoke and told him who had sent him for the job on the pipe stretcher, let out a bawl that would make a bull jump into the sump and said that the machine would not be ready for a few days. The young Texan was game and said he would like to have something to do until it was ready. The foreman did not want a common repair man to have anything on him, so he gave the boy a requisition and told him to go to the warehouse and get a bucket of "striped paint" and come back and he would put him to work. He went to the warehouse, but that was the last seen of him.

* * *

Benjamin F. Atherton, of Portland, Ore., is offering the following:

MINING PROPOSITION

The Rand Mine, South Africa, duplicated in Oregon—with this difference—it is close to two railway lines—can be electrically operated—plenty water—no clay to contend with, rock already crushed and pulverized. Four thousand acres—a steam-shovel proposition. The stratas are over 20 mi. long, 5 to 7 mi. wide and of unknown depth. Prospecting of 1,670 ft. in well shows no solid formation. The stratas are of black sand interlaid by conglomerate mineralized matter. Engineers say, that practically all of the Royal Group of Metals are represented—60% being Zircon. Concentrates run from $1 by cyanide process to an average of $40 by using our secret process of recovery, although some returns have gone to $90 per ton and over.

Consider this: Engineers say each 20 acres contain 1,000,000 tons concentrates. Cyaniding will give $1 per ton—Our Process will average $40 per ton—and one of our machines complete of 100 tons capacity will not cost over $25,000.

THIS IS A GILT-EDGE INVESTMENT

The company or individual who has the capital to invest in this mining proposition and also the purchase of this secret process—although they may license it—will double and treble their money in a very short time—receiving continuous returns. We are prepared to back our statements, have machine ready—you take Pullman car in morning—go upon the property—obtain your samples—return to Portland in the evening and make your test—satisfy yourselves. Then if you mean business, we will get down to facts.

A professor of mining in a well-known college who received one of Mr. Atherton's letters thought that it was rather cheeky, for college professors are not by any means an easy lot. For our part we find several of Mr. Atherton's ideas to be interesting. We wish only that we could take a Pullman car in the morning, find out if they are true and get back by evening.

* * *

For the first time in its history of 45 years the American Institute of Mining Engineers will next month meet in the State of Arizona. The sessions will extend over the entire week of Sept. 18-23 and will be held in the principal mining centers of the state, the members traveling between the various points by special train and automobile. Principles of mining and metallurgy of the greatest interest will be presented at the technical sessions. A special train has been arranged for to carry Eastern members from New York on Sept. 14. Other members and their guests will join the party at various points en route, and at El Paso, Tex., the Western section of the convening members, starting from Los Angeles, Cal., will meet the train and continue to Arizona. The principal towns in which the Institute sessions or visits of inspection will be held are Santa Rita and Hurley, N. M., and Douglas, Bisbee, Globe and Phœnix, Ariz. The inspections will include the Roosevelt Dam and the mines and works of practically all the leading metal-producing companies of the state. At Douglas, in the technical sessions, the Institute will discuss the special subject of "Smelting." At Bisbee papers will be read on "Mining and Geology" and at Globe the first day will be given over to "Mining and Smelting" and "Leaching." During a second day at Globe time has been set aside for what is regarded as an important discussion of "Concentration and Flotation." The company plants that will be visited are as follows: At Hurley, the mines and works of the Chino Copper Co.; at Bisbee and Douglas, the mines and works of Copper Queen Consolidated Mining Co., Calumet & Arizona Copper Co. and Shattuck Copper Co.; at the Globe District, mines and works of Inspiration Consolidated Copper Co., Miami Copper Co., Old Dominion Copper Mining and Smelting Co., together with the new works of the International Smelting Co.

An elaborate entertainment program is being planned by the Arizona Committee comprising Gerald F. G. Sherman, Arthur Notman, secretary, Norman Carmichael, W. G. McBride, John C. Greenway, W. L. Clark, B. Britton Gottsberger, and Forest Rutherford.

PERSONALS

P. K. Lucke has gone to Cuba and Costa Rica on mining business.

Charles E. Hutton, of Goldfield, Nev., has gone to New York and Boston on business.

Charles Hayden is expected in New York next Monday, returning from his Alaskan trip.

Dr. G. H. Cox and **D. H. Radcliff,** have opened offices in Tulsa, Okla., as consulting geologists.

F. G. Moses, is erecting a flotation plant at Superior, Ariz. for the General Engineering Co., of Salt Lake City.

E. A. Cappelen-Smith has been visiting the mines and smelters at Butte, Mont., with which he was formerly connected.

Wallace Lee, formerly with the Geological Survey, has joined the geological staff of the Cosden Oil and Gas Co. at Tulsa, Okla.

R. E. Cranston left San Francisco, Aug. 11 for an extended trip into Nevada, Colorado and Montana, on professional business.

Daniel Moran, of New York, and associates have been examining molybdenite properties near Amos in the Hurricanaw district in Ontario.

George H. Heitz, Colorado School of Mines '06, has moved from Denver to Leadville and is associated with the firm of Platt & Kleff, mining engineers.

Thomas A. Stroup has left the engineering staff of the Tennessee Copper Co., and is now engineering assistant with the Utah Copper Co. at Salt Lake City, Utah.

Horace Albert Scott has been elected instructor in geology and mineralogy in the Missouri School of Mines to succeed W. L. Dobie, who has resigned to go into practical mining.

Geo. H. Garrey who has spent the past six months on examination work in the Western States and British Columbia was at his Philadelphia office for a few days the past week.

Thomas W. Gibson, Deputy Minister of Mines for Ontario, has gone to Montana to investigate the system of mining taxation in connection with the work of the Ontario Nickel Commission.

Samuel D. Nicholson, manager of the Western Mining Co., operating the Wolftone mine in Leadville, has received the nomination for governor by the Colorado Republican state assembly.

John W. Finch has gone to China to make investigations for an important New York syndicate that contemplates making extensive mining explorations and developments in China and Siberia.

Martin Schwerin has been for two months at Leadville, Colo., making a geological study for the Yak Mining, Milling and Tunnel Co., and has now returned to his office at 42 Broadway, New York.

George R. Delleque who has been managing mines in Mexico for several years recently returned to his home in DeBeque, Colo., after a narrow escape from execution at the hands of Mexican military officers.

John B. Champion, pioneer Leadville mining man, superintendent for the Yak Mining, Milling and Tunnel Co. for twenty years, has resigned. He will be succeeded by Hugh C. Watson, formerly assistant superintendent.

F. G. Clapp and **M. L. Fuller,** managing engineers of the Associated Geological Engineers, have been investigating properties in Kansas. The latter has returned East, while the former has gone to Duncan, Oklahoma.

H. K. Najarian has taken a position with the firm of Bradley, Bruff & Labarth, of San Francisco. He was formerly with the Nevada Consolidated Copper Co. He is now at the new works of the Missouri Cobalt Co., Fredricktown, Mo., engaged in smelter designing.

Garrett A. Muilenburg, for the past year instructor in geology and mineralogy in the Colorado School of Mines, has been elected instructor in geology and mineralogy, in the Missouri School of Mines to succeed D. H. Radcliff, who has resigned for the purpose of going into practical work as an oil geologist in Oklahoma.

James MacNaughton, general manager and vice-president of the Calumet & Hecla Mining Co., is to take up his residence of Boston, Dec. 1. He will continue to manage the company. **John Knox,** superintendent, will take care of considerable of the work at the mine. Mr. MacNaughton will be a frequent visitor to the copper country and there will be no change in the titles of the two men.

F. J. H. von Engelkeng, of Florida, has been chosen by the President to succeed Robert W. Woolley, of Virginia as director of the Mint at Washington. Mr. Woolley resigned to become the director of publicity of the Democratic National Campaign. Mr. von Engelkeng has been an interested worker in behalf of the enactment of a Rural Credits law. He was chosen by the Southern Commercial Congress to serve with its commission in the study of the subject abroad.

Walter A. Barrows, Jr., of Brainerd, Minn., has been elected president and general manager of the Thomas Iron Co., Easton, Penn., to succeed Ralph H. Sweetser, whose resignation of several months ago becomes effective Aug. 31. Mr. Barrows has had an extended experience in blast-furnace and iron-mining work. He was for several years general manager of the Shenango Furnace Co., and for five years past has been engaged in iron mining and exploration in Minnesota.

OBITUARY

Matthew Jacobs, mining man of San Francisco, and father-in-law of Superior Judge Franklin K. Griffin was instantly killed Aug. 15 near Hopland, Calif., in an overturned automobile. R. V. Montgomery, mining partner of Jacobs, and H. M. Anthony, attorney, who were in the machine, escaped uninjured. The party were going into Lake County to examine mining property. Jacobs was 51 years old and a native of Minnesota.

Edward Gere Denniston died at his residence at San Francisco, Calif., on Aug. 7. Mr. Denniston, who was about 75 years of age at the time of his death, was one of the pioneer manufacturers of San Francisco. In 1865 he established the San Francisco Plating Works which has been one of the principal sources of supply for copper plates for mining uses ever since its establishment. Mr. Denniston is said to have been the first American manufacturer of silver plated copper plates for saving gold.

Campbell Douglas Whyte is reported to have been killed in action in the European War, supposedly in the last part of July or the first part of August. Whyte was a metallurgical chemist who went to California in 1905 from Edinburgh and was employed at the Golden Jubilee mines in Trinity County. Later he was connected with the Santa Cruz Cement Co. in California. At the outbreak of the war, he sailed for England and joined the London Fusileers. He had just been recommended for a commission prior to his death.

Captain Martin Goldsworthy, mining captain at the Chapin mine, Iron Mountain, Mich., for the Oliver Iron Mining Co. for a great many years, died Aug. 16. He worked at the property for 34 years, being in charge of the underground work the greater part of that time. The Chapin is one of the largest underground iron ore properties in the Lake Superior district and has often shipped over 1,000,000 tons in a single season. Captain Goldsworthy was 68 years of age. He was retired on a pension a few months ago and failed rapidly after giving up his work. He was well known throughout the Lake Superior district. He leaves a widow and three children. Interment was in Iron Mountain.

Ralph D. Williams, editor of the "Marine Review," Cleveland, from 1900 to 1915, died Aug. 14, aged 48 years. He was born at Nottingham, England, and when he was about 10 years old his family removed to Cleveland. He was successively reporter on the Cleveland "Plain Dealer," city editor, managing editor and Washington correspondent, resigning in 1900 to become editor of the "Marine Review." Ill health compelled his retirement in June, 1915. He was an authority on statistics and history of the Great Lakes trade, and much of this information he embodied in a biographical book, "The Honorable Peter White," published in 1907, a real contribution to the history of the Lake Superior iron ore region.

TRADE CATALOGS

Steam and Electric Shovels, Placer Dredges, Etc. Bucyrus Co., South Milwaukee, Wis. General Catalog No. 15. Pp. 40; 6x9 in. Illustrated.

Denver Fire Clay Co. has issued a special catalog of Case metallurgical furnaces, showing their adaptability for melting, refining, assaying, temporary and other uses about the plant. The furnaces themselves and special installations are described.

Editorial Correspondence

SAN FRANCISCO—Aug. 17

General Petroleum Corporation, newly organized, has secured a permit from the Commissioner of Corporations to issue its stocks and bonds, and official approval of the reorganization of General Petroleum Co. in accordance with the plan worked out by the protective committee composed of Frank B. Anderson, Herbert E. Clayburgh, Mark L. Gerstle, Joseph E. Grant, John D. McKee, Maxwell McNutt, Philip I. Manson, Percy T. Morgan and Richard Mulcahy. The effect will be to reduce materially fixed obligations of the company and prevent a foreclosure of the mortgage on the property of the General Pipe Line Co. The property taken over by the new corporation has an approximate value of $27,500,000.

Chromic-Iron Production in California made a remarkable advance in the first half of 1916. Production in the six months is estimated by the U. S. Geological Survey to be three times greater than the annual production of former years. According to the Survey figures, the average annual production for the last 35 years, 1880-1915 inclusive, was 1,229 tons, while the output in the first six months of 1916 is estimated at 3,687 tons. The Survey figures for the several years of the 35-year period are not at hand, and though the U. S. Geological Survey and the California State Mining Bureau do not always agree in statements of production of minerals and metals in the state, such figures as are at hand from both sources may here be used in showing the fluctuation in output of chromic iron for the period named. In the first seven years, 1880-1886, the average annual production increased; in the following nine years, 1887-1895, the average increased to 2,864. The largest production in this period was 3,680 tons in 1894, which decreased to 786 tons in 1895. The succeeding three years there was no production recorded by the Mining Bureau; according to the same records in the 12 years, 1900-1911, the average annual production was only 332 tons. In the last four years the production was as follows: 1,270 tons in 1912, 1,180 in 1913, 1,517 in 1914, 3,800 in 1915, or an average of 1,943 tons a year. The Survey uses long tons and the Mining Bureau short tons in computation, so that the averages here given (in short tons) may be considered approximations. But the variance between the two reports for 1914 is not reconcilable to the difference in the long and short ton. Mr. Diller's report in "Mineral Resources" for 1915 states that "the production of chromic iron in 1915 amounted to 3,281 long tons, valued at $36,744, a gain of 2,690 tons and of $28,029 over 1914", which reduces the 1914 production to 591 (long) tons valued at $8,715. The Mining Bureau (Bull. 70) gives the 1914 production as 1,517 (short) tons, valued at $9,434. The Bureau returns are not yet available for 1915. Mr. Diller's report shows an average value per (long) ton of $11.19. In the present year numerous old and new chrome properties were opened and it is probable that some of them will remain in permanent operation. The production in 1914 all came from Shasta and Calaveras Counties. In 1915 these counties increased their output and several other counties helped increase the total. The principal counties mining and shipping chromic ores in the first half of 1916 were Amador, Butte, Calaveras, Eldorado, Fresno, Glenn, Shasta, Siskiyou and Trinity.

Butte—Aug. 18

Anaconda Has So Much Zinc Ore developed in the Emma and other mines that it is not in the market for any more zinc properties, and has allowed its option on the Czarromah and Travonia Fraction to lapse. The company has developed enormous reserves of zinc ores in the upper levels of some of the copper mines in the Butte district and is also making a big zinc mine of the Douglas, a property in the Coeur d'Alene district of Idaho, which it purchased some time ago on a basis of 30c. per share for the stock of the Douglas company. Anaconda has begun mining in the Emma and the showing in that and its other properties indicate a reserve that will meet all demands for many years. The option on the Czarromah and Travonia was secured last winter shortly after the company made the deal on the Emma. The option price on the Czarromah and Travonia Fraction was $300,000 and it is understood that $50,000 has been paid to the Dickerman brothers, of Duluth, on the option. What the Dickermans will do with the properties is not known, though it is stated that they have had several other offers to take them under option. The Anaconda company could operate the claims much more economically than any other concern or individuals can, and probably no one else could afford to pay for the claims what the Anaconda company was expected to pay for them.

DENVER—Aug. 17

Arrest of Edward Tankersley, a Denver broker, suggests that wildcatting is still a factor with which legitimate mine promoters must contend. He is charged with crooked dealings pertaining to a Boulder County tungsten property. Business men of Boulder propose to see that this case is vigorously prosecuted.

Reopening of the Victor Mine, once a prominent property in the Cripple Creek district under the ownership of the Moffat-Smith syndicate, is now to be undertaken by Colorado Springs and Cripple Creek operators. The mine has not been systematically worked since 1899. It is credited with a gross production of $2,216,671 of which $1,155,000 was distributed as dividends. The Isabella, another Bull Hill pioneer mine, recently shipped 21 tons that were settled for on the basis of a gold content of 3.98 oz. per ton, while a carload lot of screenings contained 5.45 oz. gold per ton.

Boulder County's Tungsten Boom has subsided, but it is being succeeded by conditions that promise much for the near future. Tungsten mining has not ceased by any means but, instead of there being the feverish rush to organize new companies to dispose of ore at inflated prices, miners are producing ore in more systematic fashion and realizing fair profits on the normal market. The tungsten excitement brought many investors into the county and several of these men have taken hold of gold and silver properties which, under new development, are showing up well. The Yellow Pine and the Logan mines at Crisman have been taken up by a group of men styling themselves "The Lucky Seven" and have recently disclosed rich shoots of ore, the former in silver and the latter in gold. At Summerville, the Little Fred mine is being put into shipping shape, while the nearby Victoria mine, a pioneer silver producer, is being unwatered preparatory to renewed operation.

SALT LAKE CITY—Aug. 18

Unsurveyed Public Lands in Utah, according to the annual report of I. C. Thoreson, U. S. surveyor general for the district of Utah, aggregate 21,131,714 acres, as compared to less than 2,000,000 acres of unsurveyed lands in Colorado and an approximately equal amount in Wyoming. The total surveyed acreage in Utah at the close of 1914-1915, was 32,498,375 acres, to which a total of 756,286 acres was added during the year just closed making total acreage thus far surveyed 33,254,661 acres. The total acreage of the state is 54,386,375. In the mineral division, deposits received were smaller than during the year preceding—this being accounted for by the fact that advance deposits for office work were reduced last February from $30 to $20 a location. Employees in the field division of the General Land Office have been given a flat increase in pay of $10 per month.

The Iron Blossom Tax Dispute between Juab and Utah Counties over the tax on the net proceeds of the mine which covers ground in both counties, is now in the hands of the state board of equalization. According to a survey made by the county surveyor and placed before the board by two commissioners of Juab County, it appears that Juab County is this year entitled to approximately 80% of the tax money. The survey of the stopes from which ore was mined shows these to have been largely in Juab County. Utah County's claim for a large part of the Iron Blossom tax was based on a map in which there was an error in the location of the boundary line between Utah and Juab Counties. The Supreme Court in a recent ruling holds that the tax on the net proceeds of a mine must be paid into the county from which the ore is mined, notwithstanding the fact that the portal of the tunnel or the shaft through which the ore is brought to the surface may be in another county.

CHLORIDE, ARIZ.—Aug. 16

Chloride Is Growing Steadily in activity, though the camp shows no signs of a "boom" as it is generally known in the West. Considerable development is being carried on in a quiet way and the district is gradually getting away from the early-day surface mining, more attention now being paid to developing ore reserves at depth. Aside from the Tennessee nine of the U. S. Smelting, Refining and Mining Co., practially all the mining in the past has been done at a depth of not over 200 or 300 ft. The exceptions are the Schuylkill and he Elkhart, the shafts of which are down about 500 ft.; both laim good ore at that depth and are being unwatered for deeper development. It is difficult to estimate the number of men employed in the district. There has been no nrush of unemployed but the operators seem to find no diffiulty in getting men. Business in the town has been steadily mproving. The summer months are usually dull in this part of Arizona although Chloride has almost an ideal summeresort climate. A concrete-block building is just being ompleted for the Arizona Central Bank, and another is being rected for a drug store. A new and surprisingly good estaurant was started about six weeks ago, and altogether he camp shows an air of prosperity without feverish excitement which promises well for its future development.

TUCSON, ARIZ.—Aug. 18

The Arizona Federation of Labor in annual session at Tucson, Aug. 12, endorsed the candidacy of Governor Hunt and adjourned. The meeting was favored with a good deal of oreign talent. "Mother" Jones, who was sent by the Western Federation of Miners to help Hunt, vehemently fulfilled her mission. Olaf Tveitmoe, of San Francisco, who came, as he tated in his address, to speak for Hunt and to gather funds or one Schmidt and one Caplan who are on trial for murder n connection with the dynamiting of the Los Angeles Times Building, got over $600 from the laboring men and departed. On report of Member John L. Donnelly, of Morenci, that erious trouble in that district was hardly averted when the liding scale slid downward to the tune of about 25c. per day per man—the Mexicans and Spaniards believing the company managers arbitrarily fixed the price of copper—the Federation orwarded to the Secretary of Labor at Washington a resoluion asking an investigation as to the manner in which the verage monthly price of copper is ascertained. It then sent word to the boys not to strike till it finds out precisely who ets the price of copper. The organization resolved against he "home guards," formed throughout the state at the approach of hostilities between United States and Mexico, seeing n them a menace to organized labor. The Morenci Mine, Mill nd Smeltermen's Union reported as grievances that the managers will not give them ground for a union-hall site and hat too much diagnostic importance is given the cerebrations f strong union tendencies in a possible employee by the ompany surgeon, in ascertaining the fitness or unfitness of he applicant.

ROSICLARE, ILL.—Aug. 16

Operations Resumed at Rosiclare Lead and Fluor Spar Mines n Aug. 14, after being idle since July 15 on account of labor roubles. Fairview Fluor Spar and Lead Mine is making reparations to start work again about Sept. 1. The Kentucky uorspar mines were not affected by the labor disturbances nd have been producing their normal tonnage.

FLAT RIVER, MO.—Aug. 17

Much Diamond-Drill Prospecting is now being done by all ompanies, and it is the general belief among the mining men hat new deposits will soon be opened in the district. In the icinity of Valles Mines, 8 mi. north of Bonne Terre, small ockets of rich zinc ore are being opened. These prospects mine an average of 10 tons each, daily.

A New Steel and Concrete Mill is being built by the Federal Lead Co. at Elvins. The construction is practically ompleted, and machinery is now being placed. During the ast of July four Hancock jigs were installed. The mill is xpected to be operating by Jan. 1, 1917, and will be capable of reating 2,500 tons of ore per day. This is the only mill in he district that has a natural sloping base. Mining men are looking for a new cost record to be established as soon as he mill is in good working order.

JOPLIN—Aug. 19

Labor Troubles at Henryetta, Okla., continue to handicap he smelting plants. There has been a strike on at one smelery for over a month, the men demanding that the owners ecognize the Western Federation of Miners. As a result, only ne block of this plant has been operating. A fusilade of 60 hots was fired in the neighborhood of this plant last Monday morning, but no one was injured. The Picher Lead Co.'s new melting works at this place is virtually completed but it will not be started until labor conditions are quieter.

Zinc Smeltery will be built or purchased by the Lincoln Zinc and Smelting Co., according to an announcement just made. Roland R. Conklin, of New York, is chairman of the oard of directors of this company, which at present owns he Ethel Gray, the Mary C., the Seneca and Roland mines in his district. Jesse Briegel, who has been in charge of the mines, is the company's representative for Missouri, and O. A. Sneed, a well-known local operator, will have charge of operations. The corporation is chartered by the State of Delaware and executive offices are at No. 1 Wall St., New York.

HIBBING, MINN.—Aug. 19

Dynamiting Outrages on the Mesabi are alienating the sympathies of practically all residents, outside the regular members of the Industrial Workers of the World. On the night of Aug. 16 unknown parties dynamited a boarding house in Biwabik, where a number of miners who had refused to join the union were living. The front part of the house was blown to atoms, but fortunately no one was injured. The same night the home of a hoisting engineer at the Nelson location, near Hibbing, was partially destroyed by the same method. Officers are making a rigid search for the criminals and hope to be able to land them in jail. It is getting to a point now where the leaders of the I. W. W. realize that their case is getting desperate and they are resorting to any means to further their cause. It is thought that it will not be long before the strike on the Mesabi will collapse. There would be no sense in continuing the strike during the winter months when all of the pits and many of the underground mines are idle. It is already known that many of the underground properties will not be opened again until next spring, even if the strike should be called off today. The demonstrations on the Cuyuna range did not last long as the men soon realized that they had been duped by agitators. The Clark and Chester mines on the Mesabi resumed operations this week. The Tioga, which started two weeks ago, is now working with two full crews. August shipments from the Mesabi range are expected to be in excess of 10,000,000 tons.

WINNIPEG—Aug. 16

New Mining Areas in Manitoba, north of The Pas, have been visited recently by Marvin Allen, provincial engineer of Manitoba, and also by Prof. R. C. Wallace of the University of Manitoba, and it is stated that their reports will be decidedly favorable. American interests (the Clark-Stone Co., a subsidiary of Hayden, Stone & Co., of Boston) have been drilling the copper deposits discovered about a year ago by Jack Hammill, a well known northern Ontario prospector. The purchasers were to do 5,000 ft. of diamond drilling, to construct railway, smelting and water-power plants and to produce ore within five years from last January; a payment of $500,000 is to be made Jan. 12, 1917. The first portion of the contract for diamond drilling in the vicinity of Flin Flon Lake has been completed and indicates a deposit having a depth of 250 ft. and a width of 200 ft., containing about 2% copper and a good amount of gold; also some showings of zinc and silver. Some high-grade ore has also been opened. This new copper area is about 110 mi. northwest of The Pas, near the eastern boundary of Saskatchewan in the vicinity of Flin Flon Lake, Schist Lake and Lake Athapapuskow. At Schist (or Amisk) Lake, 3 mi. south of Flin Flon, the Tonopah Mining Co. has had one diamond drill operating on a copper deposit higher in grade than the Clark-Stone operation, but containing less gold. The ridge along which these deposits are situated extends for about 125 mi. and is from 10 to 20 mi. wide. At the southeastern extremity near Herb Lake, Hon. Hugh Armstrong, of Portage la Prairie, formerly provincial treasurer of Manitoba, and associates have been developing gold claims.

In the Gold Lake Section of the Rice Lake district, renewed activity is promised by the incorporation of the Manigotagan Mining and Development Co. to operate the Moose and nine other 50-acre blocks. This company has offices in Winnipeg and at 35 Wall St., New York, Frederick G. Corning, J. S. Bache and other New Yorkers having joined the directorate. The Moose shaft is down 100 ft., where about 200 ft. of drifting has been done under the direction of John Reddington, formerly of Cobalt. Henry Cecil, of Haileybury, Ont., and 25 Broad St., New York, who promoted the Manigotagan, is also planning a new organization, the Gold Pan Mines, Ltd., to operate the Gold Pan, Gold Pan Fraction, Gold Seal and Sunlight claims. On the Gold Pan claim, "jewelry ore" has been found more or less all the way down the shaft but especially from 108 ft. to the bottom, 125 ft., where a 15-ft. drift is still reported in the ore; the other shaft on this group is on the Gold Seal claim, 55 ft. deep with a drift 45 ft. on a 5-ft. vein. No work is being done on this group and shafts are battened down but it is expected that New York men may take an interest in the exploitation of this group. Boulder Gold Mines, Ltd., has acquired the Lucky Strike claim and Gold Seal Mines, Ltd., has been organized to develop ground southwest of the Gold Seal claim. The Gold Lake district is about 120 mi. northeast of Winnipeg and about 30 mi. from the Ontario boundary. It is reached by boat from Selkirk to the mouth of the Manigotagan River thence by canoe practically to Gold Lake, however, from Manigotagan to Clear Water Lake, about 48 mi., numerous portages must be made.

The Mining News

ALASKA

FIRST COAL TRAIN from the Matanuska field over the Government's railroad was taken from Goose Creek, Aug. 16, to the harbor at Anchorage.

ARIZONA

Cochise County

CALUMET & ARIZONA (Bisbee)—Reported will sink another working shaft, 1,800 ft. deep, with five compartments, in the flat between Bakersville and Cochise siding; new shaft will facilitate development, ventilation, pumping and perhaps the larger part of the ores from the Briggs and Junction country will be hoisted through it; will be concreted from top to bottom.

Gila County

ARIZONA COMMERCIAL (Globe)—Good ore being developed in 14th level, the deepest in mine. Copper output for first half of 1916 was about 2,250,000 lb. Robert R. Boyd, superintendent.

INSPIRATION-NEEDLES (Miami) — Acquiring 11 more claims, making total acreage 720. Two churn drills now down about 400 ft. Two more drills expected last week in August. Ultimately seven drills will be employed.

Mohave County

HIDDEN TREASURE (Chloride)—Crosscut adit being driven. Grading for new compressor.

SCHUYLKILL (Chloride)—Unwatering resumed after delay due to boiler repairs.

MURDOCK (Oatman)—Reported work stopped on account of water. No. 9 Cameron pump to be installed.

BOUNDARY CONE (Oatman)—Vein cut on 750-ft. level. Assumed to be same vein as opened on the 550. F. W. Dryden, manager.

TOM REED (Oatman)—Still running 20 stamps on low-grade ore. Extensive development being carried on. Five shafts being sunk on east end of property.

WRIGLEY EXPLORATION (Oatman)—Contract to be let for driving 600 ft. of tunnel. A 75-hp. Fairbanks-Morse semi-Diesel engine and 12x14-in. Ingersoll-Rand compressor being installed.

UNITED EASTERN (Oatman)—Excavation for mill nearly completed. Change house, storehouse and machine shop recently completed. Shaft connections of main shaft completed to 650-ft. level.

OATMAN COMBINATION (Oatman)—Crosscutting on 500-ft. level. Some interesting developments expected as geological features are out of the ordinary for this district. Rhyolite dike, intruded through the andesite, encountered at bottom of shaft. Dike carries some gold, averaging about $2 and running as high as $3.50 per ton. Conditions at foot-wall contact expected to be interesting. Main vein lies in other direction near andesite-latite contact through which shaft passed at about 100-ft. level.

Yavapai County

LUCKY 5 MINING (Copper Basin)—Operations resumed under direction of A. M. Horton, president.

OCTAVE MINES CO. (Octave)—Development at eighth level disclosed oreshoot, 48 in. wide; last assay $12.13. H. E. Gibbs, president, 882 Drexel Bldg., Philadelphia, Penn.

LAST CHANCE (Walker)—Active operations at this gold property will begin by Sept. 1; new hoisting machinery, compressor and air drills being installed; plans to sink 250-ft. shaft at once; Benjamin Hayes, manager.

MILDRED GOLD MINING (Stanton)—Test shipment stoped from 85-ft. level and shipped to El Paso smelter netted $39.33 a ton, principally gold; good milling-grade and some shipping ore developed on 330-ft. level and upward; drainage and haulage tunnel being driven to tap incline shaft at vertical depth of 520 ft.; has 10-stamp mill with concentrating and amalgamation equipment.

CALIFORNIA

Amador County

CENTRAL EUREKA (Sutter Creek)—Stoping on four levels from 2,700 to 3,100, most of the ore coming from 2,800; repairing shaft; sinking will soon begin. In mill 20 stamps dropping; 70 men employed.

PLYMOUTH CONSOLIDATED (Plymouth)—Installing new electric hoist in preparation for deeper development. Herringbone type of gear will be used. In July treated 10,900 tons yielding $57,300; working expense, $26,217; development, $7,214; surplus, $23,869. Other capital expended, $5,256.

Butte County

SOUTHERN CROSS (Enterprise)—Being developed by I. L. Rosenthal, of San Francisco. Flotation installation contemplated. Tube mill and other machinery will be driven by 40-hp. gasoline engine. Will install compressor and sink to 300 ft. A. E. Eagle, superintendent.

MOORETOWN AND LUMPKIN districts are active. Frank Borroughs is operating the Exposition mine, equipped with water power and 2-stamp prospecting mill; vein 18 in. wide, opened for 150 ft. Elisha Brooks installing wing dam and pump to operate new placer ground.

Eldorado County

BADGER HILL (Placerville)—Property optioned to Charles F. Bryant, John L. Woods and Otto J. Koch.

PYRAMID (Placerville)—Bonded to Oakland men who wi deepen 500-ft. shaft to 1,300 ft.; new stations are being cut.

Inyo County

ESTELLE MINING CO. (Keeler)—Permitted to issue 9,7 shares at $10 per share.

DARWIN DEVELOPMENT (Darwin)—Flotation mill ju installed will have try-out in August.

CUSTER (Darwin)—Two orebodies, recently opened, shov ing best ore ever produced by this mine.

CHRISTMAS GIFT (Darwin)—Skinner Bros. extracti good ore from this and from Lucky Jim mine.

CERRO GORDO (Keeler)—Shipments of zinc, silver a lead ores about 700 tons per month; 1,500 tons of slag p month from the old smeltery also being shipped.

BLUE MONSTER MINES CO. (Big Pine)—Lead-silver pro erty, 43 mi. southeast of Big Pine, being developed und direction of Frederick Grundy. Has tunnel 104 ft. lon Recently shipped 500 tons.

OWEN'S VALLEY SALT CO. (Los Angeles)—Leasing co poration organized to operate the Saline Valley salt industr which has a bucket tramway from the salt beds, in the valle over the Inyo Range, to a point north of Keeler.

MINARET (Bishop) — John Beck, heading prospecti party for this company, sent to Bishop on pack trains 2 to of ore said to run 176 oz. silver and 76% lead. Food supp for miners was hauled in by Alaskan dog teams. Compa also has tungsten claims. L. V. Stevens, of San Francis has found tungsten about 4 mi. from Beck's camp.

TUNGSTEN MINES (Bishop)—New 300-ton mill expect to be ready by Aug. 10. Tramway surface track complet and several cars of ore hauled to the mill bin by mule. Gas line motor will be ready for hauling ore by the time the mi is in operation. Connection between the lower tunnel a shaft of the Little Sister mine will soon be completed. Chr Lollischil injured, probably fatally, by fall of rock in Litt Sister mine.

Kern County

WERINGER MINES CO. (Woody)—Col. A. P. Peake repor from Minneapolis sale of a large block of stock and expect tion of resuming operation.

Nevada County

MANGANESE SHIPMENTS of 50 tons from deposit on Be River will be hauled by teams to the narrow-gage railroad Grass Valley. A. S. Henley, owner.

BRUNSWICK CONSOLIDATED (Grass Valley)—Below 1 200 level much new ore has recently been opened; 40 stam dropping on good-grade ore.

TEXAS (Nevada City)—Recent satisfactory mill clean induced leasers to continue operation. Manager W. H. Tutt secured control of several adjoining claims, which will worked through the Texas shaft.

DELHI (Nevada City)—Bonded to Nevada City and Gra Valley men. Unwatering lower levels begun. Proper equipped with complete plant including 20-stamp mill. Roy Tremoureux, assistant superintendent of the Champion mine will be in charge.

Plumas County

ON SQUIRREL CREEK the "shooter system" of placer mi ing has been adopted by J. P. Dutre and Mason Maynard. T shooter system of intermittent hydraulicking was introduc in the region about Quincy several years ago and there a now six or seven hydraulic mines thus operated.

GRANITE BASIN (Quincy)—Double compartment shaft h reached 100-ft. point; disclosed vein 2 to 5 ft. wide, carryi good ore. Employ 20 men. Mill may be installed.

NEW YORK (Greenville)—This manganese property North Cañon and others in Indian Valley are expecting make shipments over the Indian Valley R.R. which is to completed before heavy snows.

WALKER (Portola)—Reported shaft is 75 ft. in high-gra copper ore; face in new tunnel shows similar ore. Tran way from mine to flotation mill nearly completed. Contr option reported taken by International Smelting Co. for $63 000. Smelting company is to do 500 ft. of drifting and si shaft 200 ft. Orebody drilled to 356 ft. One crosscut in mi shows high-grade ore for 25 ft. and milling ore for 58 ft.

Shasta County

SHASTA NATIONAL COPPER CO. (Redding)—Authoriz by corporation commission to sell 2,000,000 shares at par $ Property adjoins Mammoth mine. Also permitted to iss 700,000 shares in payment for an option to purchase; this iss goes to William McEwen, M. P. Fries, C. F. Broullard, R. Shields and S. S. Norton.

Sierra County

SIERRA BUTTES (Sierra City)—Work resumed at th old producer. J. E. Westall, superintendent.

COLOMBO (Sierra City)—Crosscut in lower tunnel bei run to intersect rich shoot found in upper workings. Em Loeffler and associates, owners.

FROST (Downieville)—Being prospected by N. K. Coop of San Francisco, with view to installing machinery bef winter.

COLORADO

Boulder County

COLD SPRING (Nederland)—Steady production of good-rade ore being made.

LITTLE TED (Eagle Rock)—Rich 6-in. vein of gold ore pened in west drift on 50-ft. level.

LINCOLN (Denver)—In sinking main shaft, 12-in. shoot tungsten ore, assaying 10 to 15%, was opened at depth of ft.; 2 ft. of low-grade ore also opened. Mine now belongs recently organized Tungsten Chief Mining and Milling Co., Denver.

Clear Creek County

ECLIPSE (Idaho Springs)—Mine in Maximilian Gulch will reopened.

DIVES-PELICAN AND SEVEN THIRTY (Georgetown)—ich silver oreshoot opened for over 50 ft. on Zero level.

Gunnison County

NEW TUNGSTEN DISCOVERIES made between Blistered orn tunnel and head of Gold Creek, above Ohio City.

STAR (Gunnison)—Work resumed. Star and adjoining ull Domingo in the Italian Mountain district were old lead oducers.

Hinsdale County

CHAMPION (Lake City)—Shaft being unwatered for amination.

HOOSIER BOY (Capitol City)—New shafthouse and equip-ent completed. Shaft down 150 ft. where drifting is under ay. Lead ore being sacked.

ALPS (Lake City)—This property on Alpine mountains re-ened recently. Repairing tunnel and buildings preparatory more extensive development.

COPPER BOY (Lake City)—This company recently organ-ed by Denver men to operate group of over 30 claims in urrows Park district. Old Tobasco mill and power plant rchased. Mill will be dismantled and moved.

Lake County

GEOLOGICAL SURVEY OF LACAWANA DISTRICT be-g made by Colorado State Geological Survey under direction Prof. R. D. George, state geologist. This district, espec-lly in Mt. Champion section, has a number of promising ld prospects.

PRINCE OF WALES LEASING CO. (Leadville)—Operations Bartlett mine on Sugar Loaf resumed after completion of wer line. Electric pump installed; winze will be sunk.

Ouray County

ATLAS (Sneffles)—Mine and mill being operated steadily.

BARSTOW (Red Mountain)—Mine and mill operated by ssees.

REVENUE (Sneffles)—Mine being reopened. Small force w at work.

Pitkin County

MIDNIGHT (Aspen)—Tunnel being driven to cut vein 1,300 below present workings; tunnel now in 1,400 ft.

San Juan County

CONGRESS (Silverton)—Being developed by Pearson and sociates under lease.

BONNER (Silverton)—This mine on middle fork of Mineral eek under lease to Cunningham and Maxwell.

LEE MINING CO. (Eureka)—This company developing re-ntly purchased Klondike under direction of R. L. E. Town-nd.

NIAGARA (Silverton)—This property in Cunningham Gulch being developed by the owner, T. A. Mix. A 4-ft. copper-d vein opened on the Diamond.

STERLING (Silverton)—This property on Cement Creek ently purchased by Colorado Metals Co.; Louis Schafer, nager. Pocket of 40% tungsten ore opened on Sterling vein.

DORA (Silverton)—Three shifts sinking shaft on Dora vein 100 ft. Levels No. 2 and No. 3 cleaned out; mill being re-ired and remodeled. Tungsten ore opened in Level No. 2. R. Case, superintendent of mine; John Hughes in charge of ll.

Summit County

GOVERNOR (Breckenridge)—This old silver producer ing reopened.

PENROSE (Breckenridge)—This placer property on upper ue River being worked by lessees.

WELLINGTON MINES (Breckenridge)—Shipments of zinc ncentrates resumed after curtailment due to strike in zinc-elting plants.

Teller County

MARY McKINNEY (Cripple Creek)—Recent work on ttom level has opened good oreshoot in main vein.

GRANITE (Victor)—Crosscutting on 1,600-ft. level to open shoot found on the 1,400 level. Winze sunk 50 ft. below 00-ft. level produced some high-grade ore.

LITTLE MAY (Cripple Creek)—Gold ore assaying 0.5 oz. on has been opened by surface trenching on this property Newton Hill—a part of a 25-acre tract owned by Cripple eek General Mining and Extension Co. Company contem-tes sinking a three-compartment shaft. Frank Vetter, nager.

C. O. D. (Cripple Creek)—Station cut on 800-ft. level pre-ratory to resumption of sinking operations. Will sink shaft additional 500 ft. Machine-drilling equipment is to be talled. On 700-ft. level development is being done by Sun ngsten Co., of Denver, under lease. E J. Williams, erintendent.

JERRY JOHNSON (Cripple Creek)—Payable ore opened at breccia-schist contact, east of the shaft on the 750 ft. level of the main shaft on Ironclad Hill. Good ore also opened on 850-ft. level. The Cripple Creek Deep Leasing Co. plans to sink winze on vein and to crosscut from 950-ft. level over to the contact on which the ore has been found.

YELLOW BIRD GOLD MINING CO. (Cripple Creek)—Recent development on 200-ft. level of Red Bird shaft opened rich ore. Same shoot now being opened on the 400-ft. level, west heading. Crosscut east from shaft has cu. a gold-bearing phonolite dyke which will be thoroughly prospected. Shaft, now 440 ft. deep, will be sunk to 700 ft.; three shifts will be employed sinking and work is to be completed in about 40 days. J. J. Yeckel, president and general manager.

IDAHO

Idaho County

BLACK PINE MINING AND MILLING CO. (Elk City)—Lower tunnel at 1,000 ft. encountered high-grade gold-silver ore.

BLACK DIAMOND (Dixie)—This company has a double-compartment shaft under way and has made arrangements for a 50-ton mill and other necessary buildings.

Shoshone County

HIGHLAND-SURPRISE (Beeler)—New mill now operating regularly, producing about 25 tons concentrates daily. Motor trucks used for 9-mi. haul to railroad.

BLACK HAWK (Kellogg)—William A. Beaudry, manager of Stewart Mining Co., is operating this property personally under three-year lease. Has completed 3,000-ft. tram to facilitate transport of 75 tons ore daily to Ontario mill.

STEWART MINING (Kellogg)—This company has acquired the entire $1 000,000 capital of Lone Mountain Silver-Lead Co. for an equal amount of its own stock at par. Recently increased its capital for purpose of buying other properties.

MICHIGAN

Iron

HOLMES (Ishpeming)—Shaft making good progress; will soon be bottomed. Headframe will be highest in district. Permanent buildings being erected and production should be started this winter.

YALE (Bessemer)—New shaft is to be sunk on Jackpot property, which adjoins. Ore will come from the Yale lands, under lease to Charcoal Iron Co. of America. Company has also lease on the Jackpot from the Jones & Laughlin Ore Co. Some equipment already ordered.

AURORA (Ironwood)—New shaft now well under way. It is inclined at 68° and is 11 ft. 4 in. by 20 ft. 8 in. in size. Will have steel sets, with concrete slabs in back; slabs are 6 and 8 in. in width by 3 in. thick. Plan to sink 100 ft. a month.

MISSOURI

Joplin District

MIHOMI (Cardin, Okla.)—Building mill on Cardin lease, south of Picher.

ROSE (Lincolnville, Kan.)—Reopened old Squaw mine. Sheet ground at 100 ft.

P. & J. (Joplin)—Kansas City men have leased silicate land at Saginaw, south of German-American.

NETTA (Picher, Okla.)—This big "ton-a-minute" mill, fourth Picher Lead Co. plant, has been started.

AMIA KENNETH (Baxter Springs, Kan.)—Starting shaft; drilling showed ore at two levels, 105 to 160 ft. and 198 to 214 ft.

THEURER & DIXON (Joplin)—Started 800-ton mill on old Bullfrog at Smelter Hill. Running on tailings now but are dewatering mine.

GIBSON (Joplin)—Handling 1,200 to 1,300 tubs of 1,200 lb. each per day at West Joplin. Enough ore raised in single shift to keep mill busy 24 hr.

SYMMES (Prosperity)—Excellent drill strike on eastern part of Dixie lease. Will start new shaft immediately and connect with mill by tram.

RED WASP (Aurora)—After trying six places, finally succeeded in getting water for milling from North Pole mine, one-half mile to the southwest.

CIRCLE (Oronogo)—Aërial tramway about completed from cave south of No. 9 shaft to Bunker Hill shaft. From the Bunker Hill, ore will be carried by surface railway to mill, about ¼ mi. Circle now getting ore from seven shafts.

MONTANA

Powell County

NATIONAL TUNGSTEN AND SILVER MINING CO. (Race Track)—New Boston company, headed by W. R. Brown, president, will develop group of tungsten properties. Must build 4-mi. wagon road, costing $4,000, before production can begin.

Silver Bow County

TUOLUMNE (Butte)—Raise from 2,600 to 2,400 level completed and winze being sunk on the vein from 2,600-ft. level. About 75 tons are mined daily, a good portion of this increase coming from the newly opened 2,600 level. At the east-side properties, retimbering of Sinbad shaft is completed to the 500-ft. level where mining will soon begin; some timbering yet to be done between 600 and 700 levels. Colusa-Leonard unwatered to 600 ft.; new headframe and hoist expected to be installed in 30 days.

NEVADA

Churchill County

NEVADA HILLS (Fairview)—June profit amounted to $8,738. In recent statement quick assets were given as $302,000 on July 1, of which $64,500 was cash. Because of drop in price of tungsten, company relinquished bond on property in Arizona.

Esmeralda County

REORGANIZED KEWANAS (Goldfield)—North drift from winze on 840-ft. level now out about 700 ft. on vein. Occasional streaks of good ore encountered.

GOLDFIELD CONSOLIDATED (Goldfield)—Second 500-ton unit of flotation completed and will be in operation Aug. 20. Regular operations suspended few days to facilitate change to new treatment.

JUMBO EXTENSION (Goldfield)—July profit was $28,400, of which $800 was from sale of dump ore. Mined 1,976 dry tons, gross value $72,500. Sampling, freight and treatment charges were $23,500. Smelting loss, $5,900. Operating expenses, $15,500.

Humboldt County

SEVEN TROUGHS MINING (Seven Troughs)—Retimbering 700-ft. incline shaft completed; drifting resumed; about 12 men employed.

SEVEN TROUGHS COALITION (Seven Troughs)—On July 31 in Bird winze at depth of 1,760 ft., water encountered flooding mine to 1,500-ft. level in three days. Pumps ordered, express shipment and Pres. L. A. Freidman states mine will be unwatered in 30 days.

RAGGED TOP (Lovelock)—Wells bored at Toulon, on Southern Pacific R.R. about 10 mi. from mine, encountered water at 40 ft. Contract for 75-ton tungsten mill let to Stearns-Roger Manufacturing Co., of Denver. Shipments now hauled by caterpillar tractors 22 mi. to Miriam.

Nye County

TONOPAH ORE PRODUCTION for week ended Aug. 12 was 8,960 tons valued at $187,360, compared with 9,662 tons for week previous. Producers were: Tonopah Belmont, 2,800 tons; Tonopah Extension, 2,200; Tonopah Mining, 1,600; Jim Butler, 1,050; West End, 798; Rescue-Eula, 202; Halifax, 166; miscellaneous leases, 144 tons.

RESCUE-EULA (Tonopah)—No. 1 raise on vein from 950-ft. level up 170 ft. Winze from 950-ft. level sunk 100 ft.; crosscutting for vein.

GREAT WESTERN CONSOLIDATED (Tonopah)—Shaft repaired; additional pumps give total capacity 450 gal. per min. Water being rapidly lowered; will resume development about Sept. 1.

TONOPAH BELMONT (Tonopah)—Development at Desert Queen shaft resumed on 600-ft. level where east drift is being run to encounter 4-ft. vein of milling ore recently discovered near Jim Butler end line.

Storey County

ANDES (Virginia)—Saved 29 cars of ore on 350 level.

CONFIDENCE (Virginia)—Saved 45 cars low-grade ore on 200 level of Imperial shaft.

UNION CON. (Virginia)—Extracted 343 tons of ore: 164 tons averaging $23.74 and 132 tons $27.90 from 2,400 level; 47 tons averaging $12.41 from 2,500 level.

JACKET-CROWN POINT-BELCHER (Gold Hill)—Overhauling of electric machinery continued. No work in Crown Point or Jacket account gas. Jacket mill received 840 tons dump rock and shipped bar bullion.

MEXICAN (Virginia)—South drift on 2,500 level shows porphyry and quartz at 94-ft. point; west crosscut advanced to 368-ft. point, face in porphyry and quartz. Mexican mill received 343 tons custom ore averaging $25.57 and 112 tons from dump averaging $9.99.

NEW MEXICO

Grant County

MERGING OF PINOS ALTOS MINES on the Pinos Altos side of the mountains is being discussed; would include Savannah Copper, now under lease to Wright & Stauber, the C. & O. Mining and Milling and the Silver Hill properties.

DAVIDSON COPPER (Fierro)—Leasers shipping 7% ore; mine nets owner $2,000 per month; 15 men employed.

OZARK SMELTING AND MINING (Magdalena)—Mill destroyed by fire Aug. 10. Several hundred men thrown out of work. Custom ore was treated as well as ore from company mines.

85 MINING CO. (Lordsburg)—Diesel engine repaired and running 24 days from date of explosion. Will ship about 12,000 tons in August. New 500-hp. Lyons-Atlas engine en route. A third Diesel may be installed as spare, or a 750-kv.-a. steam-turbine unit. A. J. Inderrieden, general manager.

TEXAS

SULPHUR EXPLORATIONS continue in the Pecos region, especially in Culberson and Reeves Counties, despite relinquishing of options by well-known mining interests. West Texas Sulphur Co. composed of New Orleans men, is preparing to exploit 600 acres in the Toyah district and the Michigan Sulphur and Oil Co. has installed near Orla a 6x30-ft. cylinder for extraction of the sulphur by steam; two additional retorts en route expected to give capacity of 20 to 30 tons daily. Grinding plant to be installed. Some local consumption, but these deposits are long distance from principal markets and at disadvantage regarding freight rates as compared with Gulf Coast producers.

UTAH

Beaver County

BEAVER COPPER (Milford)—Two-foot oreshoot opened at 73 ft. from shaft on 100-ft. level.

MAJESTIC (Milford)—This group shipped 18 cars in July. Old Hickory supplied 14 cars of low-grade copper ore and O.K. three cars of higher grade; Hoosier Boy shipped one car silver-lead ore.

Carbon County

KETCHUM COAL CO. property at Castle Gate is to be opened by Eccles estate of Ogden. Plan to build new haulage way and power plant, operating with electric power. New houses for employees, and a store will be built. The co will probably be marketed in Ogden.

Iron County

NEW COAL DISCOVERY reported in Iron Springs Rang 22 mi. east of Lund and 15 mi. west of Parowan. Thr seams of good quality traced for 4,000 ft. Adit gives 400 of backs.

WASATCH OZOKERITE CO. (Soldiers Summit)—New m now operating, producing 400 to 500 lb. per day of refined wa

Juab County

TINTIC SHIPMENTS for week ended Aug. 11 amounted 173 cars.

TINTIC STANDARD (Eureka)—New equipment to installed and electric power used. Shipments being made.

IRON BLOSSOM (Silver City)—Winze in north end h reached 1,200-ft. level; drifting in search of copper ore, open on levels above.

YANKEE (Eureka)—Lessees shipping lead and zinc o from old workings. Company has three faces of ore expos in the Humbug workings. Prospecting near Beck Tunnel f continuation of Beck Tunnel ore channel.

CHIEF CONSOLIDATED (Eureka)—Recently acquir ground at Homansville being opened. Shaft sinking bei done under contract by Walter Fitch, Jr.; sank 256.3 ft. in days; in porphyry for 150 ft., remainder limestone.

Salt Lake County

UTAH-APEX (Bingham)—Net earnings, quarter ended M 31, were $417,948 as compared to $202,719 in previous quart Cave-in occurring on 1,300 level, June 16, caused reduction over 200 tons daily in shipments. New hoist to be installed surface, and shaft raised to surface opening 650 ft. of u prospected ground. Ore will be hoisted, and then lowered the Parvenu tunnel level (1,000-ft. level), and waste n carried off by railroad raised to surface. There is adequa dumping ground here, and a large saving will be effected. E periments for recovery of zinc are soon expected to bring r sults.

WISCONSIN

Zinc-Lead District

WICKS (Linden)—The 50-ton Liverpool mill moved and r built at Linden.

LAMPE (Highland)—Saxe Brothers and Lampe complet 100-ton mill on Lampe property.

VINEGAR HILL (Platteville)—New 150-ton mill started Meloy lease north of Sally Waters mine, at New Diggings.

MINERAL POINT ZINC (Mineral Point)—New 200-ton m completed on Kennedy tract at Highland. Has acquired R Jacket mine and equipment at Centerville.

CANADA

Ontario

SYLVANITE (Kirkland Lake)—Will shortly resume.

HUDSON BAY (Cobalt)—A 2-in. vein carrying native silv found at surface.

SCHUMACHER—A 2-ft. vein showing free gold encou tered in crosscut on 100-ft. level.

BEAVER (Cobalt)—Crosscutting in three directions lower contact, so far without results.

DAVIDSON (Porcupine)—An 8-ft. vein, showing free go has been found southeast of the main workings.

DOMINION RAND (Temiskaming)—Shipments of cop ore being regularly made. Over 250,000 lb. shipped in f days.

THREE NATIONS (Porcupine)—Will be sold at pub auction in South Porcupine in September to satisfy claim $19,400.

EXCELSIOR (Porcupine)—Has defaulted in payments Tommy Burns claims, which revert to Tommy Burns G Mines, Ltd.

LORRAIN CONSOLIDATED (South Lorrain)—Shaft n down 110-ft. is being sunk 200 ft. Drifting on 8-in. vein 100-ft. level.

LA ROSE (Cobalt)—Work discontinued in tunnel un bluff on La Rose Extension property, as results were encouraging.

LAKE SHORE (Kirkland Lake)—Installing new pla Underground work will not be resumed until electric pow from Cobalt reaches camp.

DOME (Porcupine)—July report shows production of $18 000, from the treatment of 38,150 tons, or $4.74 per ton; wor ing cost, $2.61 per ton.

LITTLE NIPISSING (Cobalt)—Leased by Toronto and I troit men from Peterson Lake company. Shaft will be watered. John W. Wilson in charge.

ADANAC (Cobalt)—Crosscut on 330-ft. level encounte high-grade ore previously developed on the 280. It is 3 wide. Sufficient high-grade ore has been blocked out to sure shipment at an early date.

TOUGH OAKES (Kirkland Lake)—During July appro mately 3,700 tons of ore were treated; gross value $88,000, $23.80 per ton. Oreshoot, 120 ft. long and of good gra opened on 200-ft. level.

HOLLINGER CONSOLIDATED (Timmins)—Additional mill in operation, bringing capacity of mill up to 1,900 t per day. Two 2,000-hp. transformers installed. Rich v rather narrow, found on the Millerton.

PERU

EXPORT OIL TAXES of 10% on crude petroleum 20% on distillates are provided in a bill submitted to Cong by the Peruvian government. Tax is to be progressive, ba on $8.40 per bbl. for Pennsylvania crude.

The Market Report

Metal Markets

NEW YORK—Aug. 23

All of the principal metals were strong and active during the last week, copper being especially a feature of strength. Lead and spelter both experienced smart advances, but toward the close lead was softer while spelter was distinctly reactionary.

Copper, Tin, Lead 'and Zinc

Copper—A very good business was done from day to day, largely in lots of quarter-million and half-million pounds, but there was a considerable sprinkling of big lots. The buying was chiefly by domestic manufacturers. It was significant that whereas for several weeks previously the buying had been by domestic manufacturers making munitions, last week it was to a very large extent by wire drawers. There were no sales reported as being specifically for export, but several purchases were believed to be destined to go abroad. The buying of last week was chiefly for November-December delivery. October copper is now very scarce and November copper is becoming so. There were some sales for October-December delivery, where the sellers threw in a little October copper. As in previous weeks it was distinctly a sellers' market. Buyers are turned away from one office and are directed to others to hunt for the best deliveries they can get. Prices vary according to time and competition is more a matter of time than it is of price. There was a little business done for delivery in 1917, but it did not amount to much. The total volume of transactions was probably a little less than in the previous week and was considerably exaggerated in reports in the daily papers. No further progress has yet been made in the negotiation of some large transactions that have been talked about.

The tightness in the copper market is primarily due to the deficiency of refining capacity, which the refiners do not appear to be able to increase. An interesting feature is the inability of copper manufacturers to get their scrap remelted, the furnaces of the refiners being taxed to the utmost in producing their own new copper.

Copper Sheets are 36½c. per lb., base price, tor hot rolled, and 37½c. for cold rolled. Copper wire is 31@32c. per lb. at mill for large lots.

Copper Exports from Baltimore for the week included 2,237,870 lb. bars and plates to Archangel, Russia; 3,233,476 lb. bars and ingots and 190,376 lb. brass blanks to France; 448,975 lb. ingots to Denmark; 784,092 lb. bars to Liverpool.

Visible Supply of Copper in Europe on Aug. 15 was as follows: Great Britain, 3,179; France, 2,643; afloat from Chile, 1,450; afloat from Australia, 3,750; total, 11,022 long tons, or 24,689,280 lb. This is a decrease of 618 tons from the Aug. 1 report.

Tin—This market was featureless. Fluctuations in price during the week were practically nil.

Lead—The advance by the A. S. & R. Co. that was foreshadowed by the behavior of the market at the close of last week materialized on Aug. 17, when the price was raised to 6.25c. Independent producers immediately went higher and realized what they asked. On Aug. 18, the A. S. & R. Co. advanced its price to 6.50c., independent producers promptly going to 6¾c. and getting it. Prices varied according to delivery, the supply of early lead being very short. Some producers asked 6¾c. for August-September, but would sell October at 6½c. The A. S. & R. Co. adhered to its policy of selling only for shipment within 30 days, and its own supplies being short refused business from others than its regular customers. A fair volume of business was done by most of the producers during the early part of the week, but in the latter part the demand slackened and it seemed to be the tendency of the market to settle on the basis of 6.50c., New York.

Spelter—In the early part of the week some very large business for export was done in high-grade and high-grade intermediate spelter, about all of the producers of those kinds participating in this business, much of which was done with the British Government. The business of the week in Prime Western spelter, so far as reported, was only moderate, but this market appears to have been stirred up by some transactions associated with those for high-grade metal and the smart advance that was begun in the previous week was carried further. On Aug. 18 and 19, several hundred tons of Prime Western spelter, prompt delivery, were sold for export at 10@10¼c., New York basis, equivalent to about 9¾@10c., St. Louis. However, the bulk of the business on those days was for August-September delivery and was done at about 9@9¼c. At the close of the week the excitement had completely vanished and the market had become distinctly reactionary.

Zinc Sheets are in steady demand but with no change in quotations. The base price is $15 per 100 lb., f.o.b. Peru, Ill., less 8% discount.

DAILY PRICES OF METALS IN NEW YORK

			Copper	Tin	Lead		Zinc
Aug.	Sterling Exchange	Silver, Cts. per Oz	Electrolytic, Cts. per Lb.	Spot, Cts. per Lb.	New York, Cts. per Lb.	St. Louis, Cts. per Lb.	St. Louis, Cts. per Lb.
17	4.7575	66¼	25¾ @26¼	38¾	6.25 @6.35	6.10 @6.20	8.87½ @9.12½
18	4.7575	65¾	25⅞ @26⅜	38½	6.50 @6.75	6.20 @6.40	9.00 @9.75
19	4.7575	65¾	26 @26½	38½	6.50 @6.75	6.30 @6.50	9.00 @10.00
21	4.7575	66	26¼ @26¾	38½	6.50 @6.75	6.40 @6.50	9.00 @9.50
22	4.7575	66¼	26¼ @26¾	38½	6.50 @6.70	6.40 @6.55	9.00 @9.50
23	4.7575	66⅜	26½ @27	38½	6.50 @6.65	6.40 @6.50	8.75 @9.25

The quotations herein are our appraisal of the average markets for copper, lead, spelter and tin based on wholesale contracts for the ordinary deliveries of the trade as made by producers and agencies; and represent, to the best of our judgment, the prevailing values of the metals, reduced to basis of New York, cash, except where St. Louis is given as the basing point. St. Louis and New York are normally quoted 0.17c. apart.

The quotations for electrolytic copper are for cakes, ingots and wirebars Electrolytic copper is commonly sold at prices including delivery to the consumers and is subject to discounts, etc. The price quoted for copper on "regular terms" (r.t.) is the gross price including freight to the buyer's works and is subject to a discount for cash. The difference between the price delivered and the New York cash equivalent is at present about 0.25c. on domestic business. The price of electrolytic cathodes is 0.05 to 0.10c. below that of electrolytic. Quotations for lead represent wholesale transactions in the open market for good ordinary brands. Quotations for spelter are for ordinary Prime Western brands. Only the St. Louis price is herein quoted, St. Louis being the basing market. We quote the New York price at 17c. per 100 lb. above the St. Louis price.

Silver quotations are as reported by Handy & Harman and are in cents per troy ounce of silver bars 999 fine.

Some current freight rates on metals per 100 lb. are: St. Louis-New York 17c.; St. Louis-Chicago, 6.3c ; St. Louis-Pittsburgh, 13.1c.

LONDON

		Copper				Tin		Lead		Zinc	
		Standard		Electrolytic							
Aug.	Silver	Spot	3 Mos.	£ per Ton	Cts. per Lb.	Spot	3 Mos.	£ per Ton	Cts. per Lb.	£ per Ton	Cts. per Lb.
17	31 9/16	114	111	126	26.77	171½	172¼	29¾	6.32	53	11.26
18	31 5/16	113	110	126	26.77	169¼	170¼	30	6.38	54	11.48
19	31 5/16	...	...	...	...	...	...	...	...	...	...
21	31 7/16	111	108½	127	26.99	169¼	170¼	30	6.38	55	11.69
22	31 9/16	110½	108	127	26.99	169	170	30	6.38	55	11.69
23	31⅝	110	107½	127	26.99	169¼	170¾	30	6.38	55	11.69

The above table gives the closing quotations on London Metal Exchange All prices are in pounds sterling per ton of 2,240 lb., except silver which is in pence per troy ounce of sterling silver, 0.925 fine. Copper quotations are for standard copper, spot and three months, and for electrolytic, price for the latter being subject to 3 per cent. discount For convenience in comparison of London prices, in pounds sterling per 2,240 lb., with American prices in cents per pound the following approximate ratios are given, reckoning exchange at 4.80 £15 = 3.21c.; £20 = 4.29c.; £30 = 6.43c.; £40 = 8.57c.; £60 = 12.85c. Variations, £1 = 0.21⅜c.

Other Metals

Antimony—At the close last week this market stood at about 10c. for spot. The low level of prices attracted important buying orders, amounting to several hundred tons. Inquiry for a large additional quantity from ammunition makers caused the market to become greatly excited. Quotations jumped within a day or two to 15@16½c. without, however, business being done either at those or intermediate prices, excepting in small quantities. The excitement quickly disappeared and the price receded to 13½@14c., which we quote at the close. The principal interests refused to quote on futures.

Aluminum—Business has been fair with good demand. Deliveries on contract are easy. Quotations are 58@60c. per lb. for No. 1 ingots, New York.

Nickel—There is no change. The demand is strong and shipments are pressed. Quotations are unchanged at 45@50c. per lb. for ordinary forms, according to size and terms of order. Electrolytic nickel is 5c. per lb. higher.

Quicksilver—Early in the week this market stood at $72. During the week there was a sharp advance to $75, on better demand and good sales. At the close we quote $75, New York. San Francisco reports by telegraph, $74, market unchanged.

Gold, Silver and Platinum

NEW YORK—Aug. 23

Gold—On Aug. 1, in order to avoid disclosing transfers of gold by sea from or to British possessions in time of war, the Bank of England ceased to announce daily receipts and withdrawals. The Bank return now shows daily only the total holdings at the close of the day:

The following Order in Council was promulgated in the "London Gazette" on July 28: "A person shall not melt down, break up, or use otherwise than as currency any current gold coin, and if any person acts in contravention of this regulation he shall be guilty of a summary offence against these regulations."

Silver—Owing to a decline in the demand for English Mint purchases silver price dropped to 31$\frac{5}{16}$d. in London but the general tone of the market was good, and on the appearance of buying orders for India the price stiffened and closes steady at 31⅝d. in London. India has also again been buying silver in China for coinage shipments of some 2,500,000 ounces having been made from Shanghai to Bombay recently. China continues weak.

Owing to an error in types the price of silver in London on Aug. 12 was given last week at 31d. It should have been 31$\frac{11}{16}$d. on that date.

Mexican dollars in New York were quoted Aug. 17 at 51¼@55¼c.; Aug. 18 at 51@55c.; Aug. 19 at 50⅝@54⅝c.; Aug. 21 at 50¾@54¾c.; Aug. 22 at 51@55c.; Aug. 23 at 51⅛@55⅛ cents.

Platinum—There was a much better demand for this metal. The two principal refiners both reported larger sales than for several weeks preceding. Business was done at $62.50@65, on which basis we quote the market at the close.

Zinc and Lead Ore Markets

Joplin, Mo., Aug. 19—Quotations are as follows: Base price for 2,000 lb. blende ore assaying 60% zinc, $70 for premium ore, $65@60 for medium, down to $55 for low grade. High price, $71.80; average for week's sales, $63.40. Calamine base price per 2,000 lb. assaying 40% zinc, $40@30. Average for week's sales, $33.85 per ton.

Lead base price per 2,000 lb. assaying 80% lead, $65@68; high price, $69.10; average realized for week's sales, $64 for all grades.

Shipments for week ended Aug. 19 were 4,457 tons blende, 259 tons calamine; for year to date, 213,845 tons blende, 17,426 tons calamine, 37,521 tons lead ore. Total value, $342,790 for the week; $25,292,280 for the year to date.

The excessive drought, prevailing for seven weeks, has forced several mines to close down, unable to obtain water for wet concentration of the ore. Other mines closed down on account of the stagnant condition of the market. The production, for a month under 5,000 tons is down to 4,500 tons per week. Mines that did not close down the past week reduced the working force to a minimum, further lowering the output. The advance of $5 per ton in the price of ores this week, with a decided enlivening of demand, while not indicated in this week's shipment, should show a substantial gain next week. It is having the effect of gradually lowering the stock in the bins.

Platteville, Wis., Aug. 19—Quotations of the district are according to the following figures: Base price per 2 000-lb. ton for material assaying 60% zinc is $56 por premium ore down to $50 for medium grade. For material assaying 80% lead the base price per 2,000 lb. ton is $60@64. Shipments for the week were: 3,004 tons of zinc ore, 38 tons of lead ore, and 690 tons of sulphur ore. For the year to date, the figures are: 76,727 tons of zinc ore, 2,787 tons of lead ore, and 17,471 tons of sulphur ore. Shipped during the week to separating plants, 4,372 tons of zinc ore.

OTHER ORES

Manganese Ore—The price of Brazilian ore continues about 40c. per unit at Rio de Janeiro. Freight rates are lower and the price at United States port is now 60@65c. per unit. Indian ore is 60c. per unit at tidewater. Some Virginia ore is said to have been sold at a lower price, but this is not confirmed.

Imports of manganese ore in the United States in June were 31,011 tons in 1915, and 58,143 in 1916; increase, 27,132 tons.

Imports at Baltimore for the week included 18,500 tons manganese ore from Brazil.

Antimony Ore—The position remained unchanged.

Tungsten Ore—Charles Hardy makes the following interesting report in his weekly circular: "More business in any time since April and May has been done during the past week. The foreign demand for tungsten ores is pressing and for very large quantities, France buying in the East and Russia in the West, the latter for shipment from San Francisco apparently to Vladivostok. The quantities that changed hands for these two foreign accounts run now close up to 500 tons, and the demand is still continuing. In order to relieve our market of the pressure of the accumulated stocks, some of the bigger holders were ready to shade their prices for round lots of 100 tons at a time, and the stocks in Pittsburgh alone, have been reduced by at least 200 tons. Now the bigger holders have advanced their price again to $20 and though no business has been done at this figure at the moment of writing, buyers have come close up to $20, and the negotiations are proceeding. An additional feature of interest is the fact that some of our home consumers, seeing the low prices and fearing that Europe will get all the benefit of present consumption a hundred tons changed hands. The position for tungsten has improved very considerably and though the stocks are still of fair size, at least 50% of the New York and Pittsburgh stocks ought to be cleared by now."

We quote the marketat $18@20 per unit.

Iron Trade Review

NEW YORK—Aug. 23

No great change is apparent in the general conditions of the market, either in amount of business or in the prices of material.

The American Iron and Steel Association reports the production of pig iron for the half-year ended June 30, 1916, at 19,619,522 gross tons, against 17,682,422 tons in the second half of 1915, and 12,233,791 tons in the first half of 1915. The figures show that the production in the first half of this year was 7,385,731 tons greater than in the corresponding period of last year. Details of the production are given on another page.

The United States Steel Corporation reports the total orders on its books July 31 at 9,593,592 gross tons, which is 46,866 tons less than on June 30, but 1,787.372 tons more than on Dec. 31, 1915. The total on July 31 has been exceeded only in April, May and June of this year.

Exports of Iron and Steel for June and for the fiscal year ended June 30 are reported as follows, the figures giving the gross tons of those articles which are reported by weight, the value of machinery and the total value of all iron and steel exports, including machines:

	June		Year	
	1915	1916	1914-15	1915-16
Gross tonnage...	356,829	527,542	2,003,798	4.862,154
Machinery, value	$10,266,981	$20,541,139	$93,863,694	$182,677,065
Total value.....	31,757,103	76,257,884	225,888,358	621,209.547

The total value of exports for the fiscal year was by far the largest ever reported, being more than double that for 1913, heretofore the record year.

Imports of those articles reported by weight were 31,610 tons in June, 1915, and 26,888 tons in June, 1916. For the fiscal year the tonnage was 251,251 in 1915, and 309,051 in 1916; an increase of 57,800 tons.

PITTSBURGH—Aug. 22

The steel market is slightly more active but is still decidedly quiet as compared with conditions that obtained prior to June. There is nothing that could possibly be called a "buying movement" in steel products. There is a wide divergence of view between seller and buyer. The stel mills are very confident of the future, and fully expect material to be scarce not only through this year but well into next year. Among buyers there are some, such as automobile makers, who are anxious to be covered for the first half of 1917 irrespective of price while there are others who regard present prices as so high that their trade will be seriously curtailed when the lower-priced material is all used up. Among the jobbers the sentiment is, on the whole, decidedly unfavorable. The jobbers are not ready to take hold at present prices except in the most reserved fashion.

The mills point to their well-filled order books as evidence that they need have no concern. They are making no effort to press sales but are booking a fair tonnage, at least for a midsummer month. It is stated that they are accepting much less export business than is offered because they cannot make the deliveries.

The advance in plates and shapes started by the Carnegie Steel Co. is now in full force just as the advance in bars became generally effective a week or two ago. Bars and shapes are now 2.60c and plates 3.00c., and thus specifications should be stimulated against contracts made during the past four months when prices were $2 a ton less.

So far as contract obligations are concerned, the mills are in much better position at this date than was expected, for they have passed through three dull months and still have almost as much business on their books as they had three months ago, enough, if equally distributed, to cover a run of about seven months, but as the contract tonnage is at higher prices it is not so certain that it will be fully specified.

Pig Iron—The market activity has increased further. There is more general buying of foundry and malleable grades, and the steel works are taking hold again. The Republic Iron and Steel Co. has bought 15,000 tons of bessemer and about 10,000 tons of basic for early delivery, while the Carbon Steel Co. has taken 10,000 tons of basic for delivery in the first half of 1917. A southern Ohio steel interest has taken 30,000 tons of basic for extended delivery. The business mentioned has just been closed, and follows the buying of 10,000 tons or more of basic by the American Steel Foundries. For months there have been predictions of a buying movement in pig iron which would result eventually in higher prices, possibly in even a sensational rise. Whether the present activity represents the beginning of an important movement it is too early to determine. Prices have not advanced, but a few furnaces have marked up their asking prices in anticipation. We quote: Bessemer, $21@21.50; basic, $19@18.25; foundry and malleable, $18.25@18.50; forge, $18@18.25, f.o.b. Valley furnaces, 95c. higher delivered Pittsburgh.

Steel—The scarcity of unfinished steel is unabated, but the pressure to buy steel has relaxed, either because buyers could not afford to pay higher prices or because they saw that raising their bids would not bring out steel. There is still some buying of shell steel and if this buying should cease the mills might find that they still have some soft steel to spare. We quote billets and sheet bars nominally at $45@50, with rods at $55@60 per ton.

FERROALLOYS

Ferrosilicon is somewhat firmer, the quotations for high-grade, 50% alloy, being $86@89 per ton at furnace, according to size of order. Bessemer ferrosilicon is from $31 for 10% up to $41 for 16%, per ton at furnace.

Spiegeleisen is firm and $40@45 per ton at purnace is quoted for 20% alloy, for high grade, 25 to 30% alloy, $55@65 per ton at furnace is asked.

Vanadium has caused a sensation this week through the announcement that all the stock of the American Vanadium Co., which practically controls most of the output and has built up a large business in the sale of the ore and metal and in the making of vanadium steel, has been sold to a syndicate of Philadelphia and New York capitalists for $7,000,000, which is $1,000 per share. The price is payable $650 in cash and $350 in notes or stock of the new company which is to be organized. The old company is owned in Philadelphia and Pittsburgh and has $700,000 stock. The new company, which will retain the name of the old, will have a capital of $13.500,000, made up of $5,000,000 of 7% preferred stock, $6,000,000 of common, and $2,500,000 of 6% short-term notes. At the head of the syndicate which takes over the company are J. L. Replogle and Kuhn, Loeb & Co. With them are associated Cassatt & Co., of Philadelphia, Chandler Bros. & Co., Harrison Williams, and half a dozen others. Mr. Replogle, now vice-president and general manager of the company, will be made president after the conclusion of the sale. James J. Flannery, head of the present company, will become chairman of the board.

Ferromanganese—The market is very quiet. Spot is obtainable usually at the contract price of $175. Rumors that the English makers are withdrawing the contract price are not substantiated and both English and domestic is quotable at $175 on contract.

IRON ORE

Shipments of Lake Superior iron ore in July were 9,750,157 gross tons. For the season to Aug. 1 the total shipments were, in gross tons, as reported by the "Iron Trade Review":

Port.	1915	1916	Changes
Escanaba	2,062,700	3,647,192	I. 1,584,492
Marquette	1,114,360	1,834,919	I. 720,559
Ashland	1,870,077	3,506,945	I. 1,636,868
Superior	3,064,002	5,865,546	I 2,801,544
Duluth	6,710,460	9,338,482	I. 2,628,022
Two Harbors	3,903,704	5,172,640	I. 1,268,936
Total	18,725,303	29,365,724	I. 10,640,421

Of the July shipments 7,681,084 tons, or 78.8% of the total, went to Lake Erie ports. At those ports the total ore on dock Aug. 1 was 4,810,671 tons, compared with 6,539,933 tons on Aug. 1, 1915. Shipments from lower lake ports to furnaces during the month amounted to 5,289,590 tons.

Receipts at South Chicago during July were 1,097,484 tons and at Gary, Ind., 312,773 tons.

COKE

Coke production in the Connellsville region for the week is reported by the "Courier" at 403,340 net tons; shipments, 401,577 tons. Shipments of Greensburg and Upper Connellsville districts, 37,666 tons.

Connellsville—Coke is still very scarce and commands $2.75@2.85 for spot furnace, in the limited buying, chiefly by brokers. There is no interest in contract coke. Foundry is $3.25@3.50 for either spot or contract.

Coal and Coke Tonnage of Pennsylvania R.R. lines east of Pittsburgh and Erie, seven months ended July 31, in short tons:

	1915	1916	Changes
Anthracite	6,068,036	6,766,550	I. 698,514
Bituminous	23,855,500	28,283,849	I. 4,428,349
Coke	6,088,195	8,508,352	I 2,420,157
Totals	36,011,731	43,558,751	I. 7,547,020

The total increase this year was 21%; the largest proportional gain being in coke. The total tonnage for the month of July was 6,077,780, an increase of 663,270 tons, or 12.3% over July of last year.

Chemicals

NEW YORK—Aug. 23

The general market shows rather a stronger tone. There is less resale material offering and heavy chemicals are generally firmer. It may be said that trade is unusually good for this season of the year.

Arsenic—Most of the business now forward is on contracts. Deliveries are steady, but stocks are not large. Outside demand is only moderate. Quotations are $6@6.50 per 100 lb. for spot.

Copper Sulphate—Demand is not heavy and sales have been moderate. There has been no material change. Quotations are $8@10 per 100 lb., according to grade, quantity and terms of order.

Nitrate of Soda—Increased production is reported from Chile. Further arrivals here are noted, although tonnage is still scarce and hard to get. Current demand is easier, and there is no pressure to buy. Sales have been made at $3 per 100 lb. for spot, and this might be shaded a little for futures.

Sulphur—Demand continues good and there are some large inquiries. Spot material is rather scarce and commands $35 per gross ton. Futures can be had at $30 per ton, New York delivery.

Sulphuric Acid—Spot business is a little easier, but makers are selling freely for future delivery. For 60-deg. acid $20 per ton is had for spot material. For 66-deg. acid $30 per ton is quoted.

PETROLEUM

Production of petroleum in California in July is reported at 8,010,183 bbl.; shipments, 8,076,244 bbl.; stocks on July 31 were 51,133,949 bbl. There were 58 new wells, with a total daily production of 9,360 bbl., completed in July.

The U. S. Geological Survey in a recent monograph estimates the total petroleum production of the world in 1915 at 426,892,673 bbl., or 57,298,786 metric tons; an increase of 28,194,397 bbl., or 7%, over 1914. This is believed to be the largest output ever recorded. The United States furnished 65.9% of the total, Russia 16.1% and Mexico 7.7%. The five larger producers were the United States, 37,480,547 metric tons; Russia, 9,353,077; Mexico, 4,388,068; the Dutch East Indies, 1,710,445; Rumania, 1,673,145 tons. Other countries supplied only 5.7% of the total.

Assessments

Company	Delinq.	Sale	Amt.
Algomah, Mich.	May 18		$1 00
Alta Silver, Nev.	Sept. 1	Sept 25	0 03
Beaver Gold, Utah	Aug. 19	Sept. 16	0 01
Belmont, Ida	Aug 9	Aug 26	0 006
Blue Star, Ida	Sept 25	Oct. 21	0 02
Cash Boy, Nev.	Sept. 1	Oct. 16	0 01
Challenge, Nev.	Aug 23	Sept. 13	0 05
Clear Grit, Ida	Aug. 7	Aug. 25	0 002
Coal Creek, Ida.	Aug. 25	Sept 26	0.005
Exchequer, Nev	Sept. 5	Sept 25	0.03
Emerald, Utah.	Aug. 15	Sept. 9	0 00½
Friend, Ida	Aug. 26	Sept. 16	0.002
Four Timbers, Ida.	July 26	Aug. 26	0 002
Great Bend, Nev.	Aug. 15	Sept. 20	0 01
Hector, Ida.	Aug. 7	Sept. 15	0.005
Hugo, Ida.	July 29	Aug. 30	0 002
Jacket-C Point-Belcher, Nev.	Aug. 14	Sept. 7	0.05
Jack Waite, Ida.	July 27	Aug. 28	0.01
Kewanas Reor., Nev.	Aug. 2	Sept. 6	0 01
Keweenaw, Mich.	Sept. 2	......	1.00
Lehi Tintic, Utah.	Aug. 5	Aug. 25	0.0025
Lucky Calumet, Ida.	July 20	Aug. 21	0 005
Nevada-Stewart, Ida.	Aug. 3	Sept. 2	0.003
Nevada Zinc, Nev.	Aug. 14	Sept. 2	0.01
North Lake, Mich.	June 14	.....	1.00
Old Veteran, Ida.	Sept. 9	Oct. 7	0.002
Ophir, Nev.	Aug. 16	Sept. 6	0.05
Paloma, Utah.	Aug. 21	Sept. 9	0 01
Phedora, Ida	Aug. 29	Sept. 29	0 001
Rico Argentine, Colo.	Aug. 17	Sept. 2	0.01
Rio Grande Grubstake, Nev.	June 22	Aug. 31	0.002
Sandstorm Kendall, Nev.	Aug. 22	Sept. 26	0.01
Sixes, Nev.	Aug. 23	Sept. 8	0.10
Smuggler, Utah	Sept. 20	Oct. 18	0.005
Springfield Tunnel, Calif.	Aug. 15		0.05
Sunrise, Ida.	July 27	Aug. 28	0.002
Sunset, Ida.	Aug. 5	Aug. 26	0.0015
Tar Baby, Utah.	Aug. 3	Sept 4	0 01
Tyler, Ida	Sept. 12	Oct. 12	0 0015
Utah, United, Utah.	Aug. 12	Aug. 30	0 01
Whale, Utah.	Sept. 5	Sept. 25	0.05
Wolf Mt. Copper, Utah.	Aug. 2	Sept. 6	0 005
Wonderful, Ida.	Aug. 30	Sept. 20	0.001

Stock Quotations

SAN FRANCISCO Aug. 23	
Name of Comp.	Clg.
Alta	‡ 03
Andes	08
Best & Belcher	05
Bullion	01
Caledonia	40
Challenge Con.	03
Confidence	18
Cons. Imperial	01
Con. Virginia	10
Gould & Curry	03
Hale & Norcross	06
Jacket-Cr. Pt.	06
Mexican	17
Occidental	‡ 70
Ophir	20
Overman	‡ 04
Savage	05
Seg Belcher	‡ 02
Sierra Nevada	25
Union Con	68
Utah Con.	01
Belmont	4 05
Jim Butler	84
MacNamara	05
Midway	19
Mont.-Tonopah.	‡ 23
North Star	15
Rescue Eula	23
West End Con	80
Atlanta	09
Blue Bell	‡ 01
Booth	12
C O D. Con	02
Comb Frac	06
D'field B.B.	‡ 03
D'field Daisy	3
Jumbo Extension	53
Pitts.-Silver Peak	‡ 2
Round Mountain	41
Sandstorm Kendall	‡ 04
Silver Pick	05
Central Eureka	‡ 09
Argo	‡ 10
Ariz. Central	‡ 10
Big Jim	86
Lazy Boy	‡ 2
Oatman No. Star	‡ 10
Tom Reed	‡ 55
United Eastern	‡3 12
United Western	‡ 08

LONDON Aug 11	
Alaska Tre'dwell	£5 15 0
Burma Corp.	3 3 9
Cam & Motor	0 12 6
Camp Bird	0 8 9
El Oro	0 9 0
Esperanza	0 11 6
Mexico Mines	3 12 6
Nechi, pfd	0 13 0
Oroville	0 17 0
Santa Gert'dis	0 13 0
Tomboy	1 2 6

SALT LAKE Aug. 22	
Name of Comp.	Bid.
Alta Con.	‡ 21¼
Black Jack	10
Colorado Mining	16
Crown Point	03½
Daly-Judge	7 75
Emma Cop.	‡ 54
Gold Chain	20
Grand Central	65
Iron Blossom	1 52½
Lower Mammoth	03
May Day	10
Opohongo	‡ 01½
Prince Con.	1.50
Seven Troughs	‡ 03¾
Silver King Coal'n	2 90
Silver King Con.	3 25
Sioux Con	09
Uncle Sam	05
Yankee	17

COLO. SPRINGS Aug. 23	
Acacia	‡ 07¼
Doctor Jack Pot	10½
Elkton Con.	15¾
El Paso	69
Findlay	03¾
Gold Sovereign	05¼
Golden Cycle	2 59
Granite	62
Isabella	18½
Jack Pot	06
Jerry Johnson	‡ 03¼
Mary McKinney	25
Portland	1 05½
Vindicator	1 75

TORONTO Aug. 23	
Adanac	‡ 75
Bailey	07¾
Chambers Ferland	18
Coniagas	4 75
La Rose	62
Peterson Lake	22
Right of Way	05
Seneca Superior	25
T & Hudson Bay	‡55 00
Temiskaming	58
Trethewey	‡ 21
Wettlaufer-Lor.	13
Dome Exten	25
Dome Lake	42
Foley O'Brien	59
Hollinger	27 90
Jupiter	26
McIntyre	1 31
Newray	50
Porcu Crown	63
Preston E. D	[illegible]
Vipond	39
West Dome	37

N. Y. EXCH. Aug. 23	
Name of Comp.	Clg.
Alaska Gold M	16¾
Alaska Juneau	7¾
Am.Sm.&Ref.,com	100¾
Am. Sm. & Ref., pf	111¼
Am. Sm. Sec., pf. A	‡93
Am. Sm. Sec., pf. B	85
Am. Zinc	33¾
Am. Zinc, pf	‡65
Anaconda	86¼
Batopilas Min.	†1⅜
Bethlehem Steel	480
Bethlehem Steel, pf	‡125
Butte & Superior	68
Chile Cop.	19¾
Chino	51¾
Colo. Fuel & Iron	50¾
Crucible Steel	77¼
Dome Mines	‡25¾
Federal M. & S.	‡13
Federal M. & S., pf.	‡35¼
Great Nor., ore ctf.	40¼
Greene Cananea	45¾
Homestake	‡130
Inspiration Con.	52¼
International Nickel	42
Kennecott	49⅜
Lackawanna Steel	78
Miami Copper	34¼
Nat'l Lead, com.	66¼
National Lead, pf.	‡112¾
Nev. Consol	18¾
Ontario Min	6¼
Quicksilver	‡2¼
Quicksilver, pf	‡4½
Ray Con.	24¾
Republic I&S, com.	54⅜
Republic I&S, pf.	113½
Sloss-Sheffield	50
Tennessee Copper	25¼
Utah Copper	83
U. S. Steel, com	97¼
U. S. Steel, pf.	118
Va. Iron C. & C.	42¼

N. Y. CURB Aug. 23	
Beaver Con.	38
Buffalo Mines	85
Butte & N. Y.	2
Butte C. & Z.	5½
Caledonia	66
Can. Cop. Corpn.	1¾
Cashboy	.04½
Cerro de Pasco	36
Con. Ariz. Sm.	$1\frac{9}{16}$
Con. Coppermines	‡1⅞
Con. Nev.-Utah	‡$\frac{3}{16}$
Crystal Cop.	$1\frac{1}{16}$
First Nat. Cop.	4¼
Florence	‡.75
Goldfield Con.	82
Goldfield Merger	08½
Granite	‡ 20
Hecla Min.	5[illegible]
Howe Sound	4¼
Jerome Verde	$1\frac{9}{16}$
Joplin Ore & Spel.	‡ 45
Kerr Lake	$4\frac{15}{16}$
Magma	‡15
Majestic	‡$\frac{9}{16}$
McKinley-Dar-Sa.	.59
Mother Lode	.32
Nevada Hills	‡.15
N. Y. & Hond.	15
Nipissing Mines	7¼
Oro	‡ 04
Ray Hercules	3¼
Rochester Mines	61
St. Joseph Lead	15½
Standard S. L.	1¼
Stewart	‡ 25
Success	33
Tonopah	$5\frac{9}{16}$
Tonopah Ex.	$5\frac{13}{16}$
Tribullion	‡$\frac{15}{16}$
United Zinc	‡6
White Knob, pf.	‡1¼
White Oaks	6
Yukon Gold	‡$2\frac{1}{16}$

BOSTON EXCH Aug. 23	
Name of Comp.	Bid
Adventure	3¼
Ahmeek	100¾
Algomah	1¼
Allouez	67
Ariz. Com., ctfs.	9
Bonanza	.25
Butte-Ballaklava	$1\frac{13}{16}$
Calumet & Ariz.	71¾
Calumet & Hecla	559
Centennial	16
Copper Range	64
Daly West	2
East Butte	13¼
Franklin	8
Granby	87½
Hancock	13¾
Helvetia	‡ 25
Indiana	3¼
Island Cr'k, com.	46¼
Island Cr'k, pfd.	88½
Isle Royale	28½
Keweenaw	3½
Lake	13
La Salle	4
Mason Valley	2
Mass.	12½
Mayflower	3
Michigan	3½
Mohawk	90¼
New Arcadian	6
New Idria	12
North Butte	23¼
North Lake	1
Ojibway	‡1¼
Old Colony	1½
Old Dominion	70½
Osceola	89
Quincy	92
St. Mary's M. L.	75
Santa Fe	2
Shannon	8½
Shattuck-Ariz.	29⅝
So. Lake	7
So. Utah	.22
Superior	16¼
Superior & Bost.	$4\frac{1}{16}$
Tamarack	45
Trinity	6½
Tuolumne	.45
U. S. Smelting	71½
U. S. Smelt'g, pf.	50½
Utah Apex	4
Utah Con.	14
Utah Metal	8
Victoria	3½
Winona	5¾
Wolverine	53
Wyandot	1½

BOSTON CURB Aug. 23	
Bingham Mines	10
Boston Ely	1¼
Boston & Mont.	83
Butte & Lon'n Dev.	.69
Calaveras	5½
Calumet-Corbin	.04
Chief Con.	2
Cortez	25
Crown Reserve	.35
Davis-Daly	2⅜
Eagle & Blue Bell	1¾
Houghton Copper	1⅜
Iron Cap Cop. pf.	5½
Mexican Metals	.39
Mines of America	‡2⅜
Mojave Tungsten	3⅜
Nat. Zinc & Lead	76
Nevada-Douglas	1¾
New Baltic	1¾
New Cornelia	14¾
Ohio Copper	.69
Oneco	89
Raven Copper	‡ 05
Rex Cons.	.20
Rilla	.16
United Verde Ext.	33¾

‡Last Quotations.

Monthly Average Prices of Metals

SILVER

Month	New York			London		
	1914	1915	1916	1914	1915	1916
January	56.572	48 855	56 775	26.553	22.731	26.960
February	57 606	48.477	56 755	26.573	22 753	26 975
March	58 067	50 241	57 935	26.788	23 708	27.597
April	58 519	50.250	64 415	26.958	23.709	30 662
May	58.175	49 915	74.269	26 704	23 570	35.477
June	56.471	49 034	65 024	25.948	23.267	31 060
July	54 678	47.519	62 940	25.219	22.597	30 000
August	54.344	47.163	.....	25.979	22.780	......
September	53 290	48 680		24.260	23 591	
October	50 654	49.385	..	23.199	23 925	......
November	49 082	51 714	.	22 703	25.094	......
December	49 375	54 971	...	22 900	26 373	......
Year	54 811	49 684	..	25.314	23 675	......

New York quotations cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

COPPER

Month	New York		London			
	Electrolytic		Standard		Electrolytic	
	1915	1916	1915	1916	1915	1916
Jan.	13 641	24.008	60.756	88.083	65.719	116 167
Feb.	14.394	26.440	63 494	102 667	*	133.167
Mar.	14.787	26.310	66.152	107.714	*	136 000
April	16 811	27 895	75.096	124.319	*	137.389
May	18.506	28.625	77.600	135 467	*	152 522
June	19.477	26 601	82.574	112 432	95.333	137 455
July	18.796	23 865	76.011	95 119	91.409	125 500
Aug.	16.941	......	68 673	....	82.333	..
Sept.	17.502	......	68 915	....	85.250	.....
Oct.	17.686	......	72.601	....	88.000	..
Nov.	18.627	......	77.744	....	93.273	...
Dec.	20.133	......	80.773	....	100 43	......
Year.	17.275	......	72 532	....	....	.....

TIN

Month	New York		London	
	1915	1916	1915	1916
January	34.260	41.825	156.550	175.548
February	37.415	42.717	176.925	181.107
March	48.426	50.741	180.141	193.609
April	47.884	51.230	166.225	199.736
May	38.790	49 125	162.675	196.511
June	40.288	42.231	167.636	179 466
July	37.423	38.510	167.080	168.357
August	34.389	....	151 440	.. ..
September	33.125	....	152.625	.....
October	33 080	....	151.554	....
November	39 224	....	167.670	.....
December	38 779	....	167.000	......
Av. year	38 590	....	163.960	....

LEAD

Month	New York		St. Louis		London	
	1915	1916	1915	1916	1915	1916
January	3 729	5 921	3.548	5.826	18.606	31.167
February	3.827	6 246	3.718	6.164	19.122	31 988
March	4 053	7.136	3.997	7.375	21.883	34.440
April	4.221	7.630	4 142	7.655	21.094	34.368
May	4.274	7 463	4 182	7 332	20.347	32 967
June	5.932	6 936	5.836	6 749	25.170	31.011
July	5 659	6.352	5.531	6.185	24.611	28.137
August	4 656	......	4 520	......	21.946	......
September	4.610	......	4 490	......	23.151	......
October	4.600	......	4.499	......	23 994	......
November	5 155	......	5.078	......	26 278	......
December	5.355	......	5.266	......	28 807	......
Year	4.673	......	4.567	......	22.917	......

SPELTER

Month	New York		St. Louis		London	
	1915	1916	1915	1916	1915	1916
Jan.	6.386	16 915	6 211	16 745	30.844	89.810
Feb.	8.436	18.420	8.255	18 260	39.819	97 762
Mar.	8.541	16.846	8.360	16.676	44.141	95 048
April	10 012	16.695	9 837	16.525	49.888	99.056
May	14 781	14 276	14.610	14.106	68.100	94 217
June	21.208	11 752	21.038	11 582	100.614	68 591
July	19.026	8.925	18.856	8 755	97.250	50 750
Aug.	12.781	......	12.611	......	67.786	......
Sept.	13 440	......	13.270	......	67.841	......
Oct.	12.800	......	12.696	......	66.536	......
Nov.	15.962	......	15.792	......	88.409	......
Dec.	15.391	......	15.221	......	89.400	......
Year	13.230	......	13.054	......	67.553	......

New York and St. Louis quotations, cents per pound. London, pounds sterling per long ton. * Not reported.

PIG IRON IN PITTSBURGH

Month	Bessemer‡		Basic‡		No. 2 Foundry	
	1915	1916	1915	1916	1915	1916
January	$14.59	$21.60	$13.45	$18 78	$13.90	$19.70
February	14 55	21.16	13.45	18 93	13.90	19.51
March	14 55	21 81	13.45	19.20	13.95	19.45
April	14 55	21.65	13.45	18 95	13.95	19.45
May	14.61	21.78	13.60	19 11	13.83	19.58
June	14 70	21.95	13.67	18.95	13 77	19.34
July	14 94	21.95	13.91	18.95	13.68	19.20
August	16.01	....	15.31	......	14.75	......
September	16.86	....	15.95	......	15.70	......
October	16.95	....	15.96	......	15.80	......
November	17 57	....	16.47	......	17.20	......
December	19.97	....	18.44	......	18.95	......
Year	$15.82	....	$14.76	......	$14 95	......

‡As reported by W. P. Snyder & Co

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Concentration at Inspiration*—I

SYNOPSIS—As a preliminary to the construction of the 15,000-ton Inspiration concentrator, a 600-ton experimental mill was erected, primarily for the testing out of flotation. Crushing and grinding tests resulted in the selection of Symons disk crushers and Marcy ball mills. Flotation work led to the development of the Inspiration machine. Sand-concentration tests led to the adoption of double-decked Deister tables.

In planning the construction of the Inspiration concentrator, it was realized from the very beginning that with such an enormous tonnage to treat, it would be well worth the time and cost to carefully work out a flow sheet. Accordingly a gravity test mill was erected and placed in operation near the Joe Bush shaft in November, 1910, and its operation was continued until August, 1911. Soon after this, flotation began to attract considerable attention in this country, and realizing the possibilities that might arise through its systematic investigation, it was deemed advisable to go into the process in detail.

A 50-ton Minerals Separation machine was first erected, which after a few months thoroughly demonstrated that flotation was applicable to the concentration of the Inspiration ores, but in order to determine better its proper place in the flow sheet, a 600-ton test mill was designed and erected in 1913 on the benches of the concentrator site, the grading for which was at this time completed. Ore for the test mill was obtained from development work in the mine. In this mill careful attention was given all steps of the process. Several distinct types of fine and intermediate grinding machines were put through exhaustive tests, as were also classifiers, tables, flotation processes and settling and filtering systems. Numerous flow sheets were experimented with, the final result being the one now in use in the concentrator.

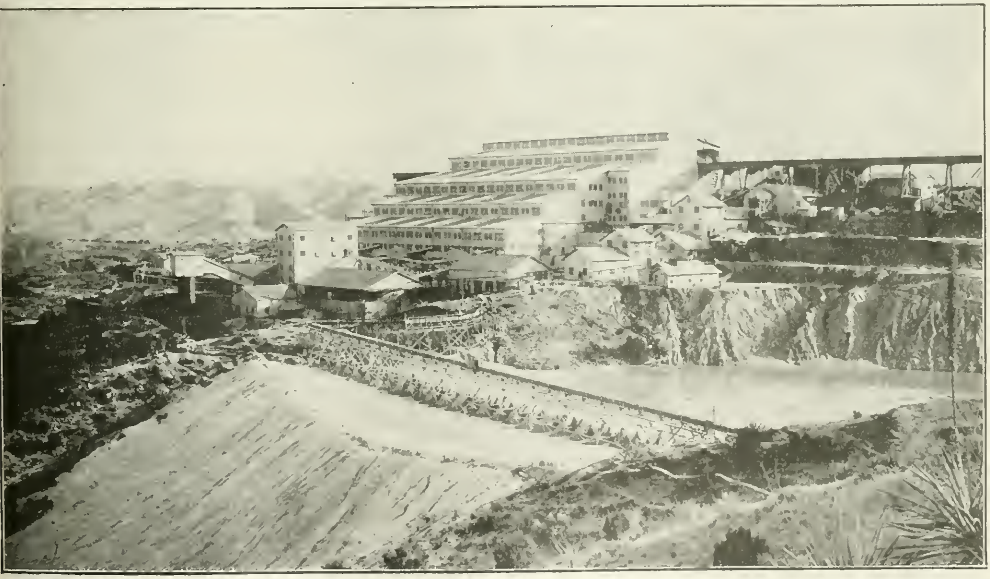

FIG. 1. INSPIRATION 15,000-TON CONCENTRATOR

That the large-scale test-mill method for working out flow sheets for large plants is the only logical method is evidenced by the fact that in nearly every stage of the treatment either an entirely new machine has been adopted or a new application of a standard machine has been made. The result in each case has been either increased efficiency or a more economical arrangement. An interesting illustration can be made to substantiate this point. The earlier studies and results from the first test mill seemed to indicate that it would be advisable to follow stage crushing in connection with wet gravity-concentration. But in the light of later experimental work this idea was dispelled and a conclusion was reached that resulted in the adoption of finished crushing in one machine followed by a combination of flotation and gravity concentration. The following comparison will serve to impress the difference in area required by the two types of mills:

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*Excerpt from "The Inspiration Plant, Concentrator and Other Surface Equipment," by H. Kenyon Burch, chief engineer of the Inspiration Consolidated Copper Co., Miami, Ariz., to be presented to the September, 1916, meeting of the A. I. M. E.

The first mill was planned to have a capacity of 7,500 tons per 24 hr. This design indicated a plant area of approximately 350,000 sq.ft., or a little over eight acres. The mill now in use covers an area of approximately 125,000 sq.ft. or a little less than three acres, but has a capacity of 15,000 tons. The recovery in the two types of plants on favorable ores—that is, ores not carrying over 10 points of oxide—may be closely estimated at 70% for the first and 85% for the second.

In order to account for the long period required for the design and construction of the plant, it may be interesting to note that six complete designs for the concentrator were executed, the idea being to keep this work abreast of the developments brought out by the test mill. Design No. 2 was completed and a contract entered into for structural-steel requirements. A portion of the steel had been fabricated when flotation developments pointed to the fact that wet gravity-concentration could be greatly improved upon. At this point all work on the steel contract was stopped and that portion of the contract pertaining to the concentrator canceled. Although facts relative to flotation continued to develop, in July, 1913, the steel design for the present concentrator building was completed. This building was no sooner erected than very marked changes in grinding machinery began to develop, the ultimate result of which was another altogether new arrangement for the entire mill. As it stands today, there are but three single pieces of machinery in the mill building occupying the places that were originally intended for them, these being the three electric cranes now in use. Considering these changes, it is quite remarkable that such a good arrangement was found possible.

TEST MILL FOR FLOTATION EXPERIMENTS

During the preliminary concentration work done at the 600-ton experimental mill first erected, it was constantly kept in mind that the particular method or machine under test might eventually be installed in the new mill to be built later.

The test mill was put up primarily to try out flotation on a large scale in order to determine its proper application to Inspiration ores. Since the flotation process as applied to the concentration of copper ores was an innovation, it was logical to suppose that in its last analysis the flow sheet might differ altogether from one of wet concentration methods. This did not prove to be the case, but the assumption was made and for this reason the test mill was made so flexible.

The test mill was started February, 1914. The concentrates sold at this writing have paid the expenses of erection and operation, a remarkable record for a test plant. It has treated from 600 to 1,000 tons per day, the amount depending upon the types of machines being tested.

The building is of timber, covered with corrugated steel. This type of building was chosen because it would facilitate changes or additions, was the cheapest and quickest form of construction and would still have considerable value when dismantled. All machinery was placed on concrete foundations.

The ore for the test mill was taken from a development shaft and reduced to 3-in. cubes in a No. 8 gyratory crusher located near-by, the crushed ore being loaded into cars which emptied into a 180-ton bin at the head of the test mill. The following description gives the way the mill was first run, the various additions and changes being noted in sequence:

Two 30-in. apron feeders delivered ore from the bin to an inclined 20-in. belt conveyor, which was equipped with a recording weighing machine and a magnetic head pulley. This conveyor delivered the ore to a 36-in. Symons horizontal disk crusher and a Symons 48-in. fine reduction disk, or vertical disk crusher. These two machines delivered to a second 20-in. inclined conveyor. If so desired, the two crushers could be bypassed, the delivery then being made direct to the second conveyor. This permitted the crushers below the second conveyor to be tried either as primary or secondary machines. The second conveyor delivered the ore to another 48-in. fine reduction disk and a Symons 48-in. roller mill. Water could be added either above or below these crushers. The ore then went to four Hardinge mills, the feed to which was regulated within suitable limits by a mechanical distributor. Three of these mills were 8 ft. in diameter with barrels 36 in., 44 in. and 72 in. long, all being direct-driven by induction motors. The fourth mill was 10 ft. in diameter, had a barrel length of 28 in. and was belt-driven. All these machines were pebble mills with either silex or El Oro linings.

FLEXIBLE ARRANGEMENT OF TEST MILL

A drag classifier followed each mill, the whole floor being so arranged that each mill could be placed in a closed circuit with its drag, or two mills and their drags run in tandem; that is, the first mill discharged into a drag, whose sands were delivered into the second mill, which in turn discharged into the second drag. The sands from the second drag were returned to join the sands from the first drag to form the feed for the second mill. The overflows from the drag were either delivered to eight sand tables by two distributors or sent to other distributors which fed eight slime tables at the lower end of the mill.

Between the sand and the slime tables were placed the flotation machines, which could be fed directly from the drag overflows or by any table product. The original installation consisted of two Minerals Separation 8-compartment flotation machines, one of 50-ton and the other of 600-ton capacity. By means of elevators any flotation product could be re-treated on the slime tables or in the small flotation machine. The concentrates from the tables and flotation machines went to a filter plant containing an Oliver and a Trent filter. The dried concentrates were loaded into one-ton cars, weighed and dumped into a railroad bin from which they were taken to the smelter. Mechanical samplers were installed at important points and hand samples taken where necessary.

The crushing and grinding experiments were not only xtensive but proved most interesting, the results being uite unexpected. The 36-in. disk crusher was the foreunner of the 18-in. disk crushers now installed following he gyratories in the crushing plant situated at the mine. As secondary or intermediate crushers—that is, mahines between the 36-in. Symons disk and the Hardinge nills—the following were tried out: The Symons 18-in. ine reduction disk; the Symons 18-in. roller mill; the ymons 56x18-in. ring mill; the Bradley 66-in. centrifgal roller mill; the Overstrom centrifugal crusher; the llis-Chalmers No. 4 hammer mill; and the Marey ball nill.

The final results indicated that the Symons fine reuction disk with a little redesigning, would be a very fficient machine for the limited field of crushing from -in. cubes to 4-mesh. It was found that this could be one with a single pass, no oversize resulting. The achine would not work well wet, and it was found ecessary to remove all fines from the feed to the machine, therwise a packing would occur. Consumption of steel earing parts appeared low as also did power consumpion, although no definite data on these two points were cured.

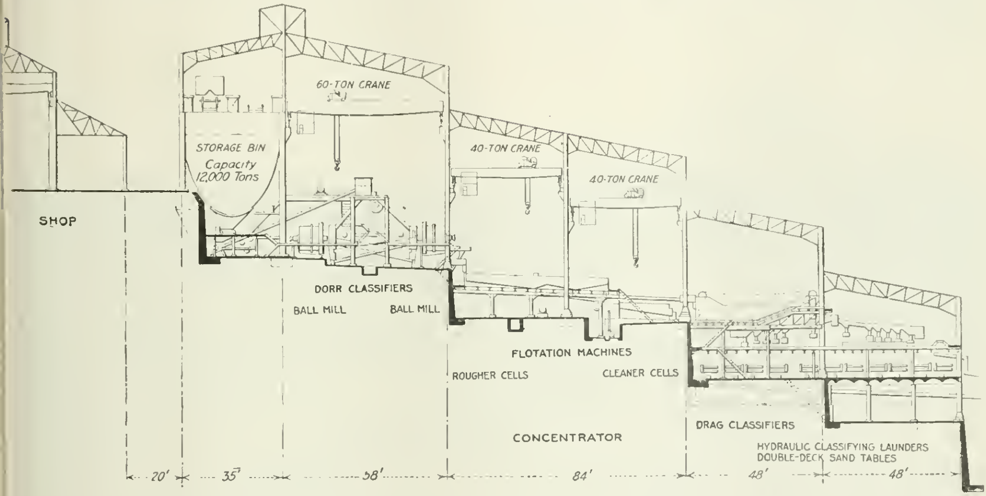

FIG. 2. SECTIONAL ELEVATION, INSPIRATION 15,000-TON CONCENTRATOR

The Marey mill also proved to be a most excellent termediate crusher, handling as high as 800 tons of -in. feed and under to pass an 8-mesh screen without turn of oversize.

To compete with the four Hardinge mills a 6x20-ft. halmers & Williams tube mill and an 8x5-ft. ball mill ere installed. The latter, a Marey mill using 5-in. iameter steel balls, was placed in a closed circuit, as ere the pebble mills, and gave very good results. It as next tried on a feed from the 36-in. disk crusher nd then on a feed direct from the gyratory. These xperiments definitely demonstrated that only three reuctions were necessary—a gyratory, followed by a disk rusher and ball mills in a closed circuit. This is the rrangement now installed in the present plant.

Several different classifiers were tried in the ball-mill rcuit, a duplex Dorr classifier finally being adopted.

The flotation machines and the tests conducted on them are described in another paper,[1] but it is interesting to note here that the following machines were tried out: Minerals Separation, Hoover and Hebbard types; the Callow flotation cells; the Cole-Bergman; and the Inspiration machines.

The Inspiration machine was devised during the operation of the test mill.

The newly built concentrating plant is equipped as follows: Four units with the Callow machines; thirteen units with the Inspiration machines; and one unit with a Minerals Separation machine.

The drag classifier originally tried out proved to be too small for the tonnage required, the drag now in the concentrator having been developed from the small one.

The tables tested were the Deister double-deck slimers, double-deck sand tables and four deck slimer; the Deister single-deck slimer, double-deck sand table and No. 1 sand machine; and the Wilfley No. 6 table with decks arranged for both sand and slime. The Deister double-deck sand table was adopted, 198 being installed.

This sketch of the test mill necessarily cannot attempt to describe tests of the many small things experimented with, such as shaking screens, Caldecott cones, samplers, feeders, slopes of launders and conveyors, or the necessary efforts to work out improvements on the new machines.

The ore from the mine crushing plant is hauled in 14-car trains to the concentrator over the trestle shown in Fig. 1, and is dumped into the bins, which have a capacity of 12,000 tons, or 670 tons per unit. These bins, best shown in Fig. 2, are of the suspension type, are filled from the double tracks above and extend the full length of the mill, 300 ft. The mill is made up of 18 units, similar in equipment except for the differences in the flotation department. Eighteen 30-in. apron feeders on the center line of the bin feed the ore to 20-in. inclined conveyor belts traveling at 150 ft. per min. Weightometers installed on these belts record the amount of ore fed to each unit. The conveyors discharge into hoppers where a split is made, half of the feed going to the north ball mills and half to the south mills, the transfer being made through launders with cast-iron liners and having a slope of 45°.

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[1] "History of the Flotation Process at Inspiration," by Dr. Rudolph Gahl, September, 1916, "Bulletin" A. I. M. E.

The ball mills are direct driven through herringbone gears by 225-hp. induction motors. There are two ball mills to each unit, which, with two 6x27-ft. duplex Dorr classifiers, form a closed circuit on oversize. The mills have a diameter of 8 ft. and a barrel length of 6 ft. Owing to some irregularities in starting up the new plant, the work of the ball mills has been somewhat uneven, but it is expected that the final product, or overflow from the classifiers, will run about 1½% on a 48-mesh screen.

OUTLINE OF CONCENTRATOR FLOW SHEET

The mills are symmetrically arranged about a center line passing through the conveyor hoppers, the classifiers being placed between them. Reference to the flow-sheet, Fig. 3, will make clear the following description: The feed for each mill consists of ore from the bin, together with the sand from the discharge of the mill opposite, the final product of the system being the overflow of the classifiers. Each mill handles about 35 tons per hour. The feed to the ball mills has a consistency of about 1 to 2, and the overflow from the classifiers about 3 to 1, the latter ratio being maintained by an automatic device which adds water as required in the discharge boxes of the ball mills.

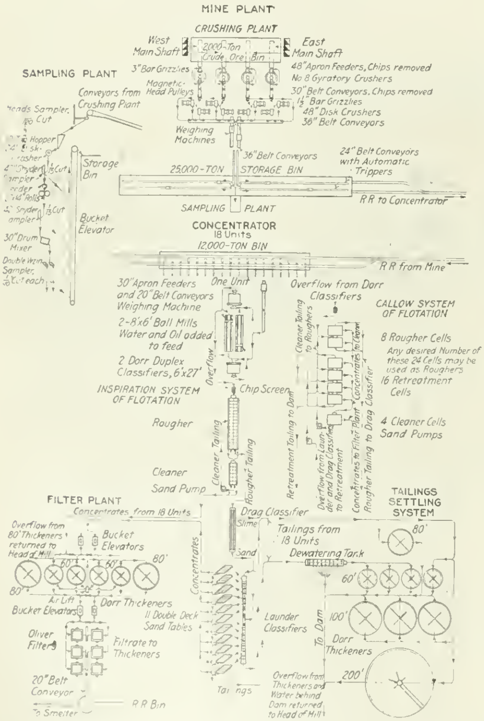

FIG. 3. FLOW SHEET OF ONE UNIT, INSPIRATION CONCENTRATOR

The overflow from the Dorr classifiers goes to the flotation machines, shown in Fig. 4, of which there are three types now in operation. Generally speaking the flotation machines make a clean concentrate which goes to the filter plant, a middling which goes to drag classifiers, and a tailing which goes to waste.

The sands product from the drag classifier goes to launders equipped with hydraulic sorting columns which furnish a classified feed for 11 double-deck sand tables, shown in Fig. 5. These tables make two products, the concentrates joining the flotation concentrates in the filter plant and the tailings going to waste. Further treatment of a middling product from these tables is contemplated, and studies have been made along this line, but as yet no definite decision has been reached. Throughout the mill adequate provision has been made for sampling. As the subject of flotation is to be taken up in detail in another paper, just enough will be given here to bring out the part the process plays in the general scheme. The flow sheets for the two processes differing somewhat, each will be considered separately.

FLOW SHEET WITH CALLOW FLOTATION CELLS

A unit installation of these machines consists of a total of 28 cells, which for sake of compactness are grouped into sets of four cells each, individual cells being 3 ft. 3½ in. by 10 ft. 2 in. Of this total, 8 are roughers, 16 are used for re-treatment, and 4 are cleaners, the arrangement of the group being such that all feeds and products except two are handled by gravity. These two are elevated by sand pumps. The Callow cells as installed in this plant make two products, a concentrate and a tailing.

The overflow from the Dorr classifiers between the ball mills first undergoes a roughing treatment in the eight roughers. Here the two products are a concentrate which goes to the four cleaners and a tailing which goes to a large, specially designed drag-classifier, a detailed description of which will be given later. The concentrate from the cleaners is a finished product and goes to the filter plant. The tailing from these cells is pumped back into the rougher cells for a second passage through the system. The tailing from the rougher cells is classified in the drag classifier into two products, a sand and a slime overflow, the sand being still further prepared for table concentration in hydraulic classifiers. The overflows from both the drag and the hydraulic classifiers are united and pumped back to the 16 retreatment cells, the concentrate from which goes to the cleaners and the tailing to waste.

FLOW SHEET WITH INSPIRATION FLOTATION MACHINES

Except for a special arrangement in one unit, the only difference, between units using Inspiration machines and those using Callow machines is found in the flotation department. From a metallurgical standpoint the difference here it not radical. In a few words the essential difference can be stated as follows:

The Inspiration system makes use of but two machines per unit, a rougher and a cleaner placed end to end, as clearly shown in Figs. 2 and 4. These are each designed to allow a free passage of the feed from the upper, or feed, end to the tailing, or discharge, end, during which passage the feed is subjected to the frothing action of several compartments. Because of the large number of compartments (16 for the rougher) it has been found that a tailing can be made, whose slimes do not require re-treatment as is the case in the Callow system. The sands contained in the rougher tailing are subjected to table concentration. The tailing from the cleaners is pumped back to the roughers for a second treatment.

Several mechanical features have been introduced that are expected to keep the cost of operation at a minimum. The arrangement is simple, requires a minimum of floor space and is easily attended. The very large capacity attained is an important feature.

Both the flotation and table concentrates receive the same treatment. From the concentrator they are either elevated or flow by gravity into the five 60-ft. and three 80-ft. Dorr tanks, placed on both sides of the elevator house. Here the moisture content is reduced to about 50%. The thickened product is drawn off through the bottoms into launders and conveyed through tunnels to bucket elevators, which raise it to the top of the elevator house, where it is distributed to six Oliver filters.

The overflow from the Dorr tanks is practically clear and flows to the return-water sump. The filters are of standard Oliver type, the drums being 11 ft. 6 in. in diameter and 12 ft. long. After leaving the filters the concentrates have a moisture content of about 17%. The arrangement is such that a single 20-in. conveyor belt traveling at 100 ft. per min. takes the concentrates away from the filters and delivers them to a railroad bin of the tank type, seen at the lower end of the mill in Fig. 1. Here they are loaded into hopper-bottomed steel cars of 60-ton capacity. A 350-ft. train shed protects the loaded cars from heavy rains and winds.

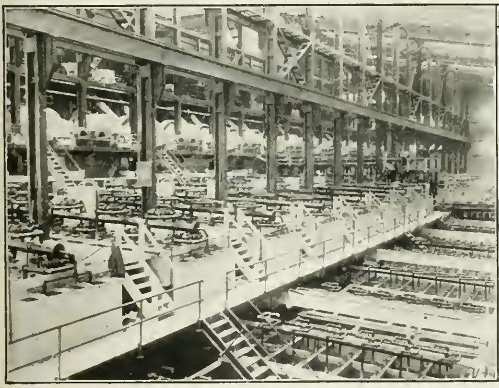

FIG. 4. FLOTATION SECTION OF MILL

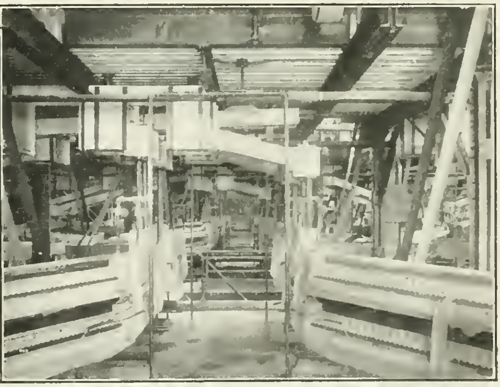

FIG. 5. DOUBLE-DECK DEISTER TABLE FLOOR

(*To Be Concluded*)

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Transactions Between Mine Co-Owners

By A. L. H. Street*

Although it is a general rule of law that, in negotiating with each other for sale of their interests, an owner of an interest in mining property owes a duty to his associate not to conceal any material fact bearing on the value of the property which both as coöwners are equally entitled to know, the Arizona Supreme Court holds that one who deeded his interest in mining property to his associate was not entitled to rescind the conveyance merely because the latter concealed the result of development work that increased the speculative value of the property, where such work disclosed no new or different condition from those already known to the conveying coöwner. (Richardson vs. Heney, 157 Pacific Reporter, 980.)

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Cuban Ore Exports Increases

Cuban ore exports, all of which are absorbed by the United States increased, as reported by the United States Department of Commerce, from 1914 to 1915, as follows: Iron ore from 665,218 tons, valued at $2,261,814, to 796,830 tons, valued at $2,378,635; copper ore from 13,268 tons valued at $1,081,712, to 58,188 tons, valued at $1,794,314. Manganese ore was newly exported in 1915—5,141 tons, valued at $87,297.

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Quarry Blast of 64,000 Tons

A successful blast, made at the Frazier ballast quarries, Frazier, W. Va., is reported in the Aug. 25 issue of the *Du Pont Magazine*. The blast consisted of twenty-four 5⅝-in. churn-drill holes varying from 65 ft. to 121 ft. in depth. About the center of the face at the bottom there were drilled thirty-four 16-ft. snake holes, which were loaded and fired with the main shot, to relieve a heavy toe at that point.

The holes were spaced 16 to 17 ft. apart and had an average burden of 22 ft. Red Cross gelatin 60% and Red Cross Extra 33% dynamite were the explosives used. Nearly all the holes were double-loaded with usually a 12-ft. break. Cordeau Bickford was used in each hole to detonate the explosives.

In all there was used in well holes 7,900 lb. of Red Cross 60% gelatin, which was used for bottom loads, and 7,300 lb. of Red Cross Extra 33% dynamite. About 300 lb. of 33% Extra was used in loading the snake holes.

There was 64,000 tons of rock shot down in this blast, well broken and distributed for hand loading.

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The Japan Aluminum Manufacturing Co., which has recently been floated by Tokyo, Osaka, and Nagoya capitalists with capital of 1,000,000 yen ($498,500) is building a factory at Rokuga-mura, a suburb of Nagoya. It is to be completed in the course of July, and operations are to be started in August. The management of the company intends at the start, the "Japan Chronicle" states, to turn out about 250 tons a year.

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*Attorney at law, 829 Security Building, Minneapolis, Minn.

Mining Methods at Mount Lyell*

SYNOPSIS—A description of some of the unusual mining methods in use at the Mount Lyell property. Stoping methods are described, and the means of facilitating ore movements explained.

The mining methods employed in the Mount Lyell Mining and Railway Co.'s mines, Tasmania, are perhaps less known to the mining world than those of other important districts, owing to the geographical remoteness and isolation of the Mount Lyell field, but they present many features that are unusual and should be of interest to the mining engineer.

Typical mining is carried out on an open-stope system, of which the outstanding feature is that the ground is so worked as to be largely self-supporting by virtue of domical form given to the stope roofs. It is locally termed "rill" stoping, but such terms as "dome stoping" or "arched-back stoping" would be more appropriate and descriptive. The Mount Lyell pyritic body lends itself to the adoption of the system in its simplest form, and a description of stoping in this mine will serve best to illustrate it, while later reference to details of practice in the North Lyell mine will indicate how it may be varied to meet more difficult circumstances.

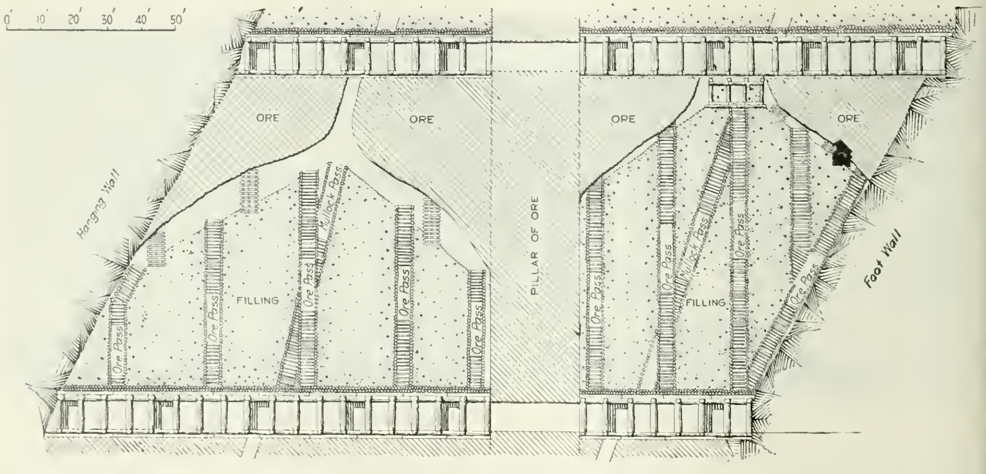

FIG. 1. STOPE ARRANGEMENT AT MT. LYELL

The Mount Lyell Ore

The orebody in the Mount Lyell mine is a huge mass of cupriferous iron pyrites, irregularly elliptical in shape in horizontal section, and with the exception of a few schist intrusions, is remarkably homogeneous and solid in character, though denser and harder on the foot wall than on the hanging-wall side. The walls are well defined, the foot wall being formed by the contact conglomerate, although that rock is almost invariably separated from the pyrites by a band of schist of varying thickness: it is strong and has a marked and regular underlay and forms an excellent "skewback" for the stope arches. The hanging wall is of the typical gray micaceous schist of the district, which flakes off fairly readily and rarely has much strength; it is irregular in underlay, varying from nearly horizontal to nearly vertical, necessitating that the stoping method adopted must provide for its being inherently weak and make special provision for the excavation of the ore below it.

The orebody has a general southwesterly underlay of 26° from the vertical between the surface and No. 7 level, and thence donwards it flattens considerably. From the outcrop down to No. 5 level, a vertical distance of 350 ft., it has been extracted almost completely by opencutting, except in its two extreme ends. The portion below No. 5 level is being worked for a depth of 250 ft. by underground mining. Its size varies considerably at each level, chiefly because of irregularities in the hanging wall above referred to.

The conditions under which underground extraction was inaugurated presented unusual opportunities for attacking the orebody by some completely predetermined method, in that its size and shape had been already ascertained by contour drives at Nos. 5, 6 and 8 levels and were also partly known at No. 7 level, while the body itself below No. 5 level was absolutely intact. As a matter of fact, the complete scheme of working that has been carried out was designed in the office before a shot was fired in the mine, and the original design has been followed practically without any modification.

The method adopted is to cut up the body at each level into suitable stoping sections, divided by pillars of solid ore 25 ft. thick, which are continuous in vertical planes throughout the mine, there being two transverse pillars 100 ft. apart, and also two longitudinal ones 75 ft. apart, as shown in Fig. 1. These pillars develop stoping areas, which they either circumscribe entirely, or which are bounded partly by them and partly by the natural walls.

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*A paper by R. M. Murray, read before the Australian Institute of Mining Engineers and published in "Proceedings," N. S., No. 19, 1915.

The area of each stope being thus outlined, sill-floor stoping in each section is commenced from some convenient point of attack and the ore beaten out for a height of about 12 ft., the back being left flat and temporarily supported by stacks where necessary; these are, however, not extensively required. Where the underlay is considerable, small isolated pillars are left under the hanging wall to provide strength in case of erratic flattening.

Traveling Ways and Mullock Passes

When the sill-floor stope has been well advanced, a rise is put up from a central position to connect with the mullock[1] pass at the level above, and the construction of the galleries, or traveling-ways, is commenced. These are laid out with special regard to the placing of ore passes adequately to serve the overhead stope, and usually comprise one main gallery leading direct to the ore-shaft, with cross galleries at right angles to it and 21 ft. apart center to center, extending to the walls or pillars, as the case may be. The galleries are constructed of strong square-set timber, forming cubical cells 7 ft. center to center, and 8 ft. 6 in. high, the legs being specially large—often from 2 ft. to 2 ft. 6 in. in diameter—in order to provide good seating for the caps and struts and afford stability against the flow of mullock during the initial filling operations. The sills of these sets are laid down on heavy round lagging 15 ft. long and 8 to 10 in. in diameter, to facilitate picking up the level subsequently. The legs are temporarily stayed in position by raking props. The sets are covered over on top with a double layer of heavy round lagging laid transversely on stringers placed longitudinally along the struts. The floors of the panels formed between the cross galleries are also covered with heavy round lagging, laid breaking joint, and the portion of the stope around the central mullock rise is then ready to receive filling.

To facilitate this the bottom of the rise is given a wide bellmouth when commenced, so that when filling is first passed down, it can be spread over a considerable area. The sides and tops of galleries having been lined with old coke bags to prevent fine material escaping through them, mullock is run in and allowed to fill as much of the nearest panels as possible and so support and cover the adjoining gallery timbers, and everything is then in readiness for the first overhead stope to be commenced. This is undertaken from the rise, working outward and downward in all directions, enlarging the original bell-mouth into a small domical chamber. Mullock is then again run in, covering further portions of the sill floors and timbers and forming a cone below the rise from which to begin further breaking operations. When several small stopes have been taken off in this manner, a fairly large dome-shaped chamber containing a corresponding cone of filling has been formed, and the stope is then well opened up for vigorous ore-breaking, the domed roof eventually covering the whole of the sill-floor area and having for its abutments the pillars or foot wall, as shown in the illustration in which the development of several stopes is indicated by means of contours.

The multiplicity and placing of ore-passes is a special feature of the system, and their construction is taken in hand immediately prior to each mullocking. They are built of 10-in. round or split timber joggled at ends, their size being 6x4 ft. They are placed on each side of the galleries at such distances that their centers are about 15 ft. apart horizontally, the close spacing reducing the handling of the ore in the stope to a minimum, and also rendering the wear on the timbers very much less than would be the case were all the ore broken handled into fewer passes. As the height of the stope increases, however, and the slope of the filling becomes greater, the ore can be conveniently handled over greater distances, and some of the passes are then discarded, being allowed to fill completely with mullock. The ones discarded are naturally those situated toward the central portion of the stope, those on the periphery being rigidly maintained, although it is an essential feature of the system that the ore is not made to gravitate to the bottom of the slopes, as is generally the case with "rill" systems, but can be readily shoveled or raked direct into a pass, whatever its position in the stope may be.

Prior to each mullocking each pass is built up to the back, against which it is wedged for support, and the logs are further held in position by vertical timbers placed against the sides and ends, those on the downhill side being strutted with raking props to withstand the force of the mullock as it is being run in. As in the case of the galleries, the outsides of the passes are lined with old bags to prevent the passage of fine material between the logs. Passes contiguous to pillars and over the central portion of stope are kept vertical, and those adjacent to walls are pulled over to conform to the underlay of same, except in cases where the hanging wall is very flat, when they are discarded. The vertical ones do not require inside lining, but where there is any considerable underlay the lower side and ends are sheathed with 8x2-in. planking to prevent the wearing away of the logs. Immediately below the mullock rise a special pass is constructed for transferring mullock to the level below. This is sheathed with 8x2-in. planking, and has a manway partitioned off. Manways, 3x3 ft., are also built in each corner of the stope. Where necessary, individual passes are built up to the back as stoping proceeds, to serve temporarily as stacks for supporting weak or heavy portions of back. All timber used for pass-building is thrown down the mullock rise from the level above, reducing the handling cost to a minimum.

Methods of Stope Filling

Mullock for filling purposes is obtained from the open-cut, where it is broken in the ordinary course of overburden removal, and if not utilized in this way, would be tipped to spoil, as was the case prior to the commencement of underground mining. It is delivered direct from wagons into each of the passes leading to the stopes as required, water being simultaneously led into the pass, so that when it reaches its destination, it has a consistency similar to that of wet concrete. The flow of mullock is controlled by a chute door at the level immediately above the stope to which it is proceeding. Under favorable conditions—that is to say, after a stope has been well opened up and the requisite slope of back attained—about 75% of the mullock required to fill it will run into position by gravity alone, the only labor expended being that of one and sometimes two men per shift controlling the overhead chute and into some of the larger stopes a quantity of 5,000 yd. (broken) is sometimes delivered at one filling. When the stage is reached that the mullock ceases to distribute itself by gravity, a gang of mullockers proceeds with the work of leading it to the remote corners, which is effected by laying timber slides of 8x2-in. planks from the pass to the place to be filled. The wet mullock travels readily along these slides, even when laid with very slight inclination, with but little assistance from men stationed with shovels at intervals along their length. Over the central portion of stope the filling is allowed to reach to within a foot or two of the back, leaving sufficient space to permit of the next layer of ore to be shot down and fall freely. Under the hanging walls and near the pillars it is allowed to run right to the back, and so afford direct support. The character of the filling is such that, when mixed with water, it soons sets very hard, requiring picking to break it, and it subsides very little after being put in. In fact, in cases where it has been necessary to make excavations in it, it has been found to stand readily with high vertical and even overhanging faces. For this reason it has been considered unnecessary to place lagging against the pillars, as no difficulty is anticipated due to "running" when these are being extracted. When mullocking is nearing completion fine material only is run in in order to fill up the interstices between the large fragments and so form an even surface upon which to break down the ore. This surface can be readily scraped down when the stope is being cleaned up prior to the next mullocking, thus insuring that none of the broken ore is lost.

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[1] Mullock.—Country rock or waste.

When breaking and mullocking operations are carried out alternately, as already described, all production from the stope necessarily ceases during the latter operation, and this, in the case of large stopes, means considerable interference with the total mine output. This interruption, however, can be overcome by so working the stope that only half of it is beaten out at a time, then erecting at the rise a barricade which will direct the filling to the depleted portion while the second half of the stope is being worked, and this is now the ruling practice in the larger stopes of the mine.

Reaching the Overhead Level

The highest portion of the stope being always at the mullock rise, it is here that the overhead level is first reached. The method of "picking up" is to flatten off the apex of the cone of filling at a convenient height for one set of timber—usually about 6 ft. below the overhead lagging—and so form a base on which to erect the 5x5-ft. picking-up sets. The leveled-off area is covered with heavy round lagging, which serves to spread the pressure, and on this the sill timbers of the sets are laid. The filling forms a firm and almost unyielding foundation, being even more than ordinarily consolidated in this locality, due to the ramming action of the mullock during the running of the pass. When the sills have been laid immediately below and around the rise the collar of latter is broken away, and the overhead lagging caught up on square sets erected on the sills, and securely packed and wedged up, stringers being used on top of the sets where necessary. As each succeeding stope is taken off, the picked-up area is increased by the addition of one or more rows of sets around those already in position, each successive mullocking increasing the area of the flat base on which they are erected.

By means of timber slides the mullock required for the lower portions of the stope can be directed from the chute at the overhead level through the picking-up sets to the summit of the rill and will flow in this way, by gravity alone, over a radius of 20 ft. (horizontal) round the pass in every direction. When the picked-up area extends beyond this limit the flow needs to be assisted on the slides by a certain amount of shoveling, and the filling is handled in this manner until a radius of 30 ft. from the pass has been attained, it being only the portion of the stope beyond this limit that requires its filling to be transported by trucking. As the picking-up sets are stood as many as possible are packed tight with filling, only those required to form passageways for the mullock slides being left open. The ore-face round the timber is always kept steep, being the upper limit of the sloping sides of the stope, and this insures that there are no thin plates or crusts forming the roof of stope and floor of overhead level, and consequently no weakness or danger of collapse of the latter on this account. The portion of the level picked up in this manner gradually subsides to a small extent, the subsidence, however, rarely exceeding more than about 12 in., and is always uniform, very little disturbance of the level timbering being noticeable.

The Cost of Stoping

In the general work of ore-breaking 3-in. piston machine drills are used, each being operated by one man, and two machines working in close proximity, so that the drillmen can assist each other in lifting, etc., the shovelers being also available for this purpose. Commencing at the rise, and working outward and downward, the holes drilled are roughly parallel to the slope of the filling and are all consequently down or "water" holes, which conduces to leaving a clean back and also minimizes dust. A water-jet is used with each machine. The ore usually breaks big, and is reduced to a convenient size for spalling by "popping" with hammer drills, and sometimes by "blistering." When approaching any flat hanging wall the work is planned as far as possible to cause the ore to settle on the filling in large masses, when it can be worked out in safety, thus avoiding the necessity of working under "shells" of ore too thin to be self-supporting. The layer of ore taken out in each "break" is usually 8 ft. thick, measured normally to the slope of the filling, and is generally taken out actually in two layers, the machines going over the whole of the back twice. In any place where the roof appears to need special support stacks are erected, but they are rarely required, and ore-passes are frequently built up to the back as substitutes.

The leading features of the system are shown in the figure, which is a vertical section through two adjoining stopes, one on the foot-wall side and the other on the hanging-wall side of the orebody, separated by a pillar. The section as drawn is based upon an actual working section, but certain modifications have been made to fully illustrate various details already described. The hanging-wall stope is shown as it would appear just after ore-breaking has been finished over its entire area, the stope being ready for pass building and for the running in of filling. The foot-wall stope is shown as it would appear immediately after filling operations have been completed, and when ore-breaking is about to be recommenced. The central portion of this stope is shown picking up the overhead level. In each stope the mullock-pass is shown logged up through the filling, and its continuation to further levels above and below the stope is indicated.

The principal advantages claimed for the method are:

1. Strength of the stope roofs, due to their domical form and to the avoidance of opening up any great area of any horizontal layer, or head.
2. Economy in handling ore in the stope.
3. Economy in filling stope.
4. Economy of timber for support, the few stacks required for this purpose being almost invariably recovered.
5. Accessibility of all portions of the back for inspection, barring, etc., any part being easily reached horizontally from some point on the filling.
6. The general advantages arising from the boring of all down holes, as well as the important one of minimizing dust.

To justify these claims some statements may be made. The average amount of ore broken per machine per shift is 25 tons, and the amount moved per man per shift is 25 tons. As much as 100 tons has been handled by one man under favorable circumstances. The amount of ore recovered per man per shift is 10½ tons. Working costs in a typical stope are shown in the table.

COST OF STOPING AT MT. LYELL

	Per Ton, Dry s.	d.
Drilling, spalling and handling	1	5
Timbering	0	3
Mullocking	0	3
Trucking	0	4½
Winding	0	2½
Steel sharpening	0	1
Explosives	0	3
Stores	0	6
Timber	0	5
Power	0	3
Miscellaneous	0	10
Supervision	0	5
Total cost, delivered into service bin	5	3

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Military and Mining Life

Life in the military encampment of the National Guard on the Mexican border is a strenuous one, but as a letter to the *Journal* from one of the officers points out, it embodies so many features for which life in the mining camps has been a good preparation that some interest may attach to a general outline of the details. The following quotations from the letter give an idea of the work that is being done:

"At 5 a.m. first call sounds, and with the last notes of the bugle the band starts playing for five minutes, and then reveille sounds and the day is begun. The recall from the last drill is 7:45 p.m., which makes the day very much like many I have put in in mining. Besides various drills and duties, there is school twice a day, one for the 'non-coms' and one for officers. From 11:30 a.m. to 3 p.m. it is so beastly hot that we emulate the natives and have *siesta.*

"The water is alkali, flat and warm, and absolutely fails to quench thirst. Butter is not a part of army rations and for some unaccountable reason is not missed. The newspaper yarns about the experiences of the National Guard are sickening to one who is in and knows; and while things are far from being beyond criticism, most of the criticism published is utterly yellow.

"My mining experience has been so much on the frontier that this kind of life finds me adaptable, and I'm quite comfortable (which some are not), except for the seven hundred million different kinds of bugs which infest the earth and air here. Much of my mining gear fits well into this life. My old 'war bag,' such as every mining engineer carries, is with me and so is my usual canvas bedding roll, which I prefer to the army bedding roll. My mining bedding has given way to olive-drab army blankets; otherwise my bedding roll is the same I have dragged over many a mountain trail. A compass is part of a military engineer's prescribed equipment, and that is where my Brunton comes in. When I first got into camp, we had no lights, so I made a 'San Pedro' lantern of a tomato can and a candle, such as every old sourdough in the desert uses, but it was a novelty in this outfit and I had a lot of fun with it. Of course, I promptly sent for some of John Simmons' carbide mining lamps, such as I have used underground, and am writing by one now, hooked into an angle in my tent fly. I am sitting in a very comfortable chair I made myself, patterned after many I have seen in prospectors' shacks. It is the only chair with a back in this outfit, except those purchased, which have folding backs; and inasmuch as we are limited to 50 lb. of impedimenta, some of the high-toned chairs are going by the wayside on some of our moves.

"This concentration camp is rapidly growing into a cantonment with many semi-permanent features as to buildings, cook and men's shacks, water-supply and shower baths."

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Greatest Petroleum Production

That 1915 was the most successful year of production in the history of the petroleum industry is shown by statistics just compiled under the supervision of J. D. Northrop, of the United States Geological Survey.

The total quantity of crude petroleum entering the world's markets in 1915, which amounted to 426,892,673 bbl., exceeds the former record, established in 1914, by 28,194,307 bbl., or 7%.

The bulk of the increase in 1915 came from the United States and Mexico, though Russia, Argentina and Japan recorded significant gains.

The distribution of this production is shown in the following table:

WORLD'S PRODUCTION OF CRUDE PETROLEUM IN 1915 AND TOTAL YIELD SINCE 1857

	Quantity, 1915			Quantity, 1857-1915		
Country	Barrels of 42 Gal.	Metric Tons	% of Total	Barrels of 42 Gal.	Metric Tons	% of Total
United States	*281,104,104	37,480,547	65.85	*3,616,561,244	482,208,266	60.10
Russia	68,548,062	9,353,077	16.06	1,690,781,907	222,984,256	28.10
Mexico	32,910,508	4,388,068	7.71	123,270,377	16,420,008	2.05
Dutch East Indies†	12,386,808	1,710,445	2.90	148,999,921	20,087,939	2.48
Roumania	12,029,913	1,673,145	2.82	130,012,387	17,477,878	2.16
India	‡7,400,000	986,667	1.73	80,789,711	10,771,961	1.34
Galicia	4,158,899	578,388	0.98	136,032,500	18,918,364	2.26
Japan and Formosa	3,118,464	415,785	0.73	30,169,622	4,022,606	0.50
Peru	2,487,251	331,633	0.58	16,794,223	2,239,229	0.28
Germany	995,764	‡140,000	0.23	13,961,333	1,875,974	0.23
Trinidad	‡750,000	100,000	0.18	2,819,430	375,924	0.05
Argentina	516,120	75,900	0.12	1,033,121	151,693	0.02
Egypt	221,768	29,569	0.05	1,308,496	174,466	0.02
Canada	215,464	28,729	0.05	23,709,074	3,161,210	0.39
Italy	39,548	‡5,500	0.01	842,020	119,279	0.01
Other	‡10,000	1,333		372,000	49,600	0.01
Total	426,892,673	57,298,786	100.00	6,017,457,366	801,038,653	100.00

* Marketed production. † Includes British Borneo. ‡ Estimated.

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Increased Quicksilver Development brought about by favorable markets has caused great activity in search of new quicksilver prospects, according to U. S. Geological Survey, and discoveries near Morton, Wash., and Beagle, Ore., in 1916, have led to some development and construction of reduction plants. Also in the Skull Valley deposits, Ariz., referred to many years ago by W. P. Blake, and at Black Pine, Idaho, some activity is reported. Many old furnaces have been repaired or enlarged in California, Nevada and Texas, old workings have been reopened, and new discoveries have been developed.

A Source of Flotative Agents*

SYNOPSIS—Since so many kinds of oils have proved available for use in flotation concentration, efforts are being made to extract them from vegetation native to the country where the process is practiced. This has been done in Australia, resulting in the use of the native eucalyptus oils.

The reagents now used in flotation consist of various acids or salts, which may be either electrolytes or nonelectrolytes, dissolved in water and some substance or combination of substances that function as collecting or frothing agents. At times the only dissolved salts present are those naturally occurring in the water used. The general effect of the electrolyte is to sharpen greatly the separation between the gangue, and the concentrate. Examples of this are the use of sulphuric acid with zinc ores and of sodium carbonate or calcium oxide (lime) with silver-gold ores. Crude pyroligneous acid is sometimes used when available. Various oxidizing agents, such as permanganates, bichromates, etc., are added in the selective flotation of lead-zinc ores. Many others, reagents for performing certain specific functions, either real or imaginary, have been proposed, and many of them have been tried upon a working scale. The wild orgy of experimentation that is now going on in flotation even exceeds that in evidence shortly after the introduction of the Washoe process for the treatment of Comstock ores when, among other things, sagebrush tea and tobacco juice were in evidence as reagents added to the pans. Out of all this will eventually come a more or less standard practice for the treatment of each class of ore.

Omitting a discussion of the functions of frothing and collecting agents, the reagents used in flotation for this purpose may be classified under five general heads: Essential oils; fixed or fatty oils; alcohols and their combinations with organic acids; coal tar and its refined products; and petroleum and its refined products.

The term "oil" in flotation parlance, as usually applied to this class of reagents, is a loose and inaccurate one. The word "oil" appears to be derived from the Greek word *elair* (meaning the olive tree) through the Latin *oleum* and the French *huile*. By the ancients it was applied to all liquids having an oily nature; for example, sulphuric acid was called oil of vitriol. When the term oil is applied, even to any one of the general classes of frothing and collecting agents, many inconsistencies are bound to arise; as, for example, acetic acid, the lowest member of the series of fatty acids, cannot in any sense be considered an oil, while the next member in the series, oleic acid, has a distinctly oily nature. Crude coal tar can scarcely be called an oil, although certain of the fractions from the redistillation of tar have a distinctly oily nature. Again, certain of the refined products of coal tar that have proven to be valuable flotative agents, such as carbolic acid, cresol, etc., are not of an oily nature. Then there are the alcohols, particularly the higher members of the series, such as amyl alcohol (fusel oil), which in some cases appears to be able to perform the dual duty of both frothing and collecting agent as efficiently as certain of the essential oils. It is, however, interesting that as you go higher in the alcohol series, they acquire a distinctly oily nature. The term "oil" has apparently been used for the lack of a better one. It would seem that the general term "flotative agents" could be applied to those substances added to function as frothing or collecting agents, while "modifying agents" could be applied to the various other reagents that are added.

A flotative agent of some kind is required in flotation as now practiced. A single reagent may perform the function of frothing and collecting agent, or a mixture of substances may be required.

In this country the essential oils used have been wood products and have been almost exclusively confined to the steam-distilled pine oils. At present the supply of these is limited and the cost almost prohibitive, so that their use has been dispensed with as far as possible.

The oils and tars resulting from the destructive distillation of the various species of the *coniferae* find a more general use on account of the greater supply and lower cost, although even these have risen in price and the future supply is somewhat problematical if the demand for them in flotation continues to increase at the same rate as in the past. The fixed or fatty oils, with the exception of oleic acid and crude pyroligneous acid and crude pyroligneous acid, are scarcely ever used, since they in general give poor results as compared with other flotative agents. Coal tar is a common and cheap product, but not all coal tars are suitable for use in flotation, and furthermore, the marketing of coal tar is coming more and more into the hands of large distributors who contract for the output of the various gas plants. The refined products of coal tar are useful flotative agents, but in the case of certain of these, as for example, carbolic acid and cresol, the price at present is prohibitive. In general, crude coal tar yields the best results when mixed with other oils. It is a frequent practice to use a small proportion of pine oil in order to modify the froth. In many cases these cheaper mixtures yield satisfactory results and can now be obtained at a reasonable cost.

MARK TWAIN AND THE SAGE BRUSH
From first edition of Mark Twain's "Roughing It"

It appears that only the crude petroleum oils having an asphaltic base are in general useful in flotation. These are invariably mixed with other oils. The refined products of petroleum are generally not satisfactory, except as constituents of oil mixtures. The one exception to this is perhaps the case of kerosene-acid sludge, which is a byproduct of petroleum refining. Kerosene acid sludge from Eastern refineries gave unsatisfactory results at Anaconda, but the California product resulting from the refining of crude oils having an asphaltic base is satisfactorily used in conjunction with a small proportion of wood creosote for the treatment of Anaconda copper ores. While California kerosene-acid sludge is, with many ores, a satisfactory flotative agent, the supply available tends to limit its use. Formerly it was a drug on the market and California refiners threw it away, but now little of it is available upon the open market, since practically the whole of the present production is contracted for a long time in advance by pioneer users.

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*A paper by G. H. Clevenger, associate professor of metallurgy, Leland Stanford Jr. University, Palo Alto, Calif., in the "Bulletin of the A. I. M. E." September, 1916. This article contains, however, material supplied by Professor Clevenger that did not appear in the A. I. M. E. publication.

Flotation Oils from Vegetable Sources

The matter of suitable oil supply, both as regards the character of oil to give the best results and its present and future availability, is a matter of serious consequence to companies operating flotation plants. It was with this in mind that I began the investigation of other possible sources of flotative agents, with the particular object of affording relief to mines in the arid regions of the West where none of the common flotative agents are locally available and where transportation costs upon those from the outside are high.

Certain plants and shrubs have the peculiar property of secreting oil during the growing season in the new growth, and particularly in the leaves. Botanists appear to be uncertain regarding the function of this oil in the metabolism of the plant. Some hold that it is a reserve food supply for the plant, while others state that it is waste product which the plant fails to throw off. Be this as it may, many plants, shrubs and trees contain oil in the leaves and new growth. A good example of this is the case of the eucalyptus tree, from the leaves of which are recovered by steam distillation essentials oils which are used for various purposes. The leaves of the variety known as *amygdalina*, unique as being the tallest tree in the world, have afforded a large proportion of the flotative agent used in the concentration of complex Australian ores. This variety of tree is, fortunately, plentiful in close proximity to these ore deposits.

Sage Brush a Source of Oil

In the great arid and semi-arid mining regions of the West, in seeking a similar source of flotative agents one is limited to a consideration of the few plants and shrubs native to the region. The most common of these, as even the casual traveler from the East can testify, are the various varieties of sage brush commonly known as mountain sage, pasture sage, wormwood sage, etc.; also, in certain regions, greasewood and other shrubs of a similar nature. It is therefore to the Sage Brush State—Nevada—and to the much-despised sage brush, that my attention has been directed in the search for flotative agents for concentrating Western ores. I need not describe sage brush, for Mark Twain[1] did this vividly years ago.

It appears that the several varieties of wild sage were first investigated by certain members of the Department of Agriculture, with regard to the possibility of producing from them by steam distillation essentials suitable for pharmaceutical use. Steam-distilled oil was prepared by Rabak[2] from the variety *artemisia frigida* in 1905, and during the summers of 1907 and 1908 larger quantities of oil were prepared from specimens of the plant collected in South Dakota. In 1912 an essential oil prepared by the steam distillation of *Ramona stachyoides* (black sage) from southern California was also reported by Rabak. This oil was said to contain 10% of champhor. In 1914 Charles E. Burke and Charles C. Scalione[3] gave an account of an investigation of an essential oil that had been prepared from the same shrub by the steam distillation of several hundred pounds of leaves and twigs collected from brush growing near Riverside, Calif. The yield of oil in this case was 0.9% of the weight of the material used. This yield was somewhat higher than that reported by the Department of Agriculture. This is perhaps accounted for by the fact that the brush was collected later in the season. This oil is reported as having the following composition:

ARTEMISIA TRIDENTATE

COMPOSITION OF BRUSH OIL

	%		%
Pinene	6	Thujone	8
Cineol	30	Camphor	25
Dipentine, terpinene, etc...	25	Resinous material	5

Camphor was separated from a portion of the oil, thus demonstrating the rather interesting possibility of black sage as a source of borneol camphor. Upon request, Mr. Scalione supplied me with a small sample of the original oil. This is clear, with but a slight yellowish tinge, and has an agreeable odor. In fact, so far as appearance and general behavior goes, although the chemical composition is somewhat different, it very m resembles steam-distilled eucalyptus oil from the Australian amygdalina. This oil is a good frothing agent, and although the amount available did not permit of thorough investigation, it yielded quite satisfactory results upon lead and zinc ores in a qualitative way. Although the idea of investigating sage brush and greasewood as possible sources of flotative agents was conceived early in January, it was not until early in March that the first 100 lb. of sage brush was forwarded to me through the courtesy of G. B. Lantz. This lot was collected near Goldfield, Nev., and upon examination proved to be the variety *artemisia tridentata*. "In the Western Arid Transition zone the flora consists largely of the true sage brush, *artemisia tridentata*."[4] therefore this would be the variety available to the mines of this region.

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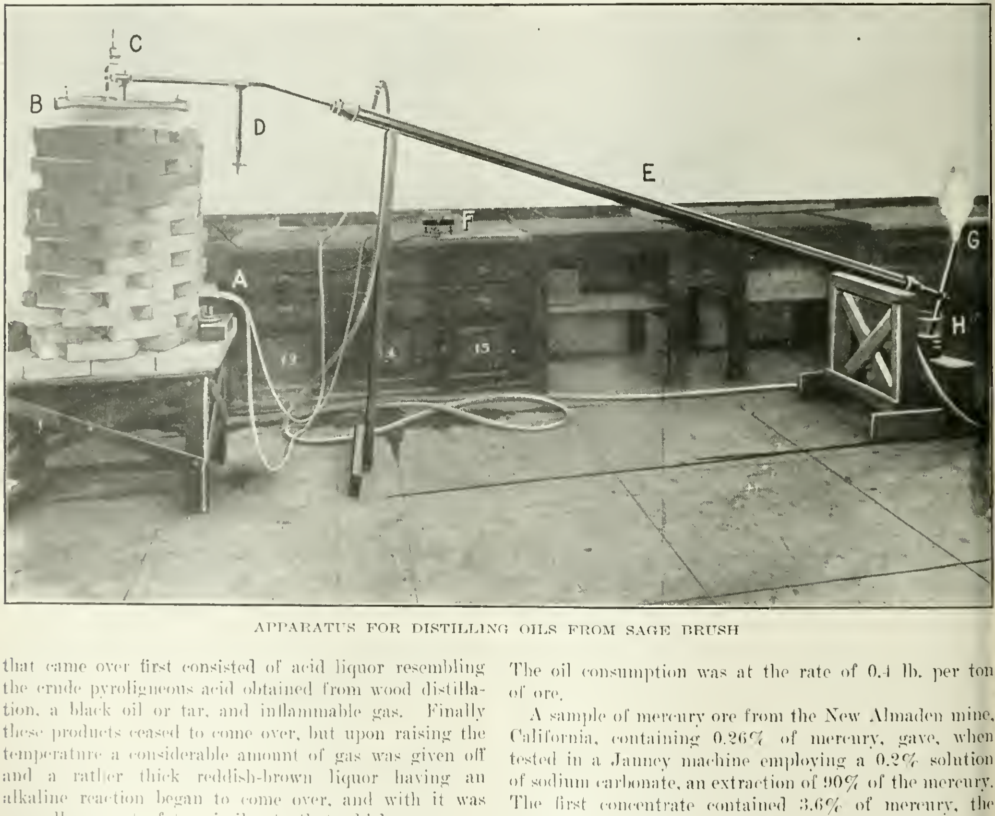
[1] "Roughing It," Mark Twain; First Edition, p. 33.

[2] "Wild Volatile-Oil Plants and Their Economic Importance," Frank Rabak; Bureau of Plant Industry, Bulletin 235, p. 22.

[3] "Investigations on Oil of Black Sage," Charles E. Burke and Charles C. Scalione; "Journ. Indus. and Eng. Chem.," Vol. 6, pp. 804, 806.

An apparatus for destructive distillation, capable of treating 30 lb. of brush at a charge, was constructed, and two charges of the brush distilled. The products that came over first consisted of acid liquor resembling the crude pyroligneous acid obtained from wood distillation, a black oil or tar, and inflammable gas. Finally these products ceased to come over, but upon raising the temperature a considerable amount of gas was given off and a rather thick reddish-brown liquor having an alkaline reaction began to come over, and with it was a small amount of tar similar to that which came over with the acid liquor. The brown liquor had the characteristic fishy odor peculiar to the mines. There was also at times a distinct ammonical odor. The acid and alkaline liquors were kept separate, while the tar from both was combined. These three products were first tried qualitatively in the flotation of finely ground samples of various minerals such as galena, cinnabar, pyrite, etc.



APPARATUS FOR DISTILLING OILS FROM SAGE BRUSH

The acid liquor behaved much as ordinary pyroligneous acid. The alkaline liquor was a good frothing agent, although the froth carried up but little mineral. The tar that came over with the acid liquor proved to be a splendid flotative agent.

TESTING SAGE OILS ON VARIOUS ORES

Following this, quantitative tests were made upon a number of different ores, employing the tar produced from this lot of sage as a flotative agent. These results, a number of which are given, were in general very satisfactory.

A sample of zinc ore from the Butte & Superior mine, Butte, Mont., containing 22.39% of zinc, gave, when tested in a Janney laboratory machine employing a solution of 0.25% of sulphuric acid, 97% extraction of the zinc. The first concentrate contained 53.8% of zinc, the second 48.9%, the third 40.5% and the fourth 18.1%. The oil consumption was at the rate of 0.4 lb. per ton of ore.

A sample of mercury ore from the New Almaden mine, California, containing 0.26% of mercury, gave, when tested in a Janney machine employing a 0.2% solution of sodium carbonate, an extraction of 90% of the mercury. The first concentrate contained 3.6% of mercury, the second 2.5%, the third 1.55% and the fourth 0.95%. The oil consumption was at the rate of 1 lb. per ton of ore.

A sample of lead ore from the Cœur d'Alene region, containing 12% of lead, gave, when tested in a Janney machine employing a 0.05% solution of sodium carbonate, an extraction of 92.2% of the lead. The calculated lead content of the total concentrate was 37.3%. The oil consumption was at the rate of 0.67 lb. per ton of ore.

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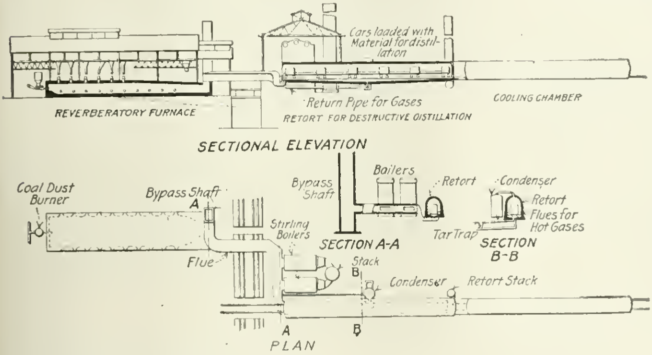
[4] "Encyclopædia Britannica" Eleventh Edition, Vol. 27, p. 634.

A sample of silver-gold ore from the Ophir mine, Virginia City, Nev., assaying 0.46 oz. gold and 7.4 oz. silver per ton, gave, when tested in a Janney machine employing a 0.1% lime or sodium carbonate solution, an extraction of approximately 90% of the silver and 95% of the gold. The first concentrate assayed gold 5.3 oz. and silver 198 oz. per ton; the second, gold 3.75 oz. and silver 72.9 oz. per ton; and the third, gold 1.32 oz. and silver 35.3 oz. per ton.

The oil consumption when employing sage tar appears to be less than with most of the other oils experimented with in treating the same ores, and furthermore, the extraction was in general better. Since it is general experience that large-scale operation requires less oil than is indicated by small-scale tests, it is reasonable to suppose that the oil consumption in treating the ores cited would be materially lessened when working upon an operating scale, and likewise, possibly the extraction could be bettered. This latter I think is particularly true of the Ophir ore.

Later in March another lot of brush was collected by Mr. Lantz from the same locality. This proved to be the same variety, but more fully in leaf than that collected earlier in the season. Distillations were run on this lot, keeping the various products separate, so that they could be properly measured and weighed.



DESTRUCTIVE DISTILLATION PLANT OPERATED IN CONNECTION WITH REVERBERATORY FURNACE

Distillation of Sage Brush

Temperature measurements were made at regular intervals by means of a thermocouple, and as a result there was better control of the heating than in former tests. The yield from the last of these tests, which was the most carefully conducted and was therefore perhaps the most representative, was as follows:

YIELD OF SAGE-BRUSH DISTILLATION

	Lb.	%
Weight of sage brush used	30	
Acid liquor	8.4	28.00
Tar with acid liquor	1.1	3.66
Alkaline liquor	0.66	2.20
Tar with alkaline liquor	0.09	0.30
Charcoal	10	33.33
Gas (by difference)	9.7	32.51

The retort was slowly heated for one hour before liquid began to condense. The temperature at the end of this time at the center of the charge as indicated by the thermocouple was 60° C.; the temperature at the sides of the charge was probably somewhat higher. In the next period of six hours, during which the acid liquor and most of the tar came over, the temperature rose from 60° to 275°; the rise above 100° taking place during the last hour and a half. The alkaline liquor and the last of the tar came over in the last period of three hours, during which the temperature rose from 275° to 611°.

It is reasonable to assume that a yield of about 4% of the tar oil can be realized if the sage is collected at the proper season and the distillation carried on by the best methods. Then there is the acid liquor, which in certain cases could be used directly in flotation, or it might prove profitable to recover the alcohol, acetic acid, the dissolved tar oil, etc., which it contains. I have not had an opportunity to thoroughly investigate the alkaline liquor, but it would seem to present many interesting possibilities. Among other things the first lot was found to contain 2.09% and the second lot 2.16% of nitrogen. I suspect that this liquor may also contain phenolic bodies that would be useful in flotation when separated from the other constituents. The charcoal is fine, but it should be possible to utilize it for fuel in heating the retorts. One peculiarity is the high percentage of ash that it contains (10.5% in the one sample analyzed). This may be in part due to dust upon the sage brush, although it was chopped fine before distillation and it would seem that a good deal of the dust would be shaken from it during this operation. If the charcoal were burned, as previously suggested, the alkaline ash might serve instead of lime or sodium carbonate in cases where flotation in alkaline solution was practiced. The inflammable gas would of course be burned under the retorts. The proportion of the heat necessary for carrying on the operation that could be realized in this way is problematical; however, it is reasonable to assume that a considerable part of that required for destructive distillation could be produced by burning the gas and charcoal. Moreover, another interesting possibility in connection with the heating of the retorts is the utilization of the waste heat from various metallurgical operations. Fig. 1 is a sketch of a general arrangement for utilizing a portion of the waste heat from a reverberatory copper-smelting furnace, for heating a retort similar to the modern concrete retorts used in the destructive distillation of wood. It would also seem feasible in certain cases to utilize the waste heat from roasting furnaces for the same purpose.

Through the courtesy of Charles Scalione, several ounces of steam-distilled essential oil was prepared from the tip ends of a portion of the last lot of sage brush. Approximately one hour was required for distilling each charge of 20 lb. The yield amounted to 0.43% of the whole plant. This oil had a greenish-yellow color when first distilled, but became yellow upon standing. It has the characteristic penetrating odor of sage, and a decided tendency to creep up the sides of the glass containing vessel. This oil appears to have distinctly different properties from the essential oil resulting from the steam distillation of the black sage. It gives quite promising results with some ores, but in my opinion it is not nearly so good as the tar oil resulting from the destructive distillation of the same shrub. In fact, under ordinary circumstances, I do not think that the steam-distilled oil can be given series consideration, since the mines that would be most benefited are generally located where fuel is high, and furthermore, the yield of oil is rather small, probably less than 1%. In addition, there are no other valuable products, unless the tannin extract resulting during steam distillation should have a market value or a demand should arise for "sage tea."[5]

Time has not been available for making analyses and a study of all the products resulting from the destructive distillation of sage. However, sufficient work has been done to at least show that the light tar is a very efficient flotative agent for a considerable number of ores, as indicated by the tests previously cited.

HISTORY OF SAGE BRUSH IN METALLURGY

The idea of utilizing sage brush in metallurgy is by no means new, as is shown by the following quotation from the writings of Dan De Quille,[6] co-editor with Mark Twain of the *Virginia City Enterprise*. This will also serve to throw light upon the early development of the Washoe process and the wild riot of experimentation accompanying it.

> The early millmen knew but little about working silver ores, and all manner of experiments were tried with a view to the thorough amalgamation of the silver contained in the rock that was crushed. This, in the opinion of most superintendents of mills, was to be accomplished by the use of chemicals. A more promiscuous collection of strange drugs and vegetable decoctions never before was used for any purpose. The amalgamating pans in the mills surpassed the caldron of Macbeth's witches in the variety and villainousness of their contents. Not content with bluestone (sulphate of copper), salt and one or two other simple articles of known efficacy, they poured into their pans all manner of acids; dumped in potash, borax, saltpeter, alum and all else that could be found at the drug stores, then went to the hills and started in on the vegetable kingdom. They peeled bark off the cedar trees, boiled it down till they had obtained a strong tea, and then poured it into the pans where it would have an opportunity of attacking the silver stubbornly remaining in the rocky parts of the ore. The native sage brush, which everywhere covered the hills, being the bitterest, most unsavory and nauseating shrub to be found in any part of the world, it was not long before a genius in charge of a mill conceived the idea of making a tea of this and putting it into his pans. Soon the wonders performed by the "sage-brush process," as it was called, were being heralded through the land. The superintendent of every mill had his secret process of working the silver ore. Often, when it was supposed that one of the superintendents had made a grand discovery, the workmen of the mill were bribed to make known the secret. To guard as much as possible against this, the superintendent generally had a private room in which he made his vile compounds. "Process-peddlers," with little vials of chemicals in their vest pockets, went from mill to mill to show what they could do and would do, provided they received from $5,000 to $20,000 for their secret. The object with many inventors of "processes" appeared to be to physic the silver out of the rock, or at least to make it so sick that it would be obliged to loose its hold upon its matrix and come out and be caught by the quicksilver lying in wait for it in the bottom of the pans. Had it been in the dark ages that these experiments were in progress, the efficacy of the blood of human victims would doubtless have been tried; they would occasionally have hoisted an honest miner up from the subterranean depths and cut his throat over a pan. The "process peddlers" finally became a worse nuisance than ever lightning-rod men have been—the limited space of country to which they were confined being considered—and the millmen became disgusted with all the patent processes—their own as well as those of others—and soon little save salt and bluestone was used in the pans. It was found that thorough grinding and careful working of the ore was what was required.

In 1913 James Hebbard,[7] in describing flotation at the Central mine, Broken Hill, Australia, comments as follows:

> Thus nature, in close proximity to the vast bodies of complex ore, has provided the means for the concentration of such ores, for the essential oil of the Australian eucalyptus is one of the best-known media available for the successful exploitation of refractory Australian ores.

The same may be said of our Western sage brush, except that it yields a greater variety and perhaps even better flotative agents than the Australian eucalyptus. Even though man has not, nature has been exceedingly kind to the flotation process.

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Copper in the Far North

The report of Rudolph M. Anderson in the New York *Times* of Aug. 17, 1916, on the findings of the southern Arctic party, under Stefansson, which has just returned to Nome after having been in the North for over three years, refers to an interesting find of native copper. Referring to the country northeast of Alaska, Dr. J. J. O'Neil, of Ottawa, the geologist of the expedition, says:

> The geological formations are varied and complicated here, but we gained much valuable information in tracing the contacts of the copper-bearing diabase rocks with the sandstones, shales and granites found in this region. The geological results, the chief work of the party, are very encouraging, for in addition to the previously known deposits, a great field was mapped and investigated where native copper is widely distributed in extensive amounts.

In commenting on the report, Dr. Chester A. Reeds, assistant curator of the Division of Geology and Invertebrate Paleontology of the American Museum of Natural History, says in the *Times* on Aug. 18, in regard to the copper discoveries:

> The finding of a great field of native copper in the vicinity of the Copper Mine River, in the neighborhood of Prince Albert Island, will not only prove of great value to the business world, but it will afford scientists an opportunity for displaying their ingenuity in finding an outlet from a region that is still unopened in a commercial sense.

When asked how the copper fields in the Copper Mine River region might be opened to commerce, Doctor Reeds replied that two routes might be worked out, but that either could be used only during the open season; that is, during August and a part of September. For a western passage he tracel a route from the mouth of the Copper Mine River through the Dolphin and Union Straits from Coronation Bay, past Cape Parry, across Beaufort Sea (ships always keep in sight of land across this water), past Point Barrow and around the west coast of Alaska into Nome. From Nome it would be necessary to go on to Seattle in order to obtain sufficient facilities for shipment by rail.

Doctor Reeds estimated that from the mouth of the Copper Mine River to Point Barrow would be about 1,100 mi.; from Point Barrow to Cape Lisburne, Alaska, about 300 mi. more, and from there to Nome would add about 350 mi., completing a journey approximately 1,750 mi. long. A second route, approximately 1,800 mi. long, was traced via Baffin Bay. This way led between Victoria Land and the Dominion of Canada, through the Dease Strait, across the Queen Maud Sea, through the Victoria and Franklin Straits into Peel Sound, and from there through Barrow Strait into Baffin Bay. From Baffin Bay the route led down the east coast of Labrador to a point like St. John's, Newfoundland.

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[5] Patents are pending covering the use of the various sage products in flotation.

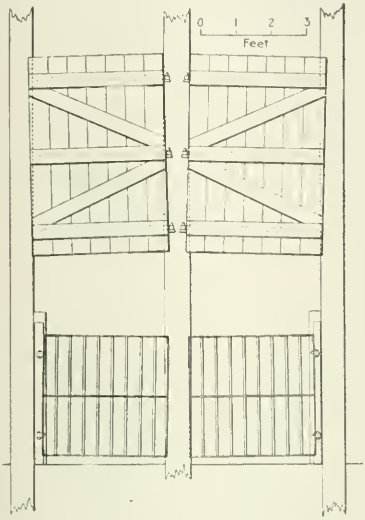
[6] "The Big Bonanza" by Dan De Quille (William Wright); American Publishing Co., Hartford, Conn., 1877, pp. 138, 140.

[7] "Flotation at the Central Mine, Broken Hill," James Hebbard: "Proc. of the Austral. Inst. of Min. Eng.," Nov. 10, 1913.

Details of Practical Mining

A Self-Closing Shaft Gate*

After trying out several kinds of shaft gates at the Santa Gertrudis mine, Pachuca, Hidalgo, Mexico, the management finally decided on the type shown as being the simplest and most efficient. The gate is merely swung off center so that it closes by gravity without undue jar. All shaft entrances are provided with these gates. The wooden upper gate shown in the illustration is used to protect anyone standing at the shaft from falling rocks.



SIMPLE SELF-CLOSING SHAFT GATES

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Using Dynamite

There was an inquiry recently concerning the use of dynamite to remove die keys in drop-hammers, says E. W. Wrigley in *American Machinist*. While I have never used dynamite for that particular job, I have often used it to remove broken shafts from gears and other similar work.

We sometimes have large steel gears or drums come into the shop with the shafts broken. We first try to remove the shaft with the hydraulic press, but if it does not start after one or two attempts, we resort to powder. The whole thing is rolled out into the vacant space in front of the shop and far enough from any building so that the concussion will not break windows, and the gear blocked up if possible so that the charge can be put on the end of the shaft and blow downward. Then the sticks of dynamite are broken up so that they can easily be piled on the shaft and covered with a piece of wet burlap. About 2 ft. of ordinary fuse is attached and the steel gear with a 5-in. shaft that usually breaks close to the hub. As it is necessary to shrink this gear on the shaft with more than the ordinary allowance, it is hardly charge fired.

One type that we often start this way is a large cast-ever possible to remove the broken piece with the hydraulic press. So we block the gear up as solidly as possible with timbers, and use four sticks of 10% powder on the end of the shaft. Occasionally a second shot is necessary, but usually the first explosion moves the shaft about ¼ in. in the hub and it is pushed easily the rest of the way with the press.

It must be remembered that the force of the blow probably will crush the shaft a little and cause it to bulge slightly 1 in. or 1½ in. from the point of contact. If the shaft happens to be the same size for its whole length, this bulging part will have to be reduced before it can pass through the hub. Another thing to remember, if the gear is keyed, is which way the key tapers, so that it will not be forced the wrong way and the gear consequently broken.

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Steam-Shovel Safety Suggestions

The following suggestion for the safe operation and maintenance of steam shovels is taken from a recent issue of the *Excavating Engineer*, and their observance should reduce the risk of operation.

A cranesman on a Bucyrus 70-ton shovel went up on the boom to tighten the U-bolt on the saddle block. While he was pulling the wrench, it slipped from the nut. He naturally lost his balance and fell over, his foot coming in contact with the thrust-lever on the boom engine, allowing the steam to be turned on. It went off like a shot. He had hold of the larger gear to save himself from falling to the ground, and before he had time to think, his hand was caught between the gear and pinion. The eventual result of this was amputation, leaving this man a cripple for life. Now while this is only one instance, this shovelman, as well as many others, had been told when going up on the boom to do work on the boom engine, that he should shut the steam off in order to avoid accidents.

No man has any business doing any work on any part of the shovel while the steam is on. If you were working on your swinging or hoisting engine, some person might come in on the front of the shovel and walk among the levers. His shoulder might open the throttle. You of course would be in a stooped position, not noticing what was going on. An injury under these circumstances is almost certain.

In changing dipper teeth, some shovelmen have a habit of doing it with the dipper handle suspended. This is a most dangerous practice. A man may be standing under or in front of the dipper which is hanging in the air. Suppose the steam got low in the boiler and the boom engine started to move. Do you think this man could get away in time to prevent a serious and perhaps fatal accident? To change dipper teeth, the dipper should be set on a small bank or loading track. If you have no bank or loading track available, it should be set on some blocking. When the rivets are cut or the bolts taken out, raise the dipper and the teeth will most likely fall off with little resistance. If a man is needed to pull them off, be sure to keep your cranesman at the throttle of the boom engine.

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*Excerpt from article by Hugh Rose in August, 1916, Bulletin, A. I. M. E.

In putting new or repaired teeth on the dipper, reverse this practice. Place the teeth on the dipper while it is hanging in the air, with the cranesman still at his post keeping a watchful eye. When this is done, place the dipper on the blocks or on the bank and put your bolts and rivets in. You will then be living up to the rule of safety first. Be sure you are right, then go ahead.

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A Reinforcement for Concrete Dams

It is highly desirable in constructing a concrete dam to have the horizontal reinforcement continuous and preferably secured by a suitable anchorage at each end. This aids materially in assuring a solid formation and tends to produce a monolithic structure.

A dam of this character constructed in mountainious country is subject to serious limitations in the choice of material, due to transportation difficulties. Where animal pack trains are the only method available, twisted steel rods are impossible. Metal rails, pipes, etc., are too massive to make possible the use of pieces of the proper length.

Under such conditions a flexible cable may be considered to be most applicable. This could be cut to the required length previous to packing and wound up in a roll which lends itself well to pack-train transportation. Where a tramway has been in operation for several years and has hence undergone cable renewals, there is a sufficient supply. The cables are freed from the oil that they had absorbed, by the simple expedient of burning it out. A fire is built and covered with several rolls of the cable. After the initial rolls are started, sufficient fuel is provided by the oil. In this way the cables are made thoroughly dry and are in no way injured for use in reinforcing.

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A Prospector's Hammock

Having spent many uncomfortable nights in various bunkhouses and shelters of dubious comfort, a prospector became convinced that some portable substitute would have to be provided. Working in the North where trees were abundant, he tried the renowned pine boughs. After spending half an hour every evening chopping branches and placing them in the approved way, he turned in always to find at least one branch poking through the boughs. In the course of his work he came to a seaport and told a sailor of his troubles. The sailor smiled and said he could fix him up in a very short time. He got a 7-ft. piece of heavy canvas and put 6 grommets in each end. A little deft work on some cotton line soon made the ends and the prospector was the owner of a hammock that gave him his allotted sleep. Harness pins kept the blankets in, and after he had mastered the di ference between turning over and rolling over, his sleepin question was settled. The hammock served as a pac roll in the daytime.

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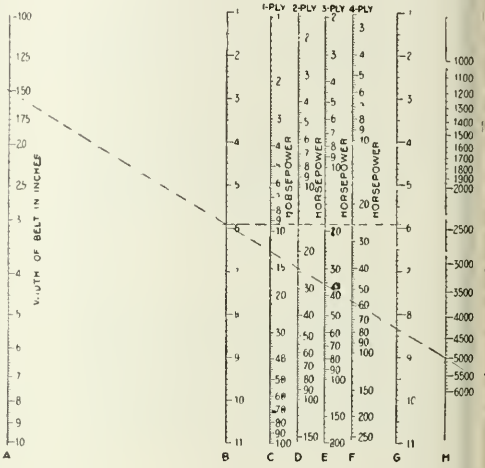
A Practical Belt Chart*

By W. F. Schaphorst†

The accompanying table has been found useful in th solution of the usual belting problems containing th factors of width, speed and horsepower. A straight-edg is used with the table. As an illustration the followin example is given:

What horsepower will a 1.5 in. belt pull when runnin at 5,000 ft. per min.? Find 1.5 in column A. Fin 5,000 in column H. Connect the two with a straigh line. This straight line cuts column B between 5 and Find the corresponding point in column G (that is, be tween 5 and 6). Lay the straight-edge across as indicate by the dotted line. The points of intersection wit columns C, D, E and F give the horsepower that 1-, 2 3-, and 4-ply belts will transmit. A 1-ply belt woul therefore transmit a little over 9 hp.; a 2-ply belt woul transmit 15 hp.; a 3-ply belt would transmit about 19 hp. a 4-ply belt would transmit 25 hp.



A PRACTICAL BELT CHART

Of course the chart can be used to find other facto equally well. If it is desired to transmit 100 hp., fo instance, with a 3-ply belt, assuming that the belt is t run 4,500 ft. per min., the final point falls between th 8- and 9-in. points, but so much closer to the 9 that th 9-in. belt should be used.

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In Sinking Delprat Shaft on the Proprietary mine, Broke Hill, Australia, from the surface, the bottom of the sha was illuminated by means of rays of electric light throw down the center by means of a parabolic reflector and mirror placed on the surface at an angle of 45°, says E. Horwood in a paper on Broken Hill mining methods pr sented at the New York meeting of the A. I. M. E., Februar 1916. In order to avoid shadows, the dividing timbers wer left out until the sinking was completed. Operations wer thus materially facilitated, especially as there was a con siderable quantity of dripping water.

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*Copyright, 1916, by W. F Schaphorst.

†Engineer, Woolworth Building, New York City.

Details of Milling and Smelting

Francis Automatic Pulp Sampler

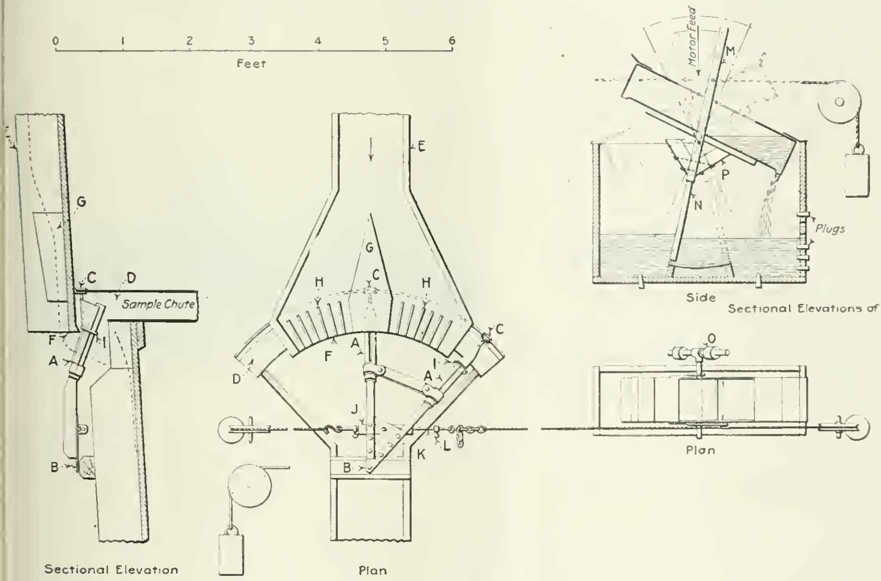
A pulp sampler that can be depended upon for accur te work and yet which may be readily constructed by carpenter and blacksmith is shown in the accompanying llustration. The instrument is of the traveling-slot ype, the motor a modification of the well-known tilting ox, and the drive a wire stretched between two pendent eights.

The two traveling slots *A* are carried on the trianular framework pivoted at *B*, whose opposite extremties are supported above a circular track by the rollers . The slots are of equal width, cut in heavy galvanzed sheet-iron tubes of 2-in. diameter, with the edges f the slots turned up to provide cutting edges.

As best shown in the sectional elevation of the samler, the slotted tubes fit over wooden arms attached to he center pivot plate of $\frac{1}{16}$-in. iron. The supporting ollers *C* revolve on stout wire nails used for spindles, hich are fastened to the lower ends of the slotted tubes y the metal saddle pieces soldered to the tubes, as shown. he open ends of the tubes discharge into the semicirular sample chute *D*, as the triangular frame, actuated y the drive wire, revolves about its pivot, causing the lots to oscillate beneath the pulp stream flowing from he launder *E*.

It is contended that half the trick of accurate samling consists in the proper disposition of the pulp stream previous to the sampler cut. If the stream is too deep, its surface velocity, particularly at the launder discharge lip, becomes excessive and is the cause of the worst loss by splash. A depth of 2 in. is suggested as a good general limit. In the Francis sampler the depth of the pulp stream is reduced by widening the supply launder, as shown, as it approaches the discharge lip *F*, splitting the current with the wedge-shaped obstacle *G* and furthering the more equal distribution of the stream along the periphery of the discharge lip by the vertical radial guides *H*.

Important details that should be noted in the sectional elevation of the sampler are the receding section of the under edge of the discharge lip *F* and the circular-plate drip ring *I*, which prevent contamination of the sample by drip from the exterior of the slotted tube.



FRANCIS AUTOMATIC PULP SAMPLER

Movement of the sampler tubes beneath the pulp stream is effected by the drive wire, which is attached to the ends of the socket bar *J*, of $\frac{1}{4}$x$1\frac{1}{4}$-in. iron, which revolves freely upon its pivot pin without play. The socket-bar ends are turned down at right angles and pierced with a $\frac{1}{2}$-in. hole to allow the free passage of the $\frac{3}{8}$-in. drawbar *K*, whose movements in the socket bar are regulated by the setscrews *L*. These setscrews are used after the motor has started up, to effect the final adjustments for stroke so that the sampler frame and tilting box bump home simultaneously, regardless of any previous movement of the drive wire, thus accomplishing satisfactory sampling movement.

The most noteworthy feature of the tilting-box motor, as best shown in the end view of the illustration, is that the power lever *M*, which is attached to the drive wire, is screwed to an independent paddle board *N*, which swings freely, within limits, about the axle of the tilting box. The axle of the tilting box is rigidly attached to it and carries on one side a vertically set balance rod *O*, which is of 1¼-in. pipe and provided with sliding weights adjustable by setscrews. With these weights the sensitiveness of the tilting box, as a whole, can be controlled to a nicety, and consequently the water charge per stroke and the strength of wire pull are easily adjusted to the work.

The tilting box illustrated is 7x8x34 in. and capable of a maximum pull of about 20 lb. Only the last half of the full downward stroke of the box is utilized for power. As the box fills with water, it falls with considerable acceleration, thus gaining power until it strikes the bracket *P*, attached to the paddle board. The force of the impact, however, is largely absorbed in overcoming the inertia of the drive wire, stretcher weights, etc. The drive-wire pull starts with the revolution of the paddle board in the water bath below. The depth of its immersion controls the speed with which the slotted tubes cut across the pulp stream, and this depth of immersion is regulated by the plugs seen in the side sectional elevation of the illustration. About an inch of clearance is allowed between the paddle board and casing as a bypass for the water to regain its level ere the return stroke.

The machine illustrated was built to sample a stream 5 in. deep by 12 in. wide. This particular design effects a stroke of about 5 in. at the drawbar, the travel of the drive wire being 1 to 2 in. in excess of this.

In sampling the pulp stream it is imperative that the cut should not be made too rapidly—there must be no bat and ball effect. It is probable that 1 yd. per sec. is the highest safe speed to insure accuracy of cut—less speed would be safer.

This sampling machine was devised by Walter R. S. Francis, and the foregoing description is largely excerpted from his description given of it in discussing Taylor's pulp sampler in the Institute of Mining and Metallurgy, Bulletin No. 141.

*

Empire Long-Stroke Table

By John Gross[*]

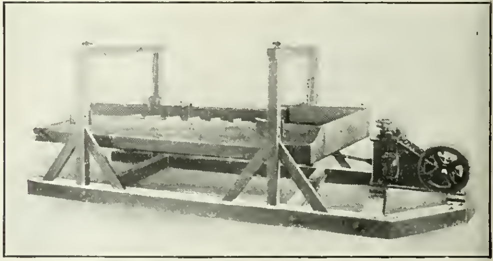
A new table that differs radically from the present type of concentrating tables has been tried out in two of the mills at Idaho Springs, Colo. This table has been developed during the last three years at Empire, Colo., and has been called the Empire table.

The deck of the table, as seen in the accompanying illustration, is of the same general shape as the Wilfley, is riffled somewhat similar to other tables and receives a reciprocal movement through a head motion. At this point it departs materially from the general lines of operation heretofore employed for concentration. The deck is suspended from above and is given a long reciprocal motion longitudinal to the table. A stroke as high as 6 in. is used. It would seem at first glance that such a long stroke would defeat the result desired, but owing to the method of applying the wash water, a rapid and perfect separation takes place. The wash water is fed to the table from behind baffles that, together with the motion of the table, cause an eddy to be formed that accomplishes the result of separation with a very small amount of water.

The forward stroke of the table is gentle, and at the end is retarded slightly by the mechanism and the weight of the table. A spring pressure comes into play only at the end of the forward stroke. The return stroke is thus assisted at the start and given a momentary acceleration due to the stored tension. At the same time the deck drops slightly away from the ore bed along the arc of a circle.

The result of the peculiar motion and the long stroke is that the bed is kept loose. This prevents packing and allows the rapid stratification of the pulp. The mineral moves forward rapidly, and the tails are washed off quickly, thus giving the table a large capacity. The shape of the riffles assists in this work. They are made of sheet metal bent up in channel form, open at the top, and are so placed on the deck as to allow the tails to wash off quickly. As the number of strokes is considerably less than ordinarily used (135 strokes or less per minute), the table runs with little vibration and therefore does not require heavy foundations.

At the Staley mill in Idaho Springs this table has been in operation for four months on the coarser portion of the mill feed. The material is 30-mesh and concentrates about 3:1. The table is given 135 strokes of 5 in. per minute. It is handling 37 tons, dry weight per 24 hr. on a 4x10-ft. deck and could handle considerably more if necessary. The table is using about 10 gal. of water per minute and requires ½ hp. to run it. The heads going to the table assay 0.20 oz. gold and 8.40 oz. silver. The tails from this head assay 0.03 oz. gold and 1.90 oz. silver. This, on a concentration of 3:1, is 90% gold and 84.9% silver extraction.



EMPIRE LONG-STROKE TABLE

At the mill of the United Mining, Milling and Tunnel Co. at Fall River, Idaho Springs, one of these tables is handling the entire unclassified product from 5 stamps crushed to 30-mesh. The table is run at 135 strokes per minute with a 5-in. stroke. It is claimed by the management that an extraction of 87½% is being made. The value in the ore is mainly gold.

During the development of this table at Empire it was operated on dumps ranging in size from the finest sand to ½-in. material, and a clean product was obtained. Owing to the long, slow stroke used and the peculiar water current, it is possible to treat coarser material, such as is now attempted only on jigs. Further work on coarse material is about to be undertaken.

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[*] Mining engineer, 523 McPhee Building, Denver, Colo.

Company Reports

Rochester Mines Co.

Rochester Mines Co., Rochester, Nev., reports a net profit of $45,751 for a period beginning May 1, 1915, and ending May 15, 1916; $92,550 was also realized from the sale of preferred stock. After writing off the discount on the new stock issue sold there was a surplus of $24,451. The company has now issued and outstanding 2,148,791 shares of stock of a par value of $1. Liabilities amounted to $30,355 and current and working assets totaled $10,722. All the leases on the company's property were purchased at a cost of approximately $40,000, including all machinery and equipment as well as all broken ore at hand, excepting the ore on the dump on Lease No. 2, known as the Codd Lease. It is stated that the lessees had naturally made an effort to extract the greatest amount of high-grade ore with the least possible expense, without any regard to the future of the property as a workable mine. The company is now conducting systematic development work in order to mine all the ore in the most economical manner. Power is furnished the mine by the Nevada Valleys Power Co., which derives its power from the Lahontan Dam, a Government irrigation project 85 mi. distant. This power is furnished at $8 per horsepower per month. It is estimated that the company has approximately 10,000 tons of ore broken in the stopes and as more storage room is made available this amount is expected to be increased to at least 40,000 tons of broken ore by the end of the present year. The mill has been increased in capacity from 100 to 120 tons per day, and extraction has been increased 2%. Further minor improvements are under way, which it is stated, will result in increased efficiency. At present 93% of the ore is ground to 200 mesh. The accompanying tables give details of costs.

MINING COST STATEMENT
Aug. 15, 1915, to May 15, 1916 (9 months)

	Cost per Ton
Mining	$1.8810
Tramming	.2973
Timbering	.3541
Surface	.0290
Blacksmithing	.1912
Ore sorting	.0909
Office expense	.0628
Assaying and engineering	.2145
Pipe and track work	.0990
Tramway operating	.1256
Total	$3.3459
Total cost per ton for labor	$2.5632
Total cost per ton for timber	.0815
Total cost per ton for power	.2312
Total cost per ton for explosives	.2455
Total cost per ton for supplies	.2245
Total cost per ton	$3.3459

MILLING COST STATEMENT
May 1, 1915, to May 15, 1916 (12½ months)

	Cost per Ton
Tramming	$0.0524
Crushing and sampling	.1597
Stamp milling	.3316
Tube milling	.5955
Classifying	.0224
Thickening	.0658
Agitation	.5220
Decantation	.1701
Precipitation	.4900
Refining	.1518
Assaying	.0763
Office expense	.0553
Total	$2.6929
Total cost per ton for labor	$0.7837
Total cost per ton for supplies	1.3488
Total cost per ton for power	.5604
Total cost per ton	$2.6929

RECAPITULATION OF COST STATEMENT
Showing Cost per Ton for the Following Months

	Average for 12½ Months, 5/1/15-5/15/16	Average for 5 Months, 1/1/16-6/1/16	For 1 Month, May, 1916
Milling	$2.6929	$2.2878	$2.1399
Mining	3.3459	3.2209	3.1030
Direct mining and milling costs	$6.0388	$5.5087	$5.2429
Indirect Expenses:			
Marketing bullion	$0.2688	$0.1588	$0.1549
Transportation	.5214	.5214	.5214
Taxes and insurance	.0769	.0694	.0452
Reconstruction of water line	.0237	.0780	.1720
Indirect costs per ton	$0.8908	$0.8276	$0.8935
Total direct and indirect costs per ton	$6.9296	$6.3363	$6.1364

Note—At the present time the mill is making an extraction of 92.87%.

⁂

Seneca Mining Co. of Michigan reports that expenses for 1915 were $12,763, leaving a balance of liabilities over assets of $179,703 on Dec. 31, 1915. Of the disbursements, $8,592 was for interest, $1,677 for Eastern expenses, $896 for mine taxes and $1,598 for mine expenses.

⁂

Wallaroo and Moonta Copper Mines of South Australia during 1915 operations raised 187,500 tons of ore, milling 175,590 tons assaying from 3.07 to 3.30% copper. The concentrator operated on material from the heaps and on slimes with satisfactory results. Sulphuric acid and bluestone were produced as byproducts. About 1,800 men were employed.

⁂

Peterson Lake Silver-Cobalt Mining Co., Cobalt, Canada, for the year ended Apr. 30, 1916, reports a surplus income of $213,291 and dividend payments of $168,127. During the year the Seneca-Superior Co. continued to make regular shipments of ore from the mine; but toward the end of the year the ore reserves were practically depleted, and extensive development of the leased area did not lead to the discovery of any new orebodies. The Gould lease was taken over by a new company called the Mercer Silver Mines, Ltd., which has been actively developing this lease, and one shipment of ore has been made. The company has prospected the Peterson Lake area through Nos. 2 and 3 shafts and have opened up the Nova Scotia territory in which several veins have been encountered, but up to the present time no commercial ore has been found in paying quantities. The production of silver amounted to 2,230,295 oz., of which 2,148,297 oz. came from the Seneca-Superior lease. On the Peterson Lake mine 4,479 ft. of development work was performed at an average cost of $13.79 per ft.

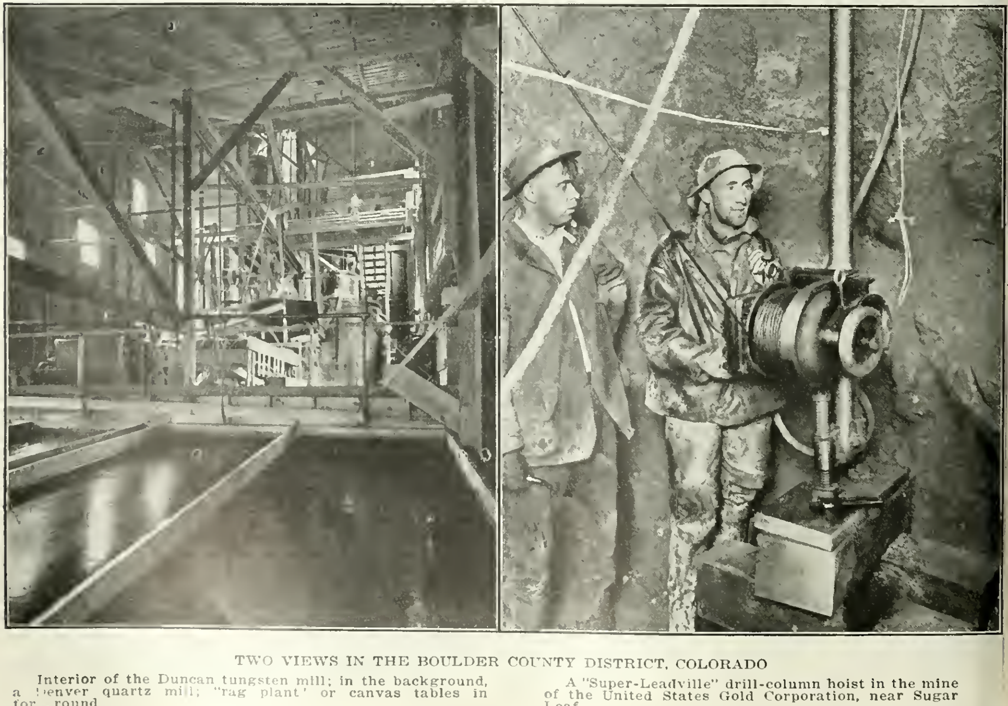
⁂

Boulder Tungsten Production Co., Boulder, Colo., reports the company's treasury now contains a surplus of $70,966.75. The net earnings of the company for the past year amount to $125,000. It was recommended that a plan be outlined by the officers whereby the Barker tract of 600 acres, partly developed by the deep tunnel, should be acquired and further improvements of plant provided for. The Clark mill has been in constant operation since its completion last January, handling both company and custom ores. An accumulation of tungsten concentrates held in the mill during the depression in the price of the metal is estimated to be worth $50,000. The total output of the plant during the last seven months is estimated at over $300,000. The sum of $170,000 has been paid out in the purchase of ores from the company lessees and others. The deep tunnel has been advanced 1,000 ft. during the past year. Several promising veins have been cut by the tunnel, three of which have yielded payable ore from development. The tunnel is being advanced as rapidly as possible and within the coming year will probably reach a length of 3,000 ft. and open the Forest Home mine at considerable depth.

Photographs from the Field

THE CONGER TUNGSTEN MINE, THE DEEPEST IN THE BOULDER COUNTY TUNGSTEN FIELD

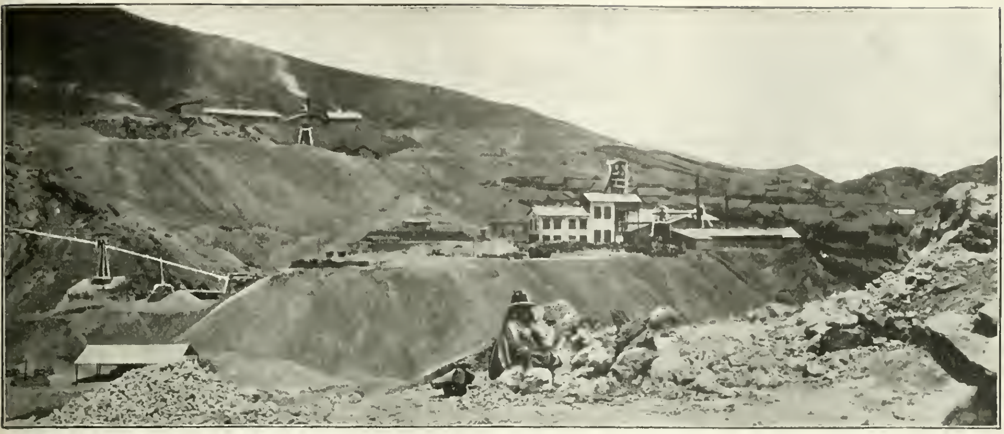
The Conger mine is the largest producer in the district and is owned by the Primos Chemical Co.; the Conger shaft is 1,100 ft. deep. Except the Beddig, which has a 600-ft. shaft, no other Boulder County tungsten mines have been opened to a depth of 500 ft. About half of the properties in the Colorado field are today less than 200 ft. deep



TWO VIEWS IN THE BOULDER COUNTY DISTRICT, COLORADO

Interior of the Duncan tungsten mill; in the background, a Denver quartz mill; "rag plant" or canvas tables in foreground

A "Super-Leadville" drill-column hoist in the mine of the United States Gold Corporation, near Sugar Loaf

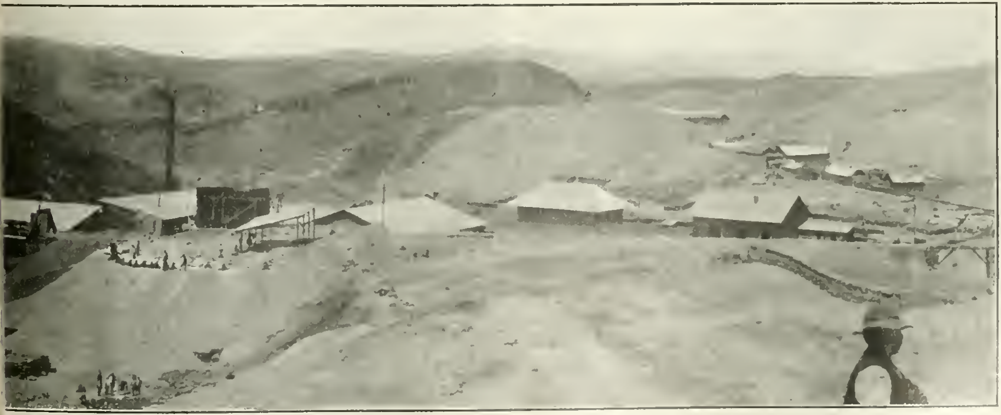


THE COROCORO DISTRICT, BOLIVIA, WHERE NATIVE COPPER HAS BEEN MINED FOR OVER 200 YEARS. SULPHIDE VEINS LATELY EXPLOITED

OUTCROP OF SULPHIDE VEIN

WOMEN SORTING ORE AT COROCORO

DUMP OF 20% SULPHIDE ORE



MILL OF THE CHILEAN COMPANY, CIA. COROCORO DE BOLIVIA

Correspondence and Discussion

Joplin Zinc-Ore Production

In the *Journal* of Aug. 19, 1916, page 363, I find the following note:

> Curtailment of zinc-ore production in this district is not so great as is indicated by the turn-ins. Reports are based on sales and shipment, and the smelters have been buying so lightly recently that the bulk of sales has been small. There is a constantly swelling surplus of ore, and while numerous mines are down, others continue to operate and pile up a reserve.

According to figures in my possession the following is true:

	July 22	July 29	Aug. 5	Aug. 12	Aug. 19
Shipment	4,980	5,480	4,780	4,810	5,160
Production	4,090	4,390	4,580	4,420	4,860

This is an average shipment for five weeks of 5,042 tons and an average production for five weeks of 4,468 tons. Each week the production was less than the shipment. The reserve stock was decreased 2,870 tons.

During April, 1916, the average weekly shipment was 9,554 tons and the average weekly production was 9,634 tons. The production for the five weeks of July and August, already given, averaged 5,166 tons per week less than the five weeks ending Apr. 29. Jesse A. Zook.

Joplin, Mo., Aug. 24, 1916.

[One of our Joplin correspondents reports elsewhere in this week's *Journal* a surplus of 23,000 tons of zinc ore as the finding of special representatives of the Southwest Missouri Safety and Sanitation Association; and a special meeting was to be held Aug. 28 to discuss the surplus and corrective measures.—Editor.]

⁂

Sampling of Spelter

Having read the editorial on "Sampling of Spelter," page 358 of the *Journal* of Aug. 19 and also in the same issue the learned remarks on page 331, "Grades and Uses of Spelter," I feel like calling attention to some important facts in regard to this situation as far as the trade is concerned.

I highly appreciate the work done by the American Society for Testing Materials and from the very beginning have supported this work and have given a good deal of time, thought and advice—mostly indirectly—to the deliberations of the committee. The shortcomings, however, of these efforts of the American Society for Testing Materials are that neither buyer nor seller is bound to the rules laid down by the society, with the result that only such concerns with whom nobody would ever have any serious difficulty are guided by these rules, while other firms adopt the rules when it suits them and disregard them when it appears better for their interests. The trouble is that the contracts between sellers and buyers do not embody the rules of the American Society for Testing Materials and that contracts between consumers of metals and producers and sellers of metals are not written uniformly and are written without consideration of coming differences.

In honor of our consumers and producers it must be stated, and most emphatically, that most of them are guided in their dealings by such high standards of business ethics that they will never take advantage of technicalities, and in the copper as well as in the spelter trade it is practically an unknown thing for anybody to try to get out of a contract because the common law might give him a right to do so. With this large class of people it is easy to deal. Unfortunately, there are a small number of people—even of high financial standing—who feel justified in taking advantage of any legal loophole, disregarding the rules of the American Society for Testing Materials as well as the custom of the trade and the question of fair dealings. Protection is needed against this class of people whether they be producers, consumers or exporters. The only remedy I know is to agree upon a uniform contract for the sale of nonferrous metals, such a contract to be agreed upon at a conference of the principal sellers and buyers with the aid and assistance of the engineers and chemists who have done such valuable service for the trade at large in calling attention to the fundamentals by which the quality of metals should be judged. With due and high respect for these gentlemen, it seems necessary to give consideration to the business and legal questions, and if the *Engineering and Mining Journal* will advocate such action and will assist in bringing order out of the chaos, it will have added to its many valuable services rendered to the metal trade and industry a new one.

New York, Aug. 24, 1916. L. Vogelstein.

⁂

Specific-Gravity Apparatus

As operator of a cyanide plant I am also interested in any detail that promises to facilitate the ordinary routine practice, or any that might point the way toward securing better results. The *Journal* is always helpful in this way, and I have found a great many articles, particularly in the "Details" department, that have been of considerable help. Occasionally, however, my judgment tells me that the thing is overdone. It is this criticism that I have to make of the article on "Specific-Gravity Apparatus" in the *Journal* of Aug. 12, 1916.

The procedure described by C. R. Olson is one with which I can find no particular fault so far as practicability is concerned, but it does appear to me to be superfluous. With all the articles we have had in the past few years about specific-gravity factors, almost any operator ought to be able to devise any kind of system he happens to need to fill local conditions. It seems to me that a study of Professor Clevenger's exhaustive article in the *Journal* of Dec. 19, 1914, covers the ground thoroughly enough for anyone. His article is clear, exhaustive and authoritative, and any further explanation or description seems unnecessary.

Mr. Olson's method is all right, undoubtedly, but it is only one of many ways of doing the same thing, which almost anyone ought to be able to deduce from a knowledge of the general principles of the subject.

New York, Aug. 14, 1916. Charles U. Warring

May Unwater Another Shaft on the Comstock

SPECIAL CORRESPONDENCE

The Combination shaft on the Comstock will be unwatered, if the plans proposed by the directors of the Savage, Hale & Norcross, Chollar and Potosi mines shall be adopted by the stockholders. This is a large undertaking and means attacking the water at two points, whereas for the last five years the attack has been at one point for the drainage of the 2,700 level of the Union and Mexican.

The lowering of the water to the 2,900 level has already been decided upon, and the pumps are now on the ground. The station at the 2,700 level is being excavated, and tanks are being installed under the personal supervision of Whitman Symmes. The pumps will be lowered down the winze to the 2,900, and as the winze is known to be opened, by soundings, the management does not anticipate any difficulty until the 2,900 station is reached. This will drain a section two miles in length at a depth of 2,900 ft., as all the mines are connected on the 2,900 level by the drift driven a year ago. Several winzes are being opened to provide ventilation. These are generally found in good condition. Although they have been submerged since 1881, the ore is known to exist in the Mexican and Union on the 2,900 level. The Con. Virginia and Sierra Nevada are practically in virgin ground below the 2,700 level, and in fact a large portion below the 2,500 level. This is all in the Northend Comstock.

The move to unwater the Combination shaft, going to a depth of 3,300 ft., is rapidly crystallizing. An electric pump will be used for this work. Two years ago the shaft was repaired to the 1,900 level, where the water now stands, and it is believed that it is in bad condition below this point, as it has been submerged for many years. The ground is believed to be of good character. At the Northend the water has been lowered to a point below the 2,700 level, and the water in the Combination shaft stands in the 1,900 level, so that connection has not been made between the Northend mines and the Savage, Hale & Norcross, Chollar and Potosi. The Savage mine, occupying an intermediate position, has not been explored below the 2,200-ft. point. It is probable that the drainage of these properties will not be expensive, as it is believed that the steady flow of water in the deep levels will be very small; in fact, that the bulk of the water comes in above the 2,300-ft. point.

The Savage, Hale & Norcross, Chollar and Potosi were among the first locations on the Comstock Lode and were all in active operation in 1860. Litigation over their boundary lines attracted a large amount of attention and extended over a long period of time, but was settled more than 30 years ago. The four mines have a total of 2,571 ft. in length on the lode and have produced approximately $50,000,000.

The reopening of these properties will be made possible by the unwatering of the Combination shaft. This was one of the greatest shafts ever sunk, and in 1886 had reached a depth of 3,265 ft., at that time the deepest excavation known in the world. It was sunk vertically in four compartments of extra-large size, and the timbering was extraordinary. It is stated that the shaft cost more than $2,000,000 to sink and equip. The pumping of this shaft ceased in 1886 because of the flooding of the Gold Hill and the Southend mines in February, 1883, which stopped all the pumps at that end of the lode and submerged all levels below 1,700, and the stopping of the pumps at the north end of the lode in December, 1881. There have since been other causes that prevented the resumption of pumping, among which were the dispute and dissension among the companies as to the percentage of pumping expense to be paid by each.

At the time of shutting down the pumps, John W. Mackay was opposed, because he believed that the showing was so promising; but Isaac Requa, Alvinza Hayward, W. H. Hobart and others contended that temporary stopping of the pumps might force the Gold Hill companies to coöperate in the pumping, which they had previously refused to do. The death of some of the principals made the abandonment permanent. Plans are now being carefully prepared looking to the most economical and expeditious method of draining the lower levels.

Uniform Mine Taxation

SAN FRANCISCO CORRESPONDENCE

A plan to accomplish uniform taxation of mines in California was considered by a joint meeting of the California Metal Producers' Association and the State Tax Commission. It is said that two plans were prepared, the one given herewith and another more favorable to mine owners, but the former reached the hands of the commission in advance of the meeting and was the only one considered. If the metal producers can obtain favorable action on this plan, it is about the best that can be looked for. It is believed that Amador County is most favored, since it has an assessor who varies his levies according to the profitable operation of the mines. If all counties had assessors of like good judgment, there would be little demand for reform in mine taxation. The following is the plan for uniform mine taxation agreed upon and submitted by the committee on mine taxation of the California Metal Producers' Association and considered at the joint meeting:

THE PLAN FOR UNIFORM TAXATION

Assessment—Valuation for assessment for purposes of local taxation as follows: (A) Surface improvements on the same basis as other property in the county in which they are located. (B) The value of mining claims and real estate, the surface of which is not used for other than mining purposes, at one-quarter of the gross value at the mine of all ores, minerals or metals produced during the preceding year; provided, however, that should the net value of such production exceed one-fourth the gross value, then the net value should be taken as the value of the mining claims and real estate. The net value should be determined by deducting from the gross value: (1) The actual cost of mining and development work performed during the year; (2) the actual cost of freight and treatment on the ore; (3) general expenses, including taxes, insurance, welfare work, cost of workmen's compensation, office expenses at both mine and headquarters, and salaries of all officers engaged in the actual operation or management of the business of the mine; (4) depreciation to the amount of the actual decrease in value of the surface plant where its value is not fully maintained by repairs and betterments, and where so maintained the cost of such repairs and betterments; (5) allowance for depletion in accordance with the provisions of the United States Revenue laws.

Tax levy—(A) For local (county and municipal) taxes the levy should be the same as for other classes of property in the same county, district and municipality. (B) For state taxation the levy should be 0.5% on the value of the net proceeds for the preceding year, and this should be in lieu of any franchise tax whatever.

The following list shows the mine-taxation systems now in use in the various states:

Alabama—Mines assessed and taxed as other property at 60% of actual value. Arkansas—Mines assessed and taxed as other property at full cash value. Arizona—Four times the net plus 12½% of the gross at full cash value. California—Mines assessed and taxed as other property at their true cash value. Colorado—One-fourth of gross proceeds or net proceeds if in excess of one-quarter gross at full value. Connecticut—Mines assessed and taxed as other property at their true cash value. Delaware—Mines assessed and taxed as other property. Florida—Mines assessed and taxed as other property at their true cash value. Georgia—Mines assessed and taxed at their fair market value. Idaho—Unpatented claims not assessed; surface at price paid Government; orebody assessed at net production. Illinois—Mines assessed and taxed as other property at 33⅓% of full value. Indiana—Mines assessed and taxed as other property at price it would bring at private sale. Iowa—Mines assessed and taxed as other property at 25% of actual cash value, except money and credits. Kansas—Mines assessed and taxed as other property at their true value in money. Kentucky—Mines assessed and taxed as other property at their true value in money. Louisiana—Mines assessed and taxed as other property. Maine—Mines assessed and taxed as other property at full market value. Maryland—Mines assessed and taxed as other property at full cash value. Michigan—Mines assessed and taxed on an ad valorem basis. Minnesota—Iron mines classified assessed at 50% of true value. Mississippi—Mines assessed and taxed as other property at their true value. Missouri—Mines assessed and taxed as other property at their true value. Montana—Annual net proceeds plus price paid United States per acre. Nebraska—Mines assessed and taxed as other property at 20% of actual value. Nevada—Mines assessed and taxed on net proceeds at 80% of actual value. New Hampshire—Mines assessed and taxed as other property at full value; undeveloped mines not taxed. New Jersey—Mines assessed and taxed as other property at full and fair value. New Mexico—Mines assessed and taxed on their net proceeds at 33⅓% of actual value. New York—Mines assessed and taxed as other property at their full value. North Carolina—Mines assessed and taxed as other property at their full value. North Dakota—Mines assessed and taxed as other property at their full value. Ohio—Mines assessed and taxed as other property at their true value in money. Oklahoma—Gross receipts taxed; also ad valorem tax; pay state ¾ of 1% of gross value. Oregon—Mines assessed and taxed as other property at true cash value. Pennsylvania—Mines assessed and taxed as other property; coal 2½% on market value of each ton. Rhode Island—Mines assessed and taxed as other property at full cash value. South Carolina—Mining land not taxed; gross proceeds of mines taxed at true value. South Dakota—Mines assessed and taxed as other property at full cash value. Tennessee—Mines assessed and taxed as other property at actual cash value. Texas—Mines assessed and taxed as other property at full and true value. Utah—Mines assessed and taxed on net annual earnings at full cash value. Vermont—Mines assessed and taxed as other property; mines and quarries exempt from taxation for 10 years. Virginia—Mines assessed and taxed as other property at fair market value. Washington—Mines assessed and taxed as other property at 50% of their true and fair value. West Virginia—Mines assessed and taxed as other property at full and fair value. Wisconsin—Mines assessed and taxed as other property at full value. Wyoming—Mines assessed and taxed on gross product at full cash market value.

* * *

A Large Quantity of Ozokerite, at first supposed to be paraffin, has accumulated from the oil wells in the Thrall field, situated 30 miles north of Austin. It is stated that ozokerite is much more valuable than paraffin. The discovery that the strange product is ozokerite was made by Dr. Schoch, head of the chemical department of the University of Texas.

On Reporting the Copper Market

We reprint the following communication from the Bisbee (Arizona) *Daily Review* of Aug. 13:

New York, Aug. 7, 1916.

Editor, Bisbee Review, Bisbee, Ariz.

Dear Sir:—Now that not only the state valuations of mining properties, but the wages and salaries paid officers and employees of the copper producers in Arizona depend so directly upon the quotation for copper as given by the "Engineering and Mining Journal," it is of extreme importance that this quotation should properly, and as accurately as practicable, represent actual and bona fide transactions in the metal. When the price of copper is ascending and consequently wages are increasing, from month to month, little or no criticism is directed at the quotation, but when, as in the months of June and July, the market was practically stagnant and little or no business transacted, except at figures far below the April and May prices, there is naturally created a desire to inquire into and ascertain the accuracy of the quoted prices. In view of the importance of this subject and of the interest which the local public necessarily has in it, I have recently, through personal interviews with W. R. Ingalls, editor of the "Journal," and through a comparison of past statistics, gone very carefully into this subject and am sending you herewith the result of my investigations.

The question of determining the actual selling price of the copper metal from day to day is one of extreme difficulty. Copper, under conditions existing at present, is seldom or never sold for immediate delivery, as there is practically no unsold metal in the hands of producers, and such transactions as are termed "spot" usually consist of "seconds," or old copper, which is remelted. The quotations, therefore, given in the "Engineering and Mining Journal," say for the month of July, represent the actual price which the consumer agrees he will pay for certain amounts of copper the delivery of which may not occur until the late autumn or the early part of 1917. Most of the copper producers sell their output ahead; that is, as crude copper produced at their smelters in one month will, under normal conditions, not reach the market as wirebars, etc., for from three to four months, they endeavor to sell their output for at least this time in the future. Realizing the momentous importance and how much depends upon the accuracy of the "Engineering and Mining Journal" quotation, Mr. Ingalls personally keeps in close touch with the producers and sellers of the metal and receives from them, in confidence, memoranda of their sales and the price and time of delivery of their output. From an average of these transactions is compiled the daily, weekly and monthly quotation published by the "Journal."

That experience has shown that these quotations are as accurate as is humanly possible to compute them is exemplified by an average quotation over a period of months or years with the actual prices received from sales of copper by the large producing companies.

The figures which I will cite below are all of record in the annual report to stockholders of Phelps, Dodge & Co. When the market is subject to violent fluctuations, or where there is a steady increase or decrease in the price of the metal, the prices realized during any year for copper "produced and delivered" may be very different than the average price for copper "produced and sold." This is due to the condition, as above stated, of selling ahead.

TABLE OF PRICE COMPARISONS

	E. & M. Journal Quotations	Price Rec'd. for Copper Sold and Delivered by P., D. & Co.
1909	12.98	13.03
1910	12.74	12.83
1911	12.37	12.36
1912	16.34	15.50
1913	15.27	15.35
1914	13.60	13.56
1915	17.27	16.05
Average	14.37	14.09

I am just in receipt of a copy of the table of copper sales in 1915 and from the year 1905 to 1915 inclusive, published in the "Engineering and Mining Journal" under date of Aug. 5. These figures are of great interest, and the accompanying explanation and analysis shows why the receipts from the sale of copper by one producer may differ through a yearly period from another, yet average the same through a space of two or more years.

My attention has been drawn to the very great discrepancy between the "Engineering and Mining Journal" quotations and those which are printed almost daily in the local press and which apparently emanate from brokerage concerns. These latter figures always appear to be from 2 to 5c. per lb. higher than the official quotations and not only do not represent actual transactions in the metal, but are obviously intended to encourage dealings in copper securities by the inference which they carry that profits in the standard stocks are greater than they actually are.

With reference to the sliding wage scale, while it is undoubtedly a fact that while the "Engineering and Mining Journal" quotation for the month of July was 23.865c. per lb., the producing companies have been receiving, during that month, a considerably higher price for the copper which they delivered. This condition, as can be readily seen, is equalized over a period of months, and it is unnecessary to point out that while the quotation governing the sliding wage scale for the months of May and June was 28.625 and 26.601 respectively, per pound, the actual prices realized by the producing companies for their copper, which as a matter of fact had been sold months before at the then prevailing price, was very much lower. In fact, one of the large producers, booking perhaps the largest individual order for copper ever placed in this country, was selling a large part of its output for 20c. per lb., while paying wages on a basis of from 22 to 27c.

It is evident, therefore, that the business of copper selling is largely dependent on the personal judgment of market conditions by the selling agents, and it is consequently the object of Mr. Ingalls to endeavor to arrive at what might be considered the actual market value of the product through the averaging of the prices obtained by all or many of the transactions that are consummated.

After a very active demand for the red metal during the months of April and May, there has been little or no movement during June and July. I am glad to state, however, that there are present indications of a more active buying movement, and while it is not our opinion that the prices will be as high as the highest that have been obtained during the year, they will materially exceed those obtained for the small amounts of copper which changed hands during the past two months.

There have recently been rumors, which came to my attention, that statements have been made that the large copper-producing interests have financial control of the "Engineering and Mining Journal" and that it is naturally to their interest that the copper quotations therein should be under, rather than over, the market, on account of the bearing which it has on the sliding wage scale. Did this condition obtain, which it does not, the copper producer or seller would be injuring himself through the publication of such a quotation, as whereas, a portion of the high price of copper goes to labor, a larger proportion goes to the producer, and it is obvious that the producer will obtain as much as he possibly can for his output and not give the purchaser and consumer the impression that the price of copper is lower than that which he is asking for it. I have investigated the ownership of the "Engineering and Mining Journal" and can refer you to the issue of Apr. 15, 1916, which, in accordance with existing laws, publishes a statement of its ownership and management, etc., and its list of stockholders. In addition to this I have the emphatic personal assurances of its very reputable and distinguished editor that not one share of stock nor any bonded indebtedness is owned by any copper producer or selling agent, individually or as a corporation.

Yours truly,
WALTER DOUGLAS,
Vice-President, Phelps, Dodge & Co.

George W. Riter

SPECIAL CORRESPONDENCE

George W. Riter, well known in Utah as a mining engineer, died in Salt Lake City, Aug. 20, as the result of an apoplectic stroke. He was born in Salt Lake in 1871, the son of Levi E. Riter, a pioneer of 1847, and Annie Riter. He attended the University of Utah and went from there to Stanford University in 1893, from which institution he was graduated in 1896, with a degree in mining engineering. On returning to Salt Lake, he became connected with the Eureka Hill Mining Co. in Tintic as secretary and general manager, which position he held until about four years before the time of his death.

Mr. Riter was city engineer for Salt Lake City from 1904 to 1906. Three years ago he went to Washington as the representative of the mine producers of Utah before the Ways and Means Committee of Congress, then engaged in the preparation of the present tariff law. Mr. Riter presented to the committee statistics in regard to the tariff on ores, as affecting the Western States. He was for nine years treasurer and a member of the executive committee of the Tintic Mine Owners' Association. He was a member of the American Institute of Mining Engineers and the Mining and Metallurgical Society of America. Funeral services were held at the University Club of Salt Lake City, where Mr. Riter for a number of years had made his home. He is survived by four brothers and a sister.

Zinc-Tailings Treatment

Zinc ores of the character occurring in the well-known Franklin Furnace, N. J., deposits have a calcite gangue in which more or less of the original CaO has been replaced by MnO, MgO, etc. The result of such replacement is to increase the gravity of the gangue particles to a point more closely approaching that of the willemite-ore particles, thereby increasing the difficulty of separation by methods at present employed. As a result it is claimed that the mill tailings average upward of 5% zinc in such form and size that further separation by gravity mill methods, such as jigging, is impractical.

The new process now to be described contemplates the further separation of the metallic from nonmetallic particles by calcining the inclosing calciferous particles, after which a separation is readily made.

The ore is subjected to an oxidizing heat, in any of the well-known forms of calcining kilns or furnaces, by passing it in a thin traveling stream in proximity to flame or flame gases. Any temperature above 700° C. may be employed, though it is desirable, particularly in attaining an overburning, to heat to around 950° C. for producing quicklime, and around 1,050° C. for overburning. Where it is desired to obtain as a byproduct merely a lime of the ordinary properties, just enough water or steam is introduced into the calcines to hydrate the lime, whereupon the latter is reduced to a fine dry dust from which the relatively coarse zinc minerals can be separated either by simple sifting or pneumatic separation.

Where the calcining is done at an overburning temperature, the calcines react slowly or not at all with water. Gangue particles thus treated form brown granules, which may be easily separated from the zinc minerals on the ordinary forms of concentrating tables, jigs, etc., the gangue particles being of less specific gravity than before burning. The inventor prefers a calcination complete enough to expel substantially all the CO_2 in the ore.

It is claimed that in one test of this method, where the original tailings contained 5% zinc and 68% manganiferous calcite, table concentration of the calcines could produce concentrates carrying over 20% zinc in one passage of the concentrator. It is further claimed that the application of this process to present milling methods will allow the preliminary table concentration to make cleaner concentrates, since the willemite thereby going into the tailings will ultimately be recovered in the concentration following calcination. In addition to the increased metallic recovery, the process will increase the capacity of the concentrators.

This process is the invention of Arthur C. Spencer, of Washington, D. C., U. S. patent No. 1,150,897.

Editorials

The Railway Situation

Another week has passed without any settlement of the controversy between the brotherhoods and the railways, but during the week the situation has clarified in many respects: that is, everybody is able now to see just what the railway men demand and there are no longer any illusions respecting abstract problems of social welfare. The theoretical idea of a universal eight-hour day on the ground that a human being ought not to work more hours than that and that society no longer sanctions a more protracted working time was received with general derision. The farmers of the country, who have to work from sunrise to sunset, wanted to know how the principle would be applied in their case, and so on.

No, the railway men never had any idea of demanding an eight-hour day for the reason that they ought not to work any longer. On the contrary, they strenuously resented all ideas of limiting their working time. They want to work more hours, but they want to be paid on an eight-hour basis. In other words, the railway men were simply making a disguised demand for increase of pay. This is the naked truth, which now everybody sees.

The development of the situation was about like this: After the prolonged palavering in New York, when the two parties were unable to agree, they decided to go to Washington and appeal to Cæsar. In Washington the railways found that Cæsar had already prejudged the case in favor of the brotherhoods and was unwilling to entertain even the fair and simple proposal of the railways for arbitration of the whole matter. It looked to the railways as if their case were hopeless. They weakened and were apparently on the point of yielding, when public sentiment crystallized strongly in their favor—probably as much to their own surprise as to that of anybody. This gave the railways their second wind; they braced up and reverted to their original contention for arbitration. In the meanwhile the President and his political advisers, having obviously backed the wrong horse, have been trying to get out of the predicament into which they fell when they made silly sophomoric utterances and threw to the winds the principle of fair play.

The delegates of the brotherhoods have now gone off in a dudgeon and threaten specifically to call a general strike at 7 a.m., Sept. 4. The President is endeavoring to persuade Congress to do something that will relieve the situation, but the outlook for his successful management of that collection of wild horses is not good. The United States is therefore threatened with something like civil war—a war between the mass of the people and a group of unions which have a strong grip on its arteries. These aristocrats of labor say in effect: "Grant our insatiable demands or we will throttle you."

It may be best to let there be a strike, to let the nation see whether a small part of the people is greater than the whole. It may be best to have a settlement of the position of union labor with respect to public utilities and necessities once for all. We do not believe that a strike will be so bad as has been pictured. Already the brotherhoods intimate that they will deign to let enough trains run to provision the United States troops and to carry milk to the babies all over the country. Obviously, they see already growing over them the shadow of the contempt of their fellow citizens, which will hang over them like a pall if they carry out the plan that they threaten.

"There's going to be a strike. That's certain. Let's have it. It will clear the air. And that's the only thing to do now," a railroad president declared on Aug. 29. "It will show the people of the country what is really going on in the industrial world." This terse statement summarizes the situation and the common opinion as we go to press.

*

The Copper Situation

The situation in copper becomes tighter and tighter. Although the mines are producing heavily, the refiners are short in their capacity and they do not seem to be able to increase it rapidly. Refining capacity is now the limiting factor. Not only is it shutting off the output of the mines, but also is it shutting off the reclaiming of a great deal of scrap copper that normally comes back from the rolling mills, wire-drawing mills, etc. A slightly ameliorating factor is the tendency of consumers of crude copper for the manufacture of bluestone, especially in Italy, to turn to the American market owing to their exclusion from the London market. This demand takes care of a considerable amount of American pig copper.

The refiners are making efforts to increase their capacity, but they are checked by the great delays in obtaining machinery and other equipment, the same condition obtaining here as in almost all other lines of construction at the present time. The copper refiners also suffer from the increasing independence of prosperous labor, which does not seem to want to work so hard as ordinarily, for what appears to it to be the excellent reason that it does not have to. This contributes to the restriction of the production of refined copper. In this connection it is to be remarked that the taking of copper by domestic manufacturers also has been restricted owing to similar causes.

During the last six weeks the copper market has experienced a complete reversal of form. Beginning in June there developed a great deal of pessimism in a good many quarters—banking, manufacturing, metal selling, etc.—and there was a widespread movement to anticipate the general decline that was believed to be impending. Manufacturers of copper goods, who found themselves temporarily over-bought with respect to their supply of raw material, appeared in the market as sellers of their surplus and were a disturbing factor. It is understood that some of these manufacturers, who thus disposed of copper that they already had on hand, have lately been buyers again at higher prices. Indeed, there has been a well-defined belief among producers that a good many manufacturers of copper were short in covering their requirements, and some of the recent urgent buying is attributed to that. Anyway, the present situation is that relatively little copper that the producers expect to turn out previous to the end of 1916 remains unsold. The foreign governments, which made very large purchases early in this year, contracted for deliveries only up to the end of the year, and the time is drawing near when they must buy for delivery in 1917 if they are going to buy at all. Conversations on this subject, between their representatives and the producers, have been going on for several weeks. A very large quantity of copper is known to be wanted. The delay in consummating the transaction appears to be only a matter of agreeing upon the price.

Iron and Steel in 1916

From time to time during the current year we have noted the fact that the blast furnaces of this country were making pig iron at the rate of 40,000,000 tons per year, approximately. This rate was never before reached, and its continuance seemed hardly possible. The half-yearly statement of the American Iron and Steel Association now informs us that the actual production for the half-year ended June 30 was 19,619,522 gross tons, or not far below the total indicated by the monthly reports of the furnaces. The gain over the first half of 1915 was 7,385,731 tons, or 60.4%, and over the second half of that year 1,937,100 tons, or 11%. Taking the half-year reported on with the second half of 1915, the production for the 12 months reached a total of 37,301,911 tons, which is by far the greatest ever reported for this country in a single year, but will in all probability be exceeded by that of the calendar year 1916 when that is completed.

The exceptional nature of the demand and business of the year is shown by the fact that the steel-company stacks made 70.7% of the total iron reported; 29.3% was merchant iron for sale, but of this a considerable quantity was basic and other steel-making irons. Apart from the heavy home demands, the extraordinary sales for export have been almost entirely of steel in finished or semifinished forms. Foundry and malleable iron fell to 18.1% of the total, while forge iron was almost a negligible quantity. Over four-fifths of the iron made went directly to the openhearth furnace or the bessemer converter. The same proportion seems likely to continue until the end of the year. The statement that 314 stacks were in blast on June 30 out of a total of 406 carried on the list shows that practically all or nearly all the available furnaces are active, the number out of blast covering only those that are necessarily under repairs and the smaller number that are still in existence, but are never likely to be blown in again, because of antiquated construction or equipment or because their situation forbids profitable operation except at the very highest range of prices.

We have noted before that the increase in producing capacity which has followed this year's boom has been rather unbalanced. The new capacity is mainly adapted for the production of semifinished steel. This has exceeded the new facilities for the manufacture of finished steel and is very considerably in excess of those for the making of pig iron. The number of new blast furnaces constructed has been comparatively few, and although several others have been started or projected, it will take some time before they are ready for work. No material increase in the rate of pig-iron production will be possible before the beginning of 1917, even if we allow for the better rate of output which usually comes with cold weather.

No official figures are available for the production of steel in the first half of this year, but considering all the conditions, there is little doubt that it was between 19,500,000 and 19,750,000 tons. This does not mean that all our pig iron was made into steel, but it implies that there was a large use of scrap in the openhearth furnaces. We know that the demand for heavy melting steel scrap has been active, and we also know that a great deal of steel—rails, shells and other finished work—was made under specifications that required heavy discards from ingots. These discards, with crop ends and other new scrap, undoubtedly went back into the steel furnace. To that extent they constitute a duplication that always exists, but was probably greater than usual this year. The actual quantity it is impossible to determine. The proportion of steel used is greater each year, owing to the declining use of wrought or puddled iron, and to the substitution of steel for many purposes where cast iron was formerly used. This is a banner year for steel, and it will continue to be so until its close. Whether 1917 will equal it depends upon conditions that it is now impossible to foresee.

As Mexico Is

The unhappy condition existing in Mexico is widely known and has given rise to a great deal of discussion in this country, most of which has been given a political twist. Our interest in that country is believed to be due to the large amount of our money invested there. No doubt this is true, and we believe it ought to be. Many of our supersensitive sentimentalists, however, object to that point of view. Let us discard, then, every possible effect of the Mexican internal conditions upon any outside nation and consider the pure facts of the case and how they affect Mexico and her people. Mexico is bankrupt. Her financial system is one in name only. There is no law, and murder can be, and is, committed with impunity. There is no real commerce, no transportation that can be depended upon, no law to which appeal may be made. The majority of the population desires peace, but cannot have it because a belligerent minority requires turbulence as the price of its easy living. It would be a fine thing if some great, unselfish statesman should appear among the Mexican people and succeed in establishing a just and able government, but Mexico is politically anæmic, and during the four years of revolution no man of ideals has appeared. The desire for peace is so strong in the country that three-quarters of the people desire intervention by the United States to put the nation in decent condition. That is not an empty statement, but one that can be substantiated by Mexicans and by many old residents of the country. Mexico is a house in disorder, dominated by a small clique of bullies who prosper on that disorder. The people are pleading for help—mutely, because it cannot be done openly. Was there ever any greater incentive for a benevolent government to perform a humane act than there is for ours to help Mexico?

BY THE WAY

An Ohio investor has written us inquiring about the value of his stock in the Mexican Mines Control Co. We do not know of a mining company by this name, but it sounds like a thinly disguised name for the Carranza government.

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The manifest of the "Deutchland," says the New York *Tribune*, as filed at the Baltimore Custom House, shows that on her return voyage to Bremen she carried a cargo made up as follows: Rubber, 802,037 lb.; nickel, 752,674 lb.; and tin, 181,049 lb.

⁂

It appears that Germany and Austria are contemplating a record purchase of copper. The Boston *News Bureau*, Aug. 12, 1916, notes that through certain representatives these countries are to effect record-breaking purchases of copper, probably the largest lot of metal ever handled in a single transaction. Estimates of inquiry ranged all the way from 250,000,000 to 500,000,000 lb. for delivery next year. Negotiations are understood to have reached the preliminary stage and to call for all metal available for export from this country in 1917, the copper to be stored here until after hostilities are concluded in Europe. It is to be shipped then to Germany, Austria and Turkey.

⁂

Here are some differences of opinion:

> "It seemed to me, in considering the subject matter of the controversy, that the whole spirit of the time and the preponderant evidence of recent economic experience spoke for the eight-hour day. It has been adjudged by the thought and experience of recent years a thing upon which society is justified in insisting as in the interest of health, efficiency, contentment, and a general increase of economic vigor." The President of the United States.
>
> "We do not assent to the statement that 'the eight-hour day now undoubtedly has the sanction of the judgment of society in its favor.' We believe that society has not yet recorded its judgment upon this subject." The Presidents of the railways of the United States.
>
> "We want to work as many hours as we please, but we demand to be paid on the basis of an eight-hour day." The Railway Brotherhoods.

There appears to be some doubt respecting the "sanction of society." Query: Do the railway presidents, the railway stockholders, and the railway men play any part in the constitution of society?

⁂

We lately came across an interesting prophecy in the preface to "Mexico of the Twenieth Century," by Percy F. Martin, published in 1907. Mr. Martin wrote:

> Another common supposition is that with the disappearance of Gen. Porfirio Diaz, either by reason of his voluntary retirement or other cause, the present condition of peace and prosperity must come to an end. This fear of collapse has been so frequently expressed, and always by individuals who, never having been in the country, can and do know nothing about it, that the world at large has come to believe it. There has seldom been perpetrated a more complete and foundationless error. While it is perfectly true that the new Mexico—Mexico of the twentieth century—owes practically everything to the long-sustained government of Porfirio Diaz, its regeneration as a nation, its rehabilitation as a power among the countries of the earth, and a force henceforth to be reckoned with, so thoroughly has this great soldier-statesman done his work, so well has he laid the foundations, built up the walls and roofed over the whole structure, that the fabric stands today self-suporting and indestructible, a living and a lasting monument to the man who built it, to his strength, his devotion and his intelligence. But Mexico is no longer in any need of a defender, nor is it now dependent upon its architect. He has built too soundly and permanently for that. Diaz may pass away, but while his name will never perish from record or recollection, his guiding hand can be dispensed with, and that without fear of untoward consequences.

Looking backward, we can pronounce Mr. Martin a distinguished failure as a prophet. There are many people who talk about what will happen in Mexico when times are normal again. They have no clear perception of things. Conditions in Mexico are normal now. They were abnormal in the peaceful times of Porfirio Diaz.

⁂

August Mining Dividends

Dividends disbursed in August, 1916, by 27 United States mining companies making public reports amount to $11,662,719, as compared with $3,637,387 in August, 1915. Iron, metallurgical and holding companies allied to mining paid $8,031,108 as compared with $18,191,785 a year ago. However, the large total of last year included the distribution by Amalgamated of $3.77 per share ($8,702,359) which was a return of capital rather than a dividend. Canadian and Mexican companies paid $1,907,963, as compared with $799,989 a year ago.

The following companies paid initial dividends in August: American Zinc, Lead and Smelting, preferred, First National Copper Co., Mass Consolidated Copper Co., South Hecla Mining Co., United Verde Extension, and Utah Metal and Tunnel Co.

The payment by the Colorado Fuel and Iron Co., preferred, covered back dividends and was the first paid on the stock since 1914. There are still unpaid accumulated dividends amounting to about 29 per cent.

United States Mining Companies	Situation	Per Share	Total
Am. Zinc, Lead and Sm., pfd., l.z	U. S.	$1.50	$144,840
Anaconda, c.	Mont.	2 00	4,662,500
Bunker Hill & Sullivan, l.s.	Ida.	50	163,500
Bunker Hill Con., g.	Calif.	02½	5,000
Caledonia, l.a.c.	Ida.	03	78,150
Champion, c.	Mich.	6 40	640,000
Chief Cons., s.g.l.	Utah	.05	44,148
First Nat. Cop., c.	Calif.	.25	150,000
Golden Cycle, g.	Colo.	.02	30,000
Hecla, l.s.	Ida.	.15	150,000
Homestake, g.	S. D.	.65	163,254
Jim Butler, g.s.	Nev.	.10	171,802
Mass Cons., c.	Mich.	1.00	100,000
Miami, c.	Ariz.	1.50	1,120,671
Mohawk, c.	Mich.	10 00	1,000,000
New Jersey Zinc.	U. S.	4.00	1,400,000
Pacific Mines Corpn., g.	Calif.	.02	12,840
Plymouth Cons., g	Calif.	24	58,520
Socorro, g.	N. M.	05	18,865
So. Hecla, l.s	Ida.	15	39,300
Tamarack & Custer	Ida.	02	35,530
United Verde, c.	Ariz.	1 50	450,000
United Verde Ext., c.	Ariz.	.50	525,000
Utah Metal and Tunnel	Utah	50	342,749
White Knob Cop., pfd.	Calif.	.10	20,000
Wilbert, l.s.	Utah	.01	10,000
Yellow Pine, l.z.s.	Nev.	.10	100,000
Iron, Metallurgical and Holding Companies	**Situation**	**Per Share**	**Total**
Cambria Steel	U. S	.62½	$562,500
Colo. Fuel & Iron, pfd.	Colo.	30 00	600,000
Dominion Steel, pfd.	Can.	1.50	105,000
Internat. Nickel, pfd.	U. S.	1 50	133,689
St. Mary's Min Land	Mich.	2 00	320,000
U. S. Steel Corpn., pfd.	U. S.	1 75	6,304,919
Canadian and Mexican Companies	**Situation**	**Per Share**	**Total**
Amparo, g.s.	Mex.	$0 05	$100,000
Coniagas, s.	Ont.	25	200,000
Granby Cons., c.	B. C.	2.00	299,970
Greene Cananea, c.	Mex.	2 00	976,828
Hollinger, g.	Ont.	.05	120,000
Rambler-Cariboo.	B. C.	.01	17,500
Seneca-Superior, s.	Ont.	.30	143,665
Standard Silver Lead, l.s.	B C.	02½	50,000

The totals for the first eight months of the year are as follows: Mining companies, $108,196,603, as against $40,410,582 in 1915; iron, metallurgical and holding companies, $66,397,367, as against $54,825,758 in 1915; Canadian and Mexican mines, $14,538,562, as against $5,297,740 in 1915. The accompanying table shows details of the month's payments.

How Railroads Earn a Dollar and How They Spend It*

Of every dollar earned by the railroads of the United States in 1915 just 69.47c. came from freight they carried. Passenger service, including the revenue from express and mails, furnished 26.54c., and 3.99c. was received from other sources, such as securities they held.

The 69.47c. received from freight operation was contributed in this proportion: Transportation of the products of mines brought in 23.86c., transportation of manufactures yielded 15.10c., carrying farm produce, 11.72c., products of forests, 7c.; animal products, 4.15c.; other merchandise, 1.32c.; miscellaneous freight, 3.32c.

The 26.54c. received from the passenger service consisted of 22.20c. in passenger fares, 2.37c. received for carrying express matter and 1.97c. for carrying mail.

Of every dollar spent by the railroads of the United States in 1915 just 43.20c. went to pay the wages of labor. Material for way and equipment, supplies and other expenses of upkeep cost 16.90c. Fuel and locomotive supplies took 8.12c. Loss and damages absorbed 2.22c. and 4.72c. went to pay taxes. All these items constitute what are known as operating expenses. It will be seen that they took 75.16c. of every dollar the railroads earned.

There remains of the dollar earned in 1915 by the railroads 24.84c. Of this 14.79c. went to pay interest on funded and unfunded debt, 3.97c. was paid out in rent for tracks under lease, 5c. was set aside for dividends and surplus. The tiniest item of all was the 1.08c. left of the dollar and spent for betterments.

Experts say that when operating expenses take more than 70c. of the railroads' dollar, the outlook for the roads is not bright. Last year 75.16c. of every dollar earned was spent on operating expenses.

These are the facts of railway earnings and spendings in 1915. The most significant fact to many will appear to be labor's big slice of the railroads' dollar. The fact that labor gets 43.20c. of every dollar earned by the roads is of the utmost importance in considering the justice of the demands now made by railway employees in train service. They are asking that their present day's wages be paid them for eight hours' work instead of 10 hours. At the very least this means a 25% increase in the pay of these men. The startling possibilities of increase if the men get a day's wage for eight hours' work have been well shown in the following illustration:

> Suppose an engineer who now makes his run in 10 hours is paid $5.60, or 56c. an hour; under the proposed plan he would get $5.60 for eight hours, or 70c. an hour, and overtime at $1.05 an hour for two hours. His total compensation would, therefore, be $7.70 if he worked 10 hours, an increase of 37½%. Suppose his train was delayed and the run took 12 hours. On the existing basis of wages he would receive $5.60 for 10 hours and overtime for the extra two hours at the same rate, making his overtime $1.12 and his total pay $6.72. Under the proposed arrangement he would receive $5.60 for eight hours, or 70c. an hour, an increase of 25% an hour, and overtime on a time-and-a-half basis, amounting to $1.05 an hour, an increase in the overtime rate an hour of 87½ per cent. As he would receive overtime for four hours instead of two, his total pay for overtime would be $4.20, an increase in it of almost 300 per cent., making his total day's wages $9.80, an increase of 45%.

The freight engineer in question, then, stands to gain a wage increase of 25 to 45% if the unions achieve their full object. Is such an increase fair, in view of the analysis of railroad expenses given at the outset of this article? Is not a 25 to 45% raise a pretty big jump to make all at once in any wage scale?

The Government has fastened upon the railroads and compelled them to submit every question of rates, which alone determine their earnings, to the arbitrament of the Interstate Commerce Commission. But the Government does not compel the railroad workers to submit their demands to any such arbitrament. Arbitration of railroad claims by other tribunals is unsatisfactory because the Interstate Commerce Commission, and that body alone, is in possession of all the facts about railway affairs. And only on the basis of these facts can a proper decision as to the justice of labor's claims be arrived at.

If the railroads must submit to the rates imposed by the Interstate Commerce Commission, should not the railroad workers be required to submit to the wage rates decided upon by the same body? If it is proper to tell the railroads just how much they shall earn, is it not proper to tell the railway men just what share of those earnings they shall receive?

It will be seen that however much one may sympathize with the desire of the railway men for better pay or better hours, if train operation can be remolded to give them better hours, their problem is only one part of the present difficulties of the railroads of this country. The solution of these difficulties will certainly do as much as anything to determine the fate of Government regulation of public utilities in the United States.

Aiming to refute a statement issued by the railroad brotherhoods to the effect that the ownership of the railroads of the United States is centralized in a few hands, C. H. Markham, president of the Illinois Central Ry., a member of the railway executives' advisory committee, declared:

> Some of the newspapers published a statement issued by the brotherhoods seeking to show that the railroads of the United States are owned by a few large investors. This is a marked instance of inaccurate generalization. It is stated that "to a very considerable extent the stock of the American railroads is owned by the railroads themselves," and the Pennsylvania R.R. is mentioned as the owner of stock in several hundred subsidiary companies and other railroads.
>
> This is true, and in the total of 622,000 stockholders shown by the reports of the railways to the Interstate Commerce Commission for 1914 undoubtedly there are many duplications of this condition, which, however, do not affect the result to any great extent.
>
> Investigations made by our committee show that in the returns for 1915, however, most of these duplications are shown and it is possible to ascertain to what extent railway stock is held by railway companies and by the public.
>
> In 1915 the total capital stock of $8,638,000,000 was held by 626,122 stockholders with an average holding of $13,796 each. For all roads with gross earnings of over $1,000,000 the commission has required a report in each case of the names and holdings of the twenty largest stockholders, which will include in most cases the intercorporate holdings.
>
> This has made it possible to separate the stock holdings of railway corporations from those of individuals. Of the 608,318 stockholders in roads of this class 688 are found to be railway corporations, leaving 607,630, most of whom are individuals with an average holding of $9,882 par value each.
>
> While this number undoubtedly includes individuals who own stock in more than one railway, it also includes brokers who hold in one name stock in a single railway for the account of several different individuals. In such cases the number of actual owners of the stock is substantially understated. Also stock frequently stands in the name of an executor or trustee for the benefit of a number of individuals, which leads to another understatement.
>
> Instead of railway stock being held by a comparatively few persons in Wall Street, as is often claimed, the bulk of such securities is held by small investors outnumbering the members of the train-service brotherhoods who are now threatening to tie up the roads, by two to one.

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*From the New York "Sun."

PERSONALS

O. B. Perry has gone to Dawson and other points in the Yukon.

George A. Laird arrived recently in San Francisco from Australia.

W. H. Moore, late at Black Diamond, Wash., is now at Los Angeles, California.

G. L. Sheldon, of Ely, Nev., has been examining mining property in San Bernardino County, California.

D. McBride, late with the New York & Honduras Rosario Mining Co. at San Juancito, Honduras, is now at Greensburg, Penn.

A. G. de Golyer, formerly of New York, has been appointed general manager of the Vernon Mining Co., at Ironton, Colo.

W. C. Thomas, of California, formerly with Samuel Newhouse, of Salt Lake, is now in Arizona examining and reporting on mines.

H. E. T. Haultain has been at Jewel, Ont., in the Craigmont corundum district, in connection with the erection of a new corundum mill.

Alex. Chisholm, formerly at the Anvil, has been made assistant superintendent at the Newport mine in Ironwood, the change being an advance.

Charles F. O. Merriam, of Wallace, Idaho, was at Nelson, B. C., last month examining and reporting on the Granite-Poorman group of gold mines.

William D. Manchester, of Rocky Hill, Conn., has been appointed superintendent of the crushing department of the Chile Exploration Co. at Chuquicamata, Chile.

Harrison A. Dunn, who has been imprisoned in Mexico City, was released on Aug. 21 and left at once for Vera Cruz. Mr. Dunn is expected to arrive in New York very soon.

Charles L. Harrington, formerly superintendent of the American Rare Metals Co., is now manager of the Overall Mining Co. His present address is Dove Creek, Colo.

Charles T. Kirk, state geologist of New Mexico, has returned to Albuquerque from various trips over New Mexico, to the Mid-Continent oil field and to Yavapai County, Ariz.

Lieut. Percy E. Barbour, 22nd New York Engineers, managing editor of the "Engineering and Mining Journal," on leave, is editing the "Rio Grande Rattler," published in camp on the Mexican border.

Arthur E. Woolsey, formerly manager of the Tata Iron & Steel Co.'s steel works at Sakchi, India, who returned to the United States some months ago, has become manager of the plant of the Anniston Steel Co. at Anniston, Ala.

Arthur Hedner has resigned his position as mining captain at the East Norrie mines of the Oliver Iron Mining Co., near Ironwood, Mich. He has taken a position as superintendent of the Anvil mine of the Newport Mining Co. at Bessemer.

Dr. D. B. Dowling, of the Department of Mines, Ottawa, has gone to Lethbridge, Alberta. He will endeavor to find an artesian water supply in southeastern Alberta. Three wells will be drilled in an area examined by Dr. Dowling last year.

H. A. Guess, managing director of the mining department of the American Smelting and Refining Co., has been elected a director of the New York & Honduras Rosario Mining Co. He is an additional director, the number of the board having been increased.

J. H. Risque has resigned his position as manager of the Tennessee Copper Co. and **N. H. Emmons** 2nd, has been appointed to the position. On account of this change, Mr. Emmons has resigned his position as secretary of the company and his address is now Copperhill, Tenn.

T. H. Jenks, who has been making his headquarters in Oatman, Ariz., for several months, has returned from a trip to Pittsburgh and New York, and is now examining copper properties near Las Vegas, N. M. He will then go to Wickenburg, Ariz., which will be his headquarters in the future.

Norman C. Stines has renewed his contract for three years with the same company with which he has been for the past three years, and has returned to Polevskoj, Government of Perm, Russia, to open up several prospects, besides managing the copper mines already developed under his management on the Sissert Estate. A shortage of men has made it necessary for him to work women in the mines, at times.

OBITUARY

Robert Strain, Jr., of Silver City, N. M., was killed Aug. 13 at the mill of the Burro Mountain Copper Co. by the overturning on him of a bucket of cresylic acid. He was 24 years old and graduated from Princeton two years ago, entering the Burro Mountain mill soon after.

William Watson Lawrence, a well known figure in New York's business world, died, Aug. 29, at his home, in that city. Mr. Lawrence was president of the National Lead Co. and was a director in the Assurance Co. of America, the Magnus Co., Inc., the Matheson Lead Co., the Seaboard National Bank and the United Lead Co. He was born in Huntington, Penn., Apr. 22, 1859, and was graduated from Princeton in 1878. His clubs were the University, Metropolitan, Riding, Automobile of America, Princeton, Westchester County, Duquesne (Pittsburg) and Maryland (Baltimore).

John Noey, aged 66, one of the oldest employees and also one of the oldest department superintendents at Andrew Carnegie's original steel plant, the Edgar Thomson Steel Works, Braddock, one of Mr. Carnegie's "junior partners," and widely known in the iron and steel business, died Aug. 23 at Pittsburgh. He was born in Johnstown in June, 1850, a son of John Noey, Sr., his father being one of the pioneer employees of the old Cambria Iron plant at Johnstown. He was a protege of the late Capt. William R. Jones. Mr. Noey had held the position of superintendent of boilers and of motive power at the Thomson Steel Works and blast furnaces for 42 years. He leaves a widow, two sons and two daughters.

SOCIETIES

Lake Superior Mining Institute—Secretary A. J. Yungbluth has announced that the 21st annual meeting will be held in Birmingham, Ala., Mar. 13 to 17, 1917. There will be no meeting this year because the mining men are too busy getting out ore to keep the furnaces going. The Institute members will assemble in Chicago and travel by special train to Birmingham, where five days will be spent looking over the mines and mills. The members of the Institute in the Birmingham district have promised that everything possible will be done for the entertainment of the visitors. The council of the Institute has voted the sum of $1,000 to aid in defraying the transportation expenses of the trip. It is believed that about 150 of the members will go south with the party. Many plan to remain in that section for several weeks, while some are figuring on a trip to Panama.

American Chemical Society—Official announcement of the meeting of the society, to be held in New York, Sept. 25 to 30, in conjunction with the Second National Exposition of Chemical Industries, was issued to the members by Dr. Charles L. Parsons, secretary, on Aug. 15. Dr. Charles H. Herty, of the University of North Carolina, president, will open the exposition on Sept. 25, with an address reviewing the history of chemistry and the chemical industries in this country and outlining developments since the outbreak of war in Europe. The presidents of coöperating societies, such as the American Electrochemical Society, the American Institute of Mining Engineers and the American Paper and Pulp Association will follow Dr. Herty with speeches of welcome and reviewing the progress made in the industries represented by them. The first general session of the American Chemical Society will open at Columbia University on Tuesday morning, Sept. 26, and arrangements are being perfected for a public meeting in the large hall of the College of the City of New York on Tuesday afternoon when addresses will be made of general public interest pertaining to the interesting developments in the field of applied chemistry during recent years. The program of the week's meetings will provide for general conferences on subjects in which the chemists of the country are now interested and it is intended that the lecture hall of the Grand Central Palace and Rumford Hall in the Chemists Club building will be occupied each afternoon at the same time by one or other of the different divisions of the society for the discussion of industrial topics. The American Electrochemical Society has planned a series of interesting meetings. The electrochemical group will open its meeting, Sept. 28, with a technical session devoted to a review of American progress in the electrochemical industry. A complimentary smoker will be held on Thursday evening and on Friday evening there will be a joint banquet at the Waldorf-Astoria.

Editorial Correspondence

SAN FRANCISCO—Aug. 23

Uniform Mine Taxation in the several counties of California is under consideration by the California Metal Producers' Association. A tentative plan has been prepared and informally discussed in a conference of the association with the State Tax Commission. But no action has been taken by either the association or the commission. Further consideration will be given the subject by the association committee and another conference held probably before direct action is taken by either body. The necessity for such a law is apparent. Producers operating in two or more counties are subjected to methods in one county entirely different to the methods in the others. It is not a difference in politics, but purely a difference in the individual notions of the assessors, who are governed by no fixed law in making assessments. There is probably no industry in the state that is subject to such irregularity and even unfairness as mining; and certainly there is none in which there is greater lack of uniformity in the taxing system.

Development of Minerals on Railroad Lands in Shasta, Siskiyou and Trinity Counties may be made possible as a result of the campaign in progress by the Northern California Counties Association to open to prospectors 1,300,000 acres of railroad land. Heretofore the prospector could only go on the land and prospect and develop minerals and metals by agreeing to pay to the Southern Pacific 15% of the gross product or buy the land at a price to be fixed by the railroad-company appraiser after the land was developed by the prospector. The improbability of profit to the prospector under such arrangement is obvious. The association of counties has succeeded after a long time in making it plain to the railroad company that the development of railroad lands will never be undertaken by mining men under these circumstances. Discussion of the legal or moral rights of the Southern Pacific or any other railroad company to hold these lands beyond the reach of the miner is not at present worth while. The railroads do hold the lands and evidently if the miner does not accept the railroad terms, he will have to keep off the railroad lands. The Southern Pacific land department has offered what is termed a concession to the prospectors in the three counties named. This offer provides that anyone discovering mineral, or having any reason to believe there is any mineral on any of the patented lands of the railroad, can obtain the right to operate in one of three ways: (1) Purchase outright for cash at a price which the railroad company will fix after examination and based upon showing of mineral, or the company will issue a short-time contract permitting mining until the contract is paid in full, a percentage of the value of mineral taken out to be credited on account of the unpaid part of the purchase price; (2) leasing for three years with renewal privilege each year, the amount of the same to be deducted from royalties; (3) leasing with purchase option at stated price. It is possible that the association will ultimately secure a wholly satisfactory arrangement with the railroad, but the miner is not likely to get much if the railroad company insists upon fixing the price after the prospect is opened, as suggested in the first method.

BUTTE—Aug. 24

Active Development at Davis-Daly mines is again in progress and increased production would have been accomplished by now had the new hoisting engine been delivered as scheduled. This is being delayed by a strike among the iron workers at Milwaukee. Everything is in readiness the moment the new engine arrives to put it into place and make the connections with the gallows frame. The new hoist will be operated by steam and will be able to handle ores down to the 4,000-ft. level. It is estimated that when it is running, production can be increased from the present output of approximately 175 tons of ore per day to from 400 or 500 tons per day. In the Colorado mine ore is being hoisted from the 1,400- and 1,500-ft. levels and from the 2,500. The second-class ore is running about 3½% and the first-class ore about 7% copper. While the last quarterly report showed a deficit of $18,000 due to expense of development work, the report for July is understood to show on the right side of the ledger. The indebtedness incurred for the new engine and for the development work now under way will be quickly taken care of by an increase in ore output.

Butte Miners Are Well Satisfied with the treatment they have received at the hands of the mining companies and the lesson learned, since the inter-union troubles, that they are better off without a union. They are cautious and suspicious now of anything that smacks of unionism. James Lord, president of the mining department of the American Federation of Labor, on his return from the recent labor convention at Great Falls, stopped in Butte to discuss unionism with Butte miners. He favored the open-forum plan by which men of each mine work out their own destiny in local affairs. There would be a local due and the local members would control their own finances. The local would correspond to a city. The next higher administrative body would be the district organization to control the affairs of the whole district. The final administrative power would be the national organization which could not, however, interfere with local affairs. Whether the Butte miners are ready to adopt such or any other plan for forming a new union, is doubtful. It will take some time to convince them that any benefit could accrue to them from such a step. Their experience in past years of being mercilessly fleeced of their hard earnings by the Western Federation of Miners without ever receiving anything in return for their sacrifices has made too deep an impression to be wiped out by any glowing promises on the part of another labor leader. The fact that since the breaking up of the local union the men have received the same and better wages than ever without being compelled to support a horde of agitators, will make them think long and hard before they will willingly submit again to such tyranny. Mr. Lord, by the way, was one of the speakers at the assembly in Miners' Union hall at Butte in June, 1914, which broke up in a riot and ended in the dynamiting of the property with the intent of ending the régime of Moyer and his henchmen.

DENVER—Aug. 24

State Compensation Insurance Fund completed its first year of business on July 30, 1916. Up to June 30, the metal mines insured in the Fund paid premiums amounting to $62,963. An amount equal to 12 per cent. of the premiums paid, or $7,555, has been credited to the next premiums, indicating a net cost of $55,407 for the 11 months of insurance. It is figured that the same operators would have paid $76,009 for this insurance at stock-company rates, and that the difference of $20,601 represents the saving made by the operators insured in the fund. This saving is about 27% of the cost of stock-company insurance. Ten per cent. of the premiums has been contributed to the surplus of the Fund according to the law. The Fund has become one of the large carriers of compensation insurance in the state. Up to June 30, it had collected $120,542 in premiums, of which $86,052 was from private business concerns. Accidents to employees covered by State Fund policies total 650 up to July 1, 1916. Twelve of these accidents resulted in death. It is estimated that the total yearly compensation premiums in Colorado are about $800,000, of which about $250,000 represents premiums paid by coal-mine operators. The annual compensation premiums in Colorado, exclusive of the coal industry, are about $550,000, of which total the Fund has secured about 18 per cent.

SALT LAKE CITY—Aug. 24

Reorganization of Ohio Copper by bondholders is causing some dissatisfaction among former shareholders, who feel that they are entitled to more consideration than is to be given them under the proposed plan. The only recognition that Ohio shareholders get under this arrangement is the right to subscribe to bonds of the proposed new company at par. Sale of the mining property is to take place on Aug. 29 at the Salt Lake County courthouse.

Tintic Milling Co., at Silver City, is installing eight new roasters, and the enlarged plant should be in operation by October. Three Holt-Dern roasters have been in successful operation for some time, and the new roasters are of the same type. The fourth shipment of precipitates—valued at approximately $24,000—has been marketed from a partial cleanup of the mill. Operations are much smoother than heretofore. The mill is now treating daily 100 tons of low-grade siliceous ores from the Tintic district, and when the roaster installation is complete, the capacity will be brought up to 300 tons. The new roasters will replace the

Knight-Christensen type, which formed part of the earlier equipment. When the plant is working at capacity, the cost of operation will be materially reduced.

The Metal Output of Utah Mines for 1916 will break all previous records, as indicated by preliminary reports for the first six months. There will be a decided increase in copper, silver and lead. Zinc production from sulphide concentrate, and oxidized and sulphide ores, will not largely exceed the 1915 output, which amounted to 22,000,000 lb. of zinc. The gold production is not expected to increase to any great extent. Practically all of the lead-silver mines are producing a much larger tonnage than before. The year's output of lead from Utah in 1915 was 199,967,347 lb. More silver will be produced from the Bingham district, as the lead output from here will break all former records. Park City is also producing at more than the usual output. The new mills that have recently started treating tailings in that district will add to the production. Zinc ore is being mined in Park City, Bingham, Tintic, Promontory, Ophir and Dry Cañon. The copper production of the state it is believed will be approximately 225,000,000 lb., if the present production is maintained. Practically all the copper mines are working at capacity, and the Utah Copper is making improvements and additions at its mills. The smelters are well stocked with copper ores, and it is difficult to market some ores of this class not contracted for. With the increased rate of production and higher price of the metal, the value of the copper output will probably be nearly double that of 1915.

OATMAN, ARIZ.—Aug. 25

Rumors of Consolidations still persist and while no official news is given out, it is certain that additional holdings are being secured by important mining interests. Control of the Sunnyside and also of the Oatman Queen has lately been acquired by leading stockholders of the United Eastern. The Keith interests, who have been developing the Oatman Pioneer, have also been extending their holdings and the fact that these strong operators are increasing their interest in the district is regarded locally as the best evidence that the camp is to warrant permanent attention of the mining industry. Energetic development is now assured for a number of properties and this work will stimulate further independent development. [Later—Jumbo Extension Mining Co. of Goldfield, Nev., has optioned the Oatman United and United Southern in the Oatman district and the Secret Pass Gold Top in the Secret Pass district.]

ALBUQUERQUE, N. M.—Aug. 23

The Carocito Copper District, about 50 mi. southeast of Albuquerque, is attracting attention. Shipments from this district near Scholle, a station on the Santa Fe, are increasing in tonnage and value. These bedded deposits differ from most Western copper deposits of this type in that the half-dozen enriched horizons are mainly limey shale, and not sandstone. The ore is therefore easily crushed and usually contains excess lime. The beds are generally about 10 in. thick—varying from 3 to 25 in.—there being half a dozen such within a 100-ft. thickness. They have a slight inclination eastward—away from the Manzano Mountains—but evidently the copper has no genetic connection with the Manzano uplift. The copper showings run along a cliff for at least 10 mi., while the best prospecting area covers about 10 sq.mi. Nearly all the prospects are in hand-cobbing ore near the surface, but one has reached a depth of 72 ft. The last 61 ft. of this vertical shaft is in ore running above 7%—some of it 9½%—by carload lots. The ore is mainly malachite at the top, but grades into much azurite below, and is dominantly copper glance at the 72-ft. level.

AUSTIN, TEX.—Aug. 23

Ozocerite, and not paraffin, is reported by Dr. E. P. Schoch, professor of chemistry, University of Texas, to be the substance which drillers of the Thrall oil field complained sealed up the well-screens and prevented the flow of oil. Tons of this valuable material have gone to waste in the Thrall field since the beginning, it having been used to cover pipes crossing the roads, as fuel, and in other ways destroyed. The production of this material in the Thrall field is small now, since most of the wells have been exhausted.

Texas Has 87,367 Sq.Mi. of Undeveloped Land, on which no reports of a geologic nature have been published, according to Dr. J. A. Udden, director of the bureau of economic geology, University of Texas. The bureau is now undertaking a thorough study of the unmapped portions of the state—nearly one-third its area—with a view to accumulating data necessary to an adequate economic investigation of the whole state. Prof. F. L. Whitney and James P. Nash, testing engineer for the bureau, have just completed a survey of Hays County, noting the formations, the nature of the fault zones, the well records, etc. They are also locating road material, building stone, cement material, as well as clay suitable to the making of brick. Other counties will be undertaken during the year. During the last few years the bureau has made extensive observations in some of the territory, upon which there is as yet no published report, for the purpose of sufficiently reconnoitering the ground to secure the data necessary for a preliminary general map of Texas. Some of the unknown part of the state is being mapped by the U. S. Geological Survey. These data will be incorporated shortly in the general map and description of the geology of Texas, now in preparation by the bureau of economic geology.

JOPLIN, MO.—Aug. 26

The Labor Trouble Bogey is looming up again. The average basis price for the month of August was only $58.75, which indicates another 25-cent. cut in wages. This brings the machine man down to $3 a day, whereas four months ago he was getting $4.25. Wages for other workers are in proportion, and there are rumors that the men are planning to stand out against this latest cut. The fact that producers are considering a shutdown may have a helpful effect.

A Surplus of 23,000 Tons of Zinc Ore in the Joplin district is the finding of special representatives of the mine operators and owners represented in the Southwest Missouri Mine Safety and Sanitation Association. To this should be added about 2,000 tons of calamine being held in the Arkansas section. Following this report officials of the mine operators' association called a special meeting of operators and owners to be held Monday afternoon, Aug. 28, and the announcement contains this statement: "Owing to the large surplus of ore in the bins throughout the district, there is a very general sentiment in favor of a shut-down until this surplus is removed or considerably diminished."

TORONTO—Aug. 26

Further Destructive Bush Fires prevailed in northern Ontario during the early part of the week, sweeping over a large area of wooded country along the route of the Temiskaming & Northern Ontario Ry. and destroying many homesteads and at least 12 lives. The plant of the Casey Cobalt mine was burned.

"Embargo on Nickel" is the "sounding brass and tinkling cymbal" with which the Liberal party is expecting to win over the people of Ontario. This slogan has a patriotic flavor and all the extraordinary circumstances of the present period have fitted in capitally with the plans of the Liberal leaders to make the campaign on these grounds, as the popular mind does not stop to consider the facts nor that the local, Dominion and British governments adopted the only practical and efficient means of securing the supplies of nickel needed by Great Britain and her Allies during the present war. The success of the Liberal leaders in steering public opinion is clearly indicated in the by-election for the Ontario Legislature in the southwestern division of Toronto on Aug. 21. This constituency, always strongly Conservative, gave a majority of 663 for Hartley Dewart, the Liberal candidate, who made the refining of all nickel in Canada the principal plank in his platform, and assailed the policy of the Canadian and Ontario governments in the strongest terms. The tone of the press demanding an embargo on nickel ore grows more pronounced every day, feeling being intensified by the report of the safe arrival of the "Deutschland" and her cargo in Germany, and the prospect of further supplies of nickel being shipped to the enemy by submarines.

Labor in Canada is becoming a serious problem and from present indications it is not likely to improve to any great extent. A change in the recruiting system has been made by the Canadian government. This is a species of registration, recently authorized by an order in council, and is probably intended to be a palliative measure, but as it is only a system of issuing badges to men who are physically disqualified, or who are engaged in some necessary occupation, it will not relieve matters to any extent. This registration is a preparation for more strenuous recruiting without disturbing the necessary industries. The shortage of labor is felt in almost every industry, and is particularly noticeable in northern Ontario in the different mining camps. In Porcupine the shortage is making itself felt acutely and some of the smaller properties that are not very well organized find it impossible to get men. The shortage is, of course, due to the war, and to the large number of men that have gone to the front. The number of alien enemies that have been sent to the detention camps is also a contributing factor. It is probable that little relief will be experienced until after the war, and until that time the operators are faced with an inferior class of workmen, a serious shortage, and an undercurrent of unrest on account of the wage question. The commission appointed by the Canadian Department of Labor to investigate the differences between the miners and mine operators of Cobalt consists of Judge Coatsworth, Toronto: A. F. Corkill, Copper Cliff, and Joseph Gibbons, Toronto.

The Mining News

ALABAMA

NOE-AXTON (Pyriton)—This newly organized company will erect 100-ton graphite mill.

ARIZONA

Cochise County

PEABODY CONSOLIDATED (Johnson)—This pioneer copper mine of the Johnson district is installing new hoist, compressor and drills to sink to greater depth. Mine opened about 25 years ago. Carbonate ore still being shipped but sulphide ore will now be sought. Incline shaft only 350 ft. deep. Shipping 2 or 3 cars weekly of 6 to 7% copper ore; silver 3 oz. W. G. Eberhardt, superintendent.

Mohave County

OATMAN GOLD (Oatman)—Company reports west drift in 330 ft. on 500 level; oreshoot 3 ft. wide assaying $14.50.

ESPERANZA (Oatman)—Active development started at this property. Outcrop traceable over a mile. Surface assays show gold.

LEXINGTON ARIZONA (Oatman)—At 126 ft. on the incline (about 110 ft. vertical) a crosscut was run through the vein of which 2½ ft. along foot wall was good ore. Woods brothers, of Colorado Springs, Colo., are interested.

Maricopa County

REID & DEVINE (Aguila)—West Bros. recently shipped carload of copper ore from these claims in Harqua Hala mountains.

GILA COUNTY CINNIBAR MINING (Phoenix)—Company developing recently purchased claims in Mazatzal Mountains. A 30-ton furnace contemplated.

PARADISE GOLD (Phoenix)—Company sinking new shaft; good milling ore recently encountered; mine 23 mi. from Phoenix in McDowell Mountains.

Santa Cruz County

DUQUESNE MINING AND REDUCTION (Duquesne)—Second unit of flotation plant will be completed in September, giving capacity of 150 tons daily.

Yuma County

SHAMROCK (Vicksburg)—Installing surface equipment purchased from Furlough Development Co. of Wickenburg.

CALIFORNIA

Amador County

AMADOR STAR (Plymouth)—Formerly known as the Rhetta; being developed by stockholders of the Argonaut. Vertical shaft about 500 ft. deep; at that point a crosscut will be run to the Rhetta ledge. Baylies Clark, superintendent.

PLYMOUTH CONSOLIDATED (Plymouth)—One drum of new hoist, weighing 13 tons, hauled from railroad station at Carbondale by 12-horse team.

Calaveras County

ROUGH DIAMOND (Angels)—Rich gravel reported at this mine on Central Hill channel. Shaft 62 ft. deep. L. J. Hutchinson and David Bard, owners.

STAR & EXCELSIOR (San Andreas)—Reported that W. N. Nuner has sold this copper mine to Eastern men for $35,000.

BUTTE DREDGING CO. (Murphy)—May install dredge near old town of Douglas Flat.

CALAVERAS COPPER CO. (Copperopolis)—S. M. Levy, manager, quoted as saying that flotation plant will be doubled, bringing capacity to 500 tons daily. Equipment will include 8-ft. Hardinge mill, 20-ft. Dorr thickener, 11 pneumatic-flotation cells and one 11.5-ft. Oliver filter. It is stated that concentrate from old method of treatment was never higher than 6% to 8% copper, while flotation has yielded a 15% product. New 3-compartment shaft completed to sixth level. New machine shop and rock crusher installed. Crushing plant will be able to handle 1,500 tons in 24 hr.

WESTERN MINES CORPORATION (37 Wall St., New York)—Issuing $600,000 convertible bonds to finance mining and developing operations in California. Officers are Maj. H. S. Howland, D C. Demarest A. F. Hughes, John Landers, A. J. Harwood, of California, and W. D. Wright and Joseph Diehl Fackenthal, of New York. Will operate the old Gwin mine in Calaveras County; develop further the Sierra Mines in Jim Crow Cañon, 4½ mi. from Downieville in Sierra County; and prospect a large low-grade deposit in Inyo County. A. F. Hughes, consulting engineer, will have headquarters at the Gwin mine, Fosteria, Calif.

Eldorado County

RISING HOPE (Placerville)—Ingersoll-Rand 10x10-in. air compressor and drills being installed on this deep-gravel mine on Webber Creek. Working tunnel to be driven. George W. Engelhardt, manager. Schuyler N. Warren, of 51 Exchange Place, New York, and associates, owners.

Nevada County

CHROME DEPOSITS in Lime Kiln and Wolf districts are now reported less extensive than first believed. Shipments from Bear River district also below estimates.

GOLDEN GATE (Grass Valley)—Reconstruction begun June 20 is completed and test runs made on tungsten ore. Capacity 60 tons in 12 hr. Ore will be shipped to mill from other counties. A 700-ft. tramway has been built to transport ore from railroad to hoist and thence to the mill.

Sierra County

ON SLATE CREEK, near Scales, dèbris dam of 4,000,000 cu.yd. capacity is under construction by Los Angeles men. In addition to their own hydraulic operations, will sell water and impound tailings of other mines. Karl Brehme in charge.

SIXTEEN-TO-ONE (Alleghany)—Injunction granted restraining Twenty-One Mining Co. from extracting ore from stope alleged to have been broken into on Sixteen-to-One ledge. Suit also filed for $100,000 damages for ore mined.

CITY OF SIX (Downieville)—On Alleghany-Downieville serpentine belt. Crosscut tunnel being run to tap payshoot 60 ft. below present shaft. Present 1,300-ft. lower tunnel may be extended. Hodgkinson & Henderson, of Los Angeles, owners. Sol Camp, in charge.

Trinity County

CHROME DEPOSITS owned by Henry Sims near Chinese station will be worked by S. W. Winsor under five-year lease.

RICH GRAVEL DEPOSITS reported on Emigrant Creek in New River district by A. F. Vincent and wife. Several good-sized nuggets have been taken out.

SURVEYS ON SOUTH FORK OF TRINITY RIVER up Hayfork Creek are being made, believed to be preliminary to railroad construction. State Highway Commission has surveyors in same region.

MANGANESE CO. (Wildwood, via. Beegum)—Second 5-ton motor truck hauling chrome ore from mines to Redding.

PAULSEN RANCH (Lewiston)—A reconstructed 5-cu.ft. bucket-elevator dredge is to be installed on Trinity River by the Trinity Star Dredging Co. Fred Paulsen, owner of the ranch, is a director.

McCORMICK (Jacksonville)—Preparations for reopening property. Compressor and drills will be installed. Huntington mill being overhauled and electric power will be substituted for gasoline.

COLORADO

Boulder County

LOGAN (Boulder)—High-grade gold ore opened in 400-ft. level by the Lucky Seven Leasing Co.

FAIRFAX (Salina)—The 300-ft. shaft being sunk 100 ft. Under lease to O. W. Kulp and Charles Walstrum.

YELLOW PINE (Boulder)—Rich silver ore in Vancleuse vein. Vein 3 ft. wide; ore runs about $100 a ton.

INTERMOUNTAIN TUNGSTEN MILLING CO. (Salina)—Mill nearing completion. Equipment includes rolls, jigs and tables. W. J. Blake, manager.

MOJAVE-BOULDER TUNGSTEN CO. (Sugar Loaf)—Equipping recently purchased Bracken mines for active development. N. H. Brown, manager.

DOSS (Wallstreet)—High-grade gold ore encountered in tunnel level; lower development to be commenced. May install compressor and other equipment. F. J. Kamm, manager.

TUNGSTEN METALS CORPORATION (Boulder)—Mill in Boulder Cañon nearly completed; being erected by Colorado Iron Works Co., of Denver. Thomas McSherry, superintendent.

UP TO DATE (Caribou)—High-grade silver ore recently shipped. Sorted ore assayed 3,000 oz. New 30-man bunkhouse erected; additional equipment being installed. John R. Wolf, manager.

GREAT BRITAIN (Boulder)—Several pockets rich gold ore opened in schist in this property; both native gold and tellurides found. Shaft down 65 ft.; rich ore in drift on 50-ft. level. Hoist and small compressor installed; additional equipment will be purchased by H. N. Williamson and associates.

Lake County

HOPE (Leadville)—Mine will be operated by lessees.

PENROSE (Leadville)—Completed enlarging of station at bottom of shaft.

HARVARD (Leadville)—Flume in Evans gulch to carry water across Harvard mine workings completed. Water in mine has decreased over 300 gal. per min. One sinking pump will now be dispensed with. Sinking of shaft will be resumed in near future. Development in Tip Top, Quadrilateral and Stars under way.

La Plata County

BESSIE G. (Durango)—Property on Junction Creek being developed by John Hickey and associates.

CROWN JEWEL (Durango)—Oreshoot carrying gold, silver and gray copper opened on Emerald claim.

COLUMBUS (La Plata)—Stated that large vein of milling-grade gold quartz opened at point 1,080 ft. from portal of exploratory tunnel being driven under workings of old mine. Mine owned by Hearst and Searles estates at different times; now owned by James Doyle, formerly of the Portland.

San Juan County

MAYFLOWER (Silverton)—Being worked under lease.

IOWA-TIGER (Silverton)—Shipping one car per day of lead concentrates assaying well in gold and silver.

BELCHER (Silverton)—Property in Belcher basin on Sultan Mountain will be reopened after long idleness

Summit County

COLUMBINE (Robinson)—Lessee, while excavating for drain box, opened in floor of stope 3-ft. vein of rich gold-silver-lead ore.

COHOMACK MINING CO. (Breckenridge)—New flotation mill to treat ore of Puzzle mine completed; first car of concentrates shipped. Much low-grade ore developed. Mine was formerly large producer.

TONOPAH PLACERS (Breckenridge) — Crosscut being driven from bottom of Miller shaft in French Gulch to cut veins containing zinc and lead sulphides discovered in dredging that part of gulch. Company operating three dredges—in French Gulch, Swan and Blue Rivers.

IDAHO

Shoshone County

REX CONSOLIDATED (Wallace)—Tramway reconstruction and mill remodelling in progress. Ore production to begin in September.

TAMARACK & CUSTER (Wallace) — Rex mill no longer available. Reported to be negotiating for Frisco mill; also National mill at Mullan.

CONSOLIDATED MARSH (Burke)—Terms of 10-year lease of Federal's Mono, O'Neil and Russell claims provide expenditure of minimum of $40,000 to validate lease and not less than $2,500 monthly; when milling ore contains 9% Pb or less, royalty shall be 35c. per ton milled; for each unit of lead above 9%, royalty shall be increased 25c.; when price of lead is above 5½c., New York, royalty shall be increased 30c. per ton for each cent rise, fractions proportionately; on crude ore, royalty is 15% of net smelter returns when lead is 5½c., New York; 20% when price is 5½@7c. and 25% when price is 7@8c.; all ore is contracted to be sold to the American Smelting & Refining Co. Marsh Company pays all taxes and secures Federal against damage, liens, etc.

MICHIGAN

Copper

ISLE ROYALE (Houghton)—An eighth shaft in contemplation on south end of property.

WINONA (Winona)—Slight increase in production anticipated in near future. Difficulty in securing enough men continues.

CHEROKEE (Houghton)—Shaft continues to show good copper rock, bottom of shaft in same quality rock first opened in pit blasting.

AHMEEK (Ahmeek)—By October will have its eighth stamp head in operation, with possible daily rock tonnage of 5,700 tons; this output exceeded only by Calumet & Hecla and Copper Range Consolidated mines.

OSCEOLA CONSOLIDATED (Osceola)—Largest tonnage now coming from North Kearsarge shafts, especially Nos. 1 and 4; No. 3 or middle shaft a small producer operations having only been resumed in June; previously shutdown owing to boiler explosion in winter. South Kearsarge dwindling in tonnage, about 1,200 tons daily, though grade is maintained. About 700 tons daily are coming from No. 6 shaft of old Osceola; old No. 3 shaft put in readiness some months ago but shortage of men prevents production.

CALUMET & HECLA (Calumet)—Production and costs per pound of copper for Calumet & Hecla and its subsidiaries for first six months of 1916 were: Calumet & Hecla 35,693,436 lb., cost 11.45c.; Ahmeek, 11,461,195 lb., 9.59c.; Allouez, 5,137,907 lb., 10.37c.; Centennial, 1,269,697 lb., 12.89c.; Isle Royale, 6,035,766 lb., 13.09c.; Osceola, 9,791,439 lb., 10.12c.; Superior, 1,758,465 lb., 12.89c.; Tamarack, 3,446,425 lb., 14.67c.; White Pine, 2,190,472 lb., 10.57c.; total, 76,784,802 lb. Calumet & Hecla will distribute to shareholders its 20,000 shares of Tamarack, one share being given for each five shares of C. & H. stock, 100,000 shares of the latter being outstanding; acquisition of Tamarack thus considered finally abandoned.

MINNESOTA

Mesabi Range

FROM NASHWAUK over 10 000 tons of ore are being shipped daily. Normal crews working at the Crosby, Quinn-Harrison, La Rue, Mace No. 2 and Hawkins. I. W. W. leaders unable to make any further progress. There is no trouble west of Keewatin at present.

MISSOURI

Joplin District

YELLOWSTONE (Joplin)—Getting 20% zinc ore at 110 ft. Have 20-ft. face well developed.

DEFENDER (Miami, Okla.)—Plans spending $30,000 in drilling campaign between Miami and Commerce. Drills already at work.

CORRELL (Joplin)—Planning $20,000 tailing mill at Commerce, Okla., to handle tailings from the Golden Hen, Never Sweat and Queen City.

WEST VIRGINIA (Galena, Kan.)—Old Durston mill remodeled and started. Ore mainly from east field shaft, connected with mill by surface railway.

NATIONAL ZINC AND LEAD (Joplin)—Planning new 400-ton mill on south part of McCorkle Hill lease at Webb City. One mill on north end of this lease now making fine showing.

ST. REGIS (Duenweg)—Mill at No. 2 mine at Chitwood completed but has no water. Shaft sunk 20 ft. to 200-ft. level, through sheet ground, but obtained no water; sinking will continue.

BUMBLEBEE (Joplin)—Purchased the Blendeville mill and will move it to Missouri Lead and Zinc Co.'s ground. Three shafts in rich ore and fourth under way. Mine flooded eight years ago when land owners stopped pumps; 90 tons of concentrates made during last week of operation at that time.

MONTANA

Deer Lodge County

SOUTHERN CROSS (Southern Cross)—Ore shipments cut considerably, owing to repairs on hoist; chippy hoist being used for ore as well as for men and supplies.

Jefferson County

CRYSTAL COPPER (Basin)—Ore being shipped regularly from upper levels. Crosscut tunnel to open orebodies at depth, in hard silicious aplite and was only advanced 65 ft. last month with one shift; another shift to be put on soon.

Lewis and Clark County

MARYSVILLE GOLD (Marysville)—This property, which embraces 30 claims containing 430 acres, is being financed by the Eisenberg-Seligman interests and has been listed on New York Curb. Ore reported to average $12.

FRANKLYN (Helena)—During month ended Aug. 15, nine cars of ore were shipped, netting the Thomas Cruse Estate $6,150 98. Shipments smaller than usual owing to large amount of development being done at this mine in the Scratch Gravel district.

Madison County

SHAFTER (Virginia City)—High-grade gold ore opened. Will begin shipping soon; 1,000 sacks ordered.

CONREY PLACER (Ruby)—Increase in wage scale of 50c. per day adopted for men previously receiving $3 and$3.50.

Silver Bow County

BUTTE & SUPERIOR (Butte)—Flotation statement for July shows 45,875 tons treated in this plant, producing 8,686 tons of concentrate valued at $48.83 per ton; cost $3.64 per ton of concentrate.

ANACONDA (Butte)—The Diamond mine closed Aug. 12 to Aug. 20, account accident to hoisting engine. Both cages went to the sump, two men were killed and two injured, and considerable damage was done the engine and engine house.

NEVADA

Elko County

JUDGE (Midas)—Hayes & Raymond have 2½ years' lease and will sink 200 ft. from tunnel level; new electric hoist to be installed. Last crushing at Elko Prince mill of 28 tons carried $120 per ton.

QUEEN (Midas)—Leasers on this mine in southern part of Gold Circle camp have good body of $16 to $20 ore at 200-ft. level and are hauling ore at an expense of $3.50 per ton to Rex mill which has been leased.

MIDAS MERGER (Midas)—Consolidation of Rico and Missing Link claims. Hoist and pump to be installed. Leasers working 100-ft. level. Recently 21 tons of high-grade ore were sent to Murray, Utah, and 80 tons lower grade to Elko Prince mill.

Esmeralda County

SILVER PICK (Goldfield)—Core drilling west of shaft indicates three separate veins giving encouraging assays.

CHAMPS D'OR (Hornsilver)—Hardwick & Reed lease opened ore on 100-ft. level for 40 ft.; assayed $75 per ton across 3 ft.

MILLER MOUNTAIN MINING CO. (Tonopah)—Organized in Tonopah to develop 15 claims on Miller Mountain near Candelaria.

FLORENCE (Goldfield)—Development on 530-ft. level recently opened 4 ft. of $35 ore in footwall of old Rogers' lease stopes. Flotation plant treating about 200 tons per day.

JUMBO EXTENSION (Goldfield)—More extensive development planned. Pres. Charles S. Sprague announced dividend for third quarter would be passed for purpose of building up larger cash reserve. Company in the field for new property.

Nye County

TONOPAH ORE PRODUCTION for week ended Aug. 19 was 9,257 tons valued at $192,706, compared with 8,960 tons for week previous. Producers were: Tonopah Belmont, 2,971 tons; Tonopah Extension, 2,200; Tonopah Mining, 1,950; Jim Butler, 850; West End, 828; Halifax, 199; Rescue-Eula, 150; miscellaneous, 109 tons.

JIM BUTLER (Tonopah)—July profit, $25,124 from 4,752 tons mined and shipped to Millers for treatment.

TONOPAH MINING (Tonopah)—July profit $26,763 from 8,019 dry tons; average value, $12.40; bullion, 111,565 oz., value, $94,485.

TONOPAH BELMONT (Tonopah)—Profit of $107,000 from July operations; 11,828 dry tons yielded 2,413.71 oz. gold and 235,045 oz. silver. Reports of favorable development at company's Surf Inlet property, about 400 mi. north of Vancouver, on Princess Royal Island, British Columbia.

Storey County

ANDES (Virginia)—Saved 28 cars of ore from development on 350 level.

HALE & NORCROSS (Virginia)—Completed reopening tunnel at 3,500-ft. point and started work at 3,900-ft. point.

MEXICAN (Virginia)—Mill received 426 tons of custom ore averaging $26.32 and 120 tons from Mexican storage piles averaging $10.74.

CONFIDENCE-CHALLENGE (Virginia)—On 200 level of Imperial shaft advanced east crosscut to 114-ft. point and saved 10 cars of low-grade ore.

OPHIR (Virginia)—Sent to Mexican mill 16 tons of ore averaging $26.02 from 2,500-level. North drift on 2,700 level is in quartz and dacite at 285-ft. point.

UNION CON (Virginia)—Extracted 410 tons of ore: 2,400 level, 198 tons averaging $22.09; 167 tons, $29.93; 35 tons, $19.73; 2,500 level, 10 tons, $15.28. Continued reopening 2,300 station of shaft; repaired southeast drift on 2,400 level to the 220-ft. point; south drift advanced 25 ft. (produced 35 tons ore).

White Pine County

CONSOLIDATED COPPERMINES (Kimberly)—After examination of old Giroux mill by John M. Callow with view of rehabilitation as flotation plant, it has been decided to expend $100,000 in remodeling plant. Contract let to General Engineering Co., of Salt Lake City; mill to be operating by first of year. Instead of further churn drilling, Morris No. 2 shaft will be sunk 200 ft. to get under orebody of the Morris, Brooks and Bunker Hill areas.

NEW JERSEY

Bergen County

TENNESSEE COPPER (Ridgefield Park)—Phenol plant has resumed work after shutdown of several months.

Sussex County

OGDEN MINE (Edison)—Owen Conly has several diamond drills at work to test the possible existence of another orebody at lower depths. The older known orebody was worked out, and nothing has been done since Thomas A. Edison made an attempt to concentrate the low-grade material. Mr. Conly was superintendent of the mine 40 years ago.

NEW MEXICO

BATOPILAS MINING CO., 50 Broad St., New York, amended charter Aug. 3 authorizing management to conduct mining, operations outside of Mexico. A property in New Mexico is being investigated.

Grant County

HANOVER BESSEMER IRON AND COPPER CO. (Fierro) —Construction of first 400-ton unit of concentrating mill will be started soon. B. E. McKechnie, manager.

Socorro County

GOOD LUCK (Mogollon)—Lauderbaugh & Thorlston, owners, have driven 250-ft. crosscut adit encountering contact at depth of 170 ft. Adjoins Confidence-Last Chance-Deadwood vein systems.

SOCORRO MINING AND MILLING (Mogollon)—At the Pacific mine, practically all equipment and lumber delivered for aërial tramway to Socorro mill; terminal stations, ore bins, etc., nearing completion; designed to deliver 75 tons daily.

MOGOLLON MINES CO. (Mogollon)—New three-compartment, 6x16-ft. shaft now 850 ft. deep. Company is erecting board flume to carry tailings through town of Mogollon and it is intended eventually to extend it to tailings dams about 4 mi. down creek.

PENNSYLVANIA

AMERICAN STEEL AND WIRE (Donora)—Reported that Donora Zinc Works has begun construction of zinc-oxide plant to treat distillery residues.

UTAH

Juab County

TINTIC SHIPMENTS for week ended Aug. 18 amounted to 188 cars; 173 cars for week preceding.

IRON BLOSSOM (Silver City)—Copper ore being shipped regularly but little siliceous ore is now marketed.

EMERALD (Mammoth)—Developing on 1,000 level west and north of shaft. Ground mineralized with iron, manganese, and quartz, carrying some silver and gold.

DRAGON CONSOLIDATED (Silver City)—Arrangements made for handling larger tonnage of iron ore. Copper ore of good grade being shipped. Daily output—largely iron ore—amounts to 230 tons.

EAGLE & BLUE BELL (Eureka)—Orebody cut in shaft at 1,832 ft. followed downward by shaft to 1,875-ft. point, where a station was cut. In sinking 20-ft. sump, good ore again encountered; gives vertical depth of 63 ft. thus far. Ore carries lead and silver. Water level thought to be at between 2,060 and 2,075 feet.

CHIEF CONSOLIDATED (Eureka)—About 150 tons weekly produced. Strike of importance made on 1,200 level, 300 ft. from other orebodies. Ore carrying lead and silver cut for 20 ft., and stoping started. The 1,800 level producing steadily, and ore extending up and down. Rapid progress being made in new shaft work under contract to Walter Fitch, Jr., at north end of property.

Salt Lake County

MONTE CRISTO (Salt Lake)—Developing on 100 level. Adjoins the Cardiff. C. A. Quigley president.

MILLER-PERUVIAN (Alta)—Ore carrying gold, silver, and lead mined at depth of 240 ft. Car at sampler. Property on south side of Little Cottonwood Cañon, west of South Hecla and Sells.

EMMA COPPER (Alta)—Prospecting by diamond drilling in coöperation with Emma Leasing Co. First hole down 500 ft. from Bay City tunnel. Hoped to find continuation of old Emma orebody beyond fault. Downthrow side thought to be to the northeast. Some iron pyrite encountered at 302 ft.

CARDIFF (Salt Lake)—Third dividend 25c. declared payable Sept. 1, making total of $375,000. Shipments held down to 100 tons a day owing to transport difficulties. Transportation by caterpillar engines and train not entirely satisfactory owing to steep grade. Additional trucks to be put on. Large tonnage of ore accumulated.

Summit County

PARK CITY SHIPMENTS for week ended Aug. 18 amounted to 2,832,670 lb. Silver King Coalition, Silver King Consolidated, Judge Mining & Smelting and Daly West had the largest output in the order named. Other shippers were the Ontario, Daly, and New Quincy.

KEYSTONE (Park City)—Will be reopened.

DALY WEST (Park City)—July output largest of any recent month.

ONTARIO (Park City)—Active development in progress and ore being mined. Frank Fleischmann, foreman.

DALY-JUDGE EXTENSION (Park City)—New shaft down 90 ft.; rock mineralized with some silver and lead.

DALY (Park City)—Special meeting will be held in Salt Lake, Sept. 11, to consider reducing capital stock.

PARK CITY MINES (Park City)—This company, leasing in the American Flag, shipped two more lots of ore (60 tons) from stopes on 1,000 level; one carried gold, silver and small amount of lead. Developing vein recently crosscut on 700 level.

BIG FOUR EXPLORATION (Park City)—Mill at Atkinson treating approximately 600 tons of tailings daily. Plant recently enlarged to 750 tons capacity, but certain minor charges necessary; expected soon to reach normal capacity. Company has under lease until 1924 tailings dump—3½ mi. long, from 200 to 900 ft. wide, and up to 5 and 8 ft. in depth—estimated at over 1,000,000 tons, carrying about 0.015 oz. gold, 3.2 oz. silver, 1.6% lead and 1.1% zinc. Lead-silver and zinc concentrates are being produced.

Tooele County

WEST MERCUR MINES (Mercur)—May enlarge mill from 100 to 150 tons in near future. Plant working one month cyaniding gold ore along lines formerly used by Consolidated Mercur. Property embraces 240 acres which are to be prospected.

WASHINGTON

NORMAN MINES CO. (Northport)—Will construct at once new mill after plans of H. W. Newton. Fines will be treated by flotation.

WISCONSIN

Zinc-Lead District

GRAND VIEW (Benton)—Has begun shipment of zinc concentrates from Kearns mine at Benton.

WICKS (Mineral Point)—New company operating the Wicks at Linden has also taken over the Senator mine at Mifflin.

WISCONSIN ZINC CO. (Platteville)—The C. A. T. mill is completed; construction of Longhorn mill begun at New Diggings.

KISTLER & STEPHENS (Platteville)—Weigle tract. proved by drill, recently purchased at $250 per acre; will be opened by shaft.

LINDEN ZINC CO. (Cuba City)—Has rebuilt the Campbell roasting plant, adding two new kilns and seven Campbell separating machines, with Dings' feed attachment, increasing capacity from 200 to 450 tons of green ore per week.

CANADA

British Columbia

FLORENCE SILVER (Ainsworth)—Contract let to Broderick & Bascom Rope Co., of St. Louis, Mo., for 1,400-ft. aërial tramway from tunnel portal to new 250-ton mill now nearing completion. Hydro-electric equipment being delivered. Ferdinand R. Wolfle, of Spokane, Wash., president.

Ontario

COBALT ORE SHIPMENTS for July are reported by Arthur A. Cole, mining engineer for Temiskaming & Northern Ry., as follows: Beaver, 23.33 tons; Buffalo, 70.55; Cobalt Comet, 61.53; Coniagas, 70.12; Crown Reserve, 91.07; Kerr Lake, 93.53; La Rose, 135.15; McKinley-Darragh, 201.39; Mining Corporation of Canada (Townsite-City), 107,31; Nipissing, 131.95; O'Brien, 31.77; Temiskaming, 60.52; Trethewey, 41.94; total, Cobalt proper, 1,120.16 tons; Casey Cobalt (New Liskeard), 30.54; total silver-ore shipments, 1,150.70 tons. Alexo mine (Porquois Jct.), 671.15 tons nickel ore; Rand Syndicate (Temagami), 155.80 tons pyrites (69 tons previously reported as copper ore should have been classed as pyrites).

WEST DOME (Porcupine)—Will install electric driven plant to permit development on greater scale.

DOME (Porcupine)—On 700-ft. level, orebody is reported 440 ft. long and 240 ft. wide, averaging over $5 a ton. Second ball mill now in operation.

SCHUMACHER (Schumacher)—Orebody on 100-ft. level drifted on for 50 ft. and is now 30 in. wide, averaging $20 per ton. Crosscutting from 200-ft. level.

DOME EXTENSION (Porcupine)—What appears to be extension of Dome orebodies cut with diamond drill at depth of over 1,600 ft. in a 60° hole. Under option to the Dome.

TRETHEWEY (Cobalt)—At recent meeting, shareholders refused to ratify sale to Northern Customs Concentrator for $125 000. Company is making about $12,000 net a month.

OPHIR-PEOPLES (Cobalt)—Shaft being sunk on Peoples property under joint arrangement between the companies reached diabase; crosscutting started at 425-ft. level.

McKANE (Kirkland Lake)—In this property, worked under option by the Beaver of Cobalt, two high-grade veins have been opened on the 300-ft. level. Option will probably be exercised.

LA ROSE (Cobalt)—Has optioned Hurd claims in Kirkland Lake and will start work at once. Developments on Maidens MacDonald property in Porcupine, also under option, are satisfactory.

INTERNATIONAL NICKEL (43 Exchange Place, New York)—Will spend about $2,000,000 on new refinery at Port Colborne. Company now producing about 5,000,000 lb. of nickel and 3,000,000 lb. of copper per month.

BRITISH-CANADIAN NICKEL CO. (Sudbury)—New company to succeed British-America company in control of Murray nickel mine. Will proceed with power development on Wahnapitae River. Hybinette refining process to be used. Company reported to have contracted output to British government for 10 years.

AFRICA

Belgian Congo

UNION MINIERE du HAUT KATANGA (Elisabethville)—Copper production in July, 2,088 tons.

Union of South Africa

GOLD PRODUCTION IN TRANSVAAL in July is reported at 761,087 oz., which is 677 oz. less than in June, and 9,268 oz. less than in July, 1915. This is the first month this year in which the output has fallen below last year's figures. For the seven months ended July 31 the total was 5.178.403 oz. in 1915, and 5,392,954 oz.—or $111,472 359—in 1916; an increase of 214,551 oz. this year. The number of negro laborers in the gold mines in July was 192,130, a decrease of 679 from June. In addition 13.271 were employed in the diamond and coal mines, an increase of 51 over June.

The Market Report

Metal Markets

NEW YORK—Aug. 30

The metal markets all around were less active than in the previous week. Spelter in particular was dull and a declining tendency was exhibited. Copper was strong and advancing. Lead was quiet, but there were signs of more activity toward the close.

Since Monday all of the markets have been disturbed over anticipation of the railway strike, which threatens to tie up business in a multiplicity of ways that nobody ventures to forecast. Copper refiners have such stocks of crude copper and fuel that they can continue operations, but they will be hampered in deliveries, except for export. The smelters and manufacturers, not only of copper but also of lead and spelter, on the other hand, will be troubled in many ways.

Copper, Tin, Lead and Zinc

Copper—A pretty good business was done, but the volume was less than in the previous week. No export sales were reported, all the business being for domestic account, but some of the copper that was sold is going to be exported subsequently in manufactured form. There was no demand for September copper and scarcely any for October. The major market continued to be for November-December delivery. Some of the producers having filled their books for that period, the business went to those who could still supply that delivery and they were able to get better prices, the demand being fairly urgent. Other producers began to sell for December-January and January delivery, taking such business at concessions from present prices, but such transactions were not general. However, it appears likely that within a week or two all producers will have disposed of all of their copper available for delivery this side of December and the major market will become for December-January delivery.

The negotiations with the representatives of the allied governments for a large quantity of copper to be delivered during the first half of 1917 have been dropped The reason was failure to agree upon price. We suspect that the dropping of the matter was due to the withdrawal of the producers, who saw their books becoming practically filled for 1916 and large demand looming up in other quarters for 1917 at better prices than were offered to the Allies when the negotiations were opened.

Copper Sheets are 37½c. per lb., base price, for hot rolled, and 38½c for cold rolled. Copper wire is 31@32c. per lb. at mill for large lots.

Copper Exports from Baltimore for the week included 1,456,140 lb to Great Britain; 3,000,000 lb. to Archangel, Russia

Copper exports from Atlantic ports in August are estimated on the basis of custom returns at 27,700 gross tons Exports from Gulf and Pacific ports will run probably up to 7,000 tons.

Tin—This market was very quiet and changes in price were insignificant.

Imports of tin into the United States in June were 4,949 gross tons in 1915, and 8,941 in 1916; increase, 3,992 tons. Reëxports of foreign tin were 72 tons in 1915, and 10 tons this year.

Tin exports from the Federated Malay States, seven months ended July 31, were 26,862 gross tons in 1915, and 25,224 in 1916; decrease, 1,638 tons.

Lead During the early part of the week this market was more quiet and there was a tendency for the premiums over the price of the principal producer to disappear. However, they were still realized in some cases right through the week. This appeared to be chiefly a matter of the delivery that was wanted and could be supplied. In most cases the producers had sold themselves out for September In other cases producers who were not in a position to command premiums for early delivery met the price of the principal producer and then made sales, this happening in the latter part of the week. The A S. & R Co. kept out of the market except for the supply of its regular customers. During the last two days decidedly more inquiry was reported, including some for round lots for export.

Exports of Lead from the United States in June were 14,977,496 lb., of which 644,073 lb. were produced from foreign ores.

Spelter—This market was extremely dull, producers reporting nothing but trifling sales, and quotations therefore reflect offerings rather than sales. From all quarters spelter was steadily offered at concessions.

The spelter market at present is of a see-saw character. When the price gets down to about 8c., sellers withdraw, and when it gets up to about 9c., buyers disappear. Producers express themselves as expecting a renewal of demand at around 8 cents.

Exports from Baltimore for the week included 224,110 lb. spelter to London. Imports included 7,592 tons zinc ore from Spain.

The zinc output of Japan in 1915 showed an increase of 206% over 1914, according to a recent consular report. The completion of the plants of the Osaka Zinc Industry Co. and the Miike Zinc Refining Works during the year was largely responsible for this increase.

Zinc Sheets continue unchanged, the base price being $15 per 100 lb., f o.b. Peru, Ill., less 8% discount. Sales are good and there are some heavy inquiries for export.

Other Metals

NEW YORK—Aug. 30

Aluminum—Business has been good and there is some pressure to buy, chiefly from automobile makers. Quotations are a little firmer at 60@62c. per lb. for No. 1 ingots, New York.

Imports of aluminum into the United States in June were 649,465 lb., against 1,786,889 lb. in June of last year.

Antimony—The abatement of the excitement that developed a fortnight ago continued, and the price receded further. We quote 12c. as an average for the business of the week. It is doubtful if so much could have been realized on large lots. The market is nervous. When a buyer appears the price goes up 3 to 5c., but after he has been satisfied it falls back again. Some producers ask 14@15c., but those are merely nominal asking prices.

Imports of antimony into the United States in June included 1,755,817 lb. in 1,235 tons of ore, and 4,960,751 lb metal and regulus; a total of 6,716,568 lb., against 1,564,579 lb. in June of last year.

Quicksilver—This market was stronger. There were reports of sales of several hundred flasks for export. We quote $77, New York. San Francisco reports, by telegraph, $75, demand improving.

Exports of quicksilver in June were 72,745 lb., against 2,748 lb in June of last year. A shipment of 42,000 lb. to England is reported this week.

Nickel—Business is good and prices are unchanged at 45@50c. per lb. for ordinary forms, according to size and terms of order. Electrolytic nickel brings 5c. per lb. premium

Imports of nickel ore and matte into the United States in June were 5,064 tons, containing 6,246,176 lb. nickel, an increase of 1,800 tons ore and 2,231,785 lb. nickel contents. Exports of nickel, oxide and other products were 2,290,631 lb., a decrease of 1,492,369 lb. from June of last year.

Minor Metals—Current quotations for **Bismuth** are $3.15@3.30 per lb., New York—**Cadmium** is quoted at $1.30@1.50 per lb—**Cerium**, electrolytic, is sold at $8@9 per lb—**Cobalt Metal** is quoted at $1.25 per lb.—**Magnesium** is steady, with sales at $3.50@3.75 per lb. for 99% pure—**Selenium** is from $3 up to $5 per lb., according to size of order.

Gold, Silver and Platinum

NEW YORK—Aug. 30

Gold continues to come into New York in considerable quantity, chiefly from Canada.

The Kolar goldfield in India reports gold production in July at 45,146 oz. For the seven months ended July 31 the total was 32,462 oz. in 1915, and 311,677 oz.—or $6,442,363—in 1916; a decrease of 12,943 oz. this year.

Gold production in the Transvaal in July was 761,087 oz For the seven months ended July 31 the total was 5,392,954 oz., or $111,472,359, an increase of $4,434,769 over last year.

Platinum—The improvement in the demand continued. Early in the week sales were made at $65, compared with $62½@65 at the close of the previous week. The advance went further, sales being made at $70 and then $75. At the close $80 was asked. We quote the average for the week at $65@75.

Our Russian correspondent writes that the market and prices are strong, with a good demand for both domestic and export business. Demand for small lots from producers is active. The quotations at Ekaterinburg are 18.20 rubles per zolotnik; at Petrograd 69,000 rubles per pood, both for crude metal and 83% platinum. These prices are equal to $68.43 and $67.62 per oz. respectively.

Silver—The market has remained steady with upward tendency. Continued buying for coinage together with orders from India and smaller

SILVER AND STERLING EXCHANGE

Aug.	Sterling Exchange	Silver: New York, Cents	Silver: London, Pence	Aug.	Sterling, Exchange	Silver: New York, Cents	Silver: London, Pence
24	4.7575	66⅜	31⅝	28	4 7575	66½	$31\frac{11}{16}$
25	4.7575	66¼	$31\frac{9}{16}$	29	4 7575	66⅞	$31\frac{13}{16}$
26	4.7575	66⅛	31½	30	4 7575	67¼	32

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine.

DAILY PRICES OF METALS IN NEW YORK

Aug.	Copper: Electrolytic	Tin: Spot.	Lead: N. Y.	Lead: St. L.	Zinc: St. L.
24	26½ @27	38⅝ @38¾	6 50 @6 62½	6 40 @6 50	8.75 @9.00
25	26¾ @27	38⅞ @39	6 50 @6 60	6 40 @6.50	8.62½ @8.87½
26	26¾ @27	38⅞ @39	6 50 @6 60	6 40 @6.50	8 50 @8.75
28	26¾ @27¼	39¼ @39½	6 50 @6.60	6.40 @6.50	8.50 @8 75
29	27¼ @27¾	39⅛ @39¼	6.50 @6.60	6.40 @6.50	8.50 @8 75
30	27½ @27¾	38⅞ @39	6 50 @6.60	6.40 @6.50	8.37½ @8.62½

The quotations herein are our appraisal of the average markets for copper, lead, spelter and tin based on wholesale contracts for the ordinary deliveries of the trade as made by producers and agencies; and represent, to the best of our judgment, the prevailing values of the metals, reduced to basis of New York, cash, except where St. Louis is basing point.

The quotations for electrolytic copper are for cakes, ingots and wirebars. Electrolytic copper is commonly sold at prices including delivery to the consumers and is subject to discounts, etc. The price quoted for copper on "regular terms" (r.t.) is the gross price including freight to the buyer's works and is subject to a discount for cash. The difference between the price delivered and the New York cash equivalent is at present about 0.25c. on domestic business. The price of electrolytic cathodes is 0.05 to 0.10c. below that of electrolytic. Quotations for lead represent wholesale transactions in the open market for good ordinary brands. Quotations for spelter are for ordinary Prime Western brands. Only St. Louis price is given, St. Louis being basing market. We quote New York price at 17c. per 100 lb. above St. Louis.

Some current freight rates on metals per 100 lb. are: St. Louis-New York 17c.; St. Louis-Chicago, 6.3c.; St. Louis-Pittsburgh, 13.1 cents.

LONDON

Aug.	Copper: Standard: Spot	Copper: Standard: 3 Mos.	Copper: Electrolytic	Tin: Spot	Tin: 3 Mos.	Lead: Spot	Zinc: Spot
24	109½	107½	129	170	171	30½	57
25	110	108	129	170¾	171¾	30⅝	58
26							
28	111	109	129	172¼	173⅝	30¾	58
29	110	108	129	173	173¾	31	58
30	110	108	129	171	171¾	31¼	54

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2,240 lb. Copper quotations for electrolytic are subject to 3% discount. For convenience in comparison of London prices, in pounds sterling per 2,240 lb., with American prices in cents per pound the following approximate ratios are given, reckoning exchange at 4.80. £15 = 3.21c.; £20 = 4.29c.; £30 = 6.43c.; £40 = 8.57c.; £60 = 12.85c. Variations, £1 = 0.21⅜ cents.

arrivals of spot silver, have tended to raise the price.

The market in China continues bearish and exchange rules below parity. Market closes steady at 32d. bid in London.

Quotations for Mexican dollars in New York are reported Aug. 24 at 51@55c.; Aug. 25 at 51@55c.; Aug. 26 at 51@55c; Aug. 28 at 51¼@55¼c.; Aug. 29 at 51½@55½c.; Aug. 30 at 51½@55½ cents.

Zinc and Lead Ore Markets

Joplin, Mo., Aug. 26—Price quotations, per 2,000 lb.: Blende, high, $71.95; per ton 60% zinc, premium ore, $70; medium, $65@55; low, $50; calamine, per ton 40% zinc, $40@30. Average selling price, all grades of zinc, $65.26 per ton.

Lead, base price, $65@70 per ton 80% metal content. High price, $68.25; average selling price, all grades of lead, $65.08 per ton

Shipments of the week: Blende, 5,848 tons; calamine, 144 tons; lead, 1,090 tons. Value, the week, $461,990; the year to date, $25,751,270.

This week's shipment exceeds the production about 1,000 tons, further reducing the stock, now well picked over for choice ore, leaving a residue largely composed of ores below medium grade.

One or more mines are forced to close each week from lack of water for wet concentration, but their production is replaced by new mills or the restarting of renovated and enlarged mills.

The Cherokee Smelting Co.'s works at Bruce, the Lanyon Smelting Co.'s and the American Spelter Co.'s works at Pittsburg are being closed down as fast as the new gas smelters at Quinton are ready to start; part of them is now being fired. The Nevada Smelting Co.'s plant at Nevada is being closed down as the stock of ore is diminished. The Missouri Co., at Rich Hill, is having labor troubles

Platteville, Wis., Aug. 26—Quotations of the district are according to the following figures: Base price per 2,000 lb. ton for material assaying 60% zinc was $59 for premium ore down to $53 for medium grades. For material assaying 80% lead the base price advanced to $71 per 2,000 lb. ton.

Shipments for the week were 2,295 tons of zinc ore, no lead ore, and 886 tons of sulphur ore. For the year to date, the figures are: 79,022 tons of zinc ore, 2,787 tons of lead ore, and 18,357 tons of sulphur ore. Shipped during the week to separating plants, 4,358 tons of zinc ore.

Butte, Mont.—Butte & Superior produced 8,686 tons of blende concentrates in July, compared with 10,830 tons in June.

OTHER ORES

Manganese Ore Imports in Great Britain, seven months ended July 31, were 154,158 gross tons in 1915, and 259,309 in 1916; increase, 105,151 tons

Imports at Baltimore for the week included 1,780 tons manganese ore from Brazil.

Pyrites—Imports at Baltimore for the week included 5,910 tons of pyrites from Huelva, Spain.

Tungsten Ore—The foreign demand continued, in connection with which several hundred tons were sold. This business was done at $17@18 per unit. Later about 100 tons were sold to domestic consumers at $18@20. The demand continuing both for domestic and foreign consumption, $20 was realized on Aug. 29. At the close we quote the market at $18@20.

Antimony Ore—No business was reported, which is not surprising in view of the situation in the metal.

Iron Trade Review

NEW YORK—Aug. 30

There is no material change apparent in the iron and steel markets. Export orders are still the chief feature though a fair domestic business is reported.

The chief increase in home orders is in structural steel for which more new contracts are noted. Mill production is delayed by the extreme hot weather.

Pig iron has been active with large sales reported, chiefly of basic iron. Prices have been rather variable, but with a tendency to advance.

Exports from Baltimore for the week included 464,820 lb. steel pipe, 375,138 lb. wire and wire rods, 498,678 lb. tinplates, 4,778,686 lb. steel billets and 1,908,480 lb. pig iron to Great Britain; 9,857,717 lb. steel rails and rail fastenings to France.

PITTSBURGH—Aug. 29

The steel and pig-iron markets have not reflected any material change that could be attributed to the imminence of a general railroad strike. Such a strike would affect consumers equally as to their receipts and despatch of products. A general strike would practically stop the production and consumption of steel The blast furnaces usually carry no more coke than would be needed to bank and the furnaces would promptly bank and the steel works, shut off from pig iron and fuel and unable to ship their product, would necessarily close.

The steel market appears quiet, as it has since early in June, yet week by week the mills appear to be sold to a time farther ahead and from the mill viewpoint the whole situation is a very strong one. The large mills are sold up on bars and plates practically to the middle of next year and the pipe, wire and sheet mills for approximately the remainder of this year, while the tinplate mills will have to carry from one to two months of production over into the new years. The tinplate and sheet mills have not opened books for next year, although importuned by some classes of consumers to do so

Finished-steel prices are very firmly maintained all along the line. Premiums for early deliveries are showing a slight advancing tendency and if the present extreme scarcity of unfinished steel continues some decided advances are to be expected before the end of the year. Present trends, however, may possibly not continue indefinitely as month by month the cheaper contracts for finished steel are being worked off and as consumers are forced to pay higher prices on steel received their consumption in certain directions may decrease materially. Many consumers insist strongly that they will have to curtail operations.

Pig Iron—The movement in foundry iron has broadened further and the market is quite active, with buying for the remainder of this year and the fore part of next year Foundry iron at $18.25, Valley, has practically disappeared and the market is on a basis of $18.50, a price formerly obtained only occasionally. There is no general disposition to ask above $18.50, but some sellers are endeavoring to restrict sales at this figure to deliveries not later than Apr. 1, 1917. Basic iron at $18, Valley, hitherto the regular market, is claimed to be exhausted and $18.25 and $18.50 are asking prices, but no sales are reported at the higher level. About 5,000 tons additional of bessemer iron has gone at $21, Valley, and this grade is also regarded as scarce for the balance of the year. We quote: Bessemer, $21@21.50; basic, $18@18.25; foundry and malleable, $18.50; forge, $18, f.o.b. Valley furnaces, 95c. higher delivered Pittsburgh.

Steel—The market for unfinished steel is practically nominal, at about $45@50. It is difficult to find any steel at all at any price, while on the other hand, it is a question whether any large tonnages could be sold if the steel were available at the prices mentioned The sheet mills could not afford to pay the price, for instance, while on the other hand the premiums obtainable for plates for prompt shipment would justify plate mills in paying $50 for slabs. Billets could probably be sold in limited tonnages at $45, perhaps at a shade more.

BIRMINGHAM—Aug. 28

The Southern iron market is stronger and inquiry brisker. Actual transactions are for small lots at $15, with some high sulphur and other low-grade metals under that basis. Stocks of resale metal went down 18,000 to 20,000 tons in July, and Tennessee metal is still offered under $15, Birmingham

Export movement from Birmingham furnaces since July 15 has been over 25,000 tons. Spain took 500 tons of high-sulphur iron, and a shipment was made to Norway. Bulk of exports, however, is through Mediterranean ports.

Steel plants are groaning under shrapnel orders. The Anniston works are turning out shells rapidly, and shrapnel shapes are going out of Tennessee Co. mill at Ensley by thousands of tons.

Proposed advances of $2 per ton on coke and pig iron and of $6 on cast-iron pipe to Pacific Coast points, announced as effective Sept 1, have raised a storm of protest. Commerce Commission is hearing them this week.

Coke is very strong, with standard beehive foundry remaining around $4.25 and $4.50, f.o.b. ovens, and furnace coke at $3.25 to $3.50 Demand for steam coal has picked up.

PHILADELPHIA—Aug. 29

A less heavy tonnage of steel was placed under contract in this district last week and less feverishness attended sales, but specifications against contracts with some of the larger mills were in greater volume than for several weeks. The market is still flooded with inquiries for steel to be used in the manufacture of war munitions, especially for export, exceeding 250,000 tons; but two of the largest eastern Pennsylvania companies, having sold their capacity for shell bars up to June and July of 1917, will no longer entertain such propositions, while a third mill steadily adheres to the attitude of reserve that it has maintained on shell steel since the beginning of the war. Shipyards and railroads have placed additional contracts for plates and shapes aggregating between 30,000 and 40,000 tons. British interests closed for a moderate tonnage of marine steel for export to Hong Kong, and Japanese interests bid urgently for marine boiler plates. Several orders for forging and rerolling billets, aggregating probably 25,000 tons, were taken for domestic shipment. Foreign interests, still urgently in the market, found it difficult to buy either ingots or semi finished steel in appreciable tonnages. The position of blast-furnace interests was further improved by more numerous small sales, larger shipments and reduced stocks, together with a substantial gain in inquiries for both steel-making and for foundry grades.

FERROALLOYS

Ferrosilicon is unchanged at $86@89 per ton at mill, according to quantity, for 50% alloy Bessemer ferrosilicon is from $31 for 10% up to $41 for 16%, at furnace.

Spiegeleisen is quiet and unchanged at 40@45 per ton at furnace for 20%. For high grade—25@30%—$55@65 per ton is asked.

Ferromanganese—The market continues decidedly quiet. Contract is available at $175 as formerly and prompt lots bring about the same figure, there being no active demand.

Imports at Baltimore for the week included 1,854 tons ferromanganese from Liverpool

FOREIGN IRON

French Iron and Steel Imports for three years are reported as follows:

	1913	1914	1915
Pig iron	32,669	15,885	166,709
Bars and plates..	19,379	16,888	580,130
Machine steel......	6,903	5,160	64,831
Sheets.	13,760	6,652	76,230
Tin plates....	19,460	24,878	68,340
Wire..	6,088	7,407	44,511
Rails..	1,792	547	40,678

Of the total iron and steel imported in 1915 the United States furnished 43,770 tons.

IRON ORE

Shipments are being pushed in spite of bad weather. Some wild tonnage has been chartered to carry iron ore from Duluth to Lake Erie for the balance of the season at $1 per ton, net.

A considerable quantity of iron ore from the Lake Champlain district is now being shipped to Lehigh Valley furnaces in Pennsylvania. At present this ore is sent by rail to Albany, by barge down the Hudson and by rail from Elizabethport, N. J., to the furnaces. With the completion of the Champlain Canal improvement next year it will be possible to ship in large barges from Port Henry or Crown Point direct to Elizabethport.

British Iron Ore Imports, seven months ended July 31, were 3,666,789 tons in 1915, and 4,137,609 gross tons in 1916; increase, 470,820 tons.

COKE

Coke production in the Connellsville region for the week is reported by the "Courier" at 408,060 net tons; shipments, 408,179 tons. Shipments of Greensburg and Upper Connellsville districts, 38,500 tons.

Connellsville—The market has not softened as was expected from the starting a fortnight ago of one-half the new byproduct plant at Youngstown. Possibly there was little coke released by the operation as the operators who formerly shipped coke to that point must now ship coal. Prompt furnace coke is bringing $2.80@2.90 and the stiffening coal market makes operators reserved about offering coke, so that $2.75 is now spoken of as the prospective asking price on contracts for the first thalf of next year.

British Fuel Exports, seven months ended July 31, in gross tons:

	1915	1916	Changes
Coal.......	25,871,707	22,379,578	D. 3,492,125
Coke..	486,644	881,632	I. 394,988
Briquettes..	750,755	817,614	I. 66,859
Bunker coal	8,499,198	7,589,900	D. 909,298
Total...	35,608,304	31,668,724	D 3,939,580

The bunker coal is coal shipped abroad for the use of steamships in the foreign trade, or delivered to such steamships.

Chemicals

NEW YORK—Aug. 30

The general market has been quiet and rather steady. The undertone is strong and there is an anticipation of increased activity in heavy chemicals.

Arsenic—Demand is not specially active, but supplies are only moderate and prices are steady. Quotations are unchanged at $6@6.25 per 100 lb. for both spot and futures.

Copper Sulphate—There is continued inquiry, chiefly moderate sized lots, and a fair business has been done. Quotations continue at $8@10 per 100 lb., according to size and terms of order.

Nitrate of Soda—Notwithstanding rather heavy receipts here prices have been well maintained. Quotations are $3 per 100 lb. for both spot and futures. Shipments from Chile for the seven months ended July 31 were: Europe, 756,700; United States, 729,800; total, 1,486,500 gross tons, an increase of 522,650 tons over last year.

Sulphuric Acid—No change is reported and sales are being made ahead freely. Buyers are paying about 1c. per lb. for 60-deg. acid, while 1½c. per lb. is asked for 66-deg. acid

Assessments

Company	Delinq.	Sale	Amt.
Algomah, Mich.	May 18	....	$1.00
Alta Silver, Nev.	Sept. 1	Sept. 25	0.03
Beaver Gold, Utah	Aug. 19	Sept. 16	0.01
Blue Star, Ida.	Sept. 25	Oct. 21	0.02
Cash Boy, Nev.	Sept. 1	Oct. 15	0.01
Challenge, Nev.	Aug. 23	Sept. 13	0.05
Coal Creek, Ida.	Aug. 25	Sept. 26	0.005
Exchequer, Nev.	Sept. 5	Sept. 26	0.03
Emerald, Utah.	Aug. 15	Sept. 9	0.00½
Friend, Ida.	Aug. 26	Sept. 16	0 002
Great Bend, Nev.	Aug. 15	Sept. 20	0.01
Hector, Ida.	Aug. 7	Sept. 15	0 005
Idaho-Nevada, Ida	Sept. 14	Oct. 14	0.002
Jacket-C.Point-Belcher, Nev.	Aug. 14	Sept. 7	0 05
Jack Waite, Ida.	July 27	Aug. 28	0 01
Kewanas Reor., Nev.	Aug. 2	Sept. 6	0 01
Keweenaw, Mich.	Sept. 2	....	1.00
Lucky Calumet, Ida.	July 20	Aug. 21	0.005
Nevada-Stewart, Ida.	Aug. 3	Sept. 2	0 003
Nevada Zinc, Nev.	Aug. 14	Sept. 2	0.01
North Lake, Mich.	June 14	.....	1.00
Old Veteran, Ida	Sept. 9	Oct. 7	0.002
Ophir, Nev.	Aug. 16	Sept. 6	0.05
Paloma, Utah	Aug. 21	Sept. 9	0.01
Phedora, Ida	Aug. 29	Sept. 29	0.001
Rico Argentine, Colo.	Aug. 17	Sept. 2	0.01
Rio Grande Grubstake, Nev.	June 22	Aug. 31	0.002
Sandstorm Kendall, Nev.	Aug. 22	Sept. 26	0.01
Sells, Utah	Sept. 21	Oct. 7	0.06
Sixes, Nev.	Aug. 23	Sept. 8	0.10
Smuggler, Utah	Sept. 20	Oct. 18	0.005
Springfield Tunnel, Calif.	Aug. 15	.....	0.05
Sunrise, Ida.	July 27	Aug. 28	0.002
Sunset, Ida.	Aug. 5	Aug. 26	0.0015
Tar Baby, Utah.	Aug. 3	Sept. 4	0.01
Tyler, Ida.	Sept. 12	Oct. 12	0.0015
Umatilla, Nev.	Sept. 18	Oct. 24	0.0025
Utah, United, Utah	Aug. 12	Aug. 30	0 01
West Toledo, Utah	Sept. 12	Oct. 3	0.01
Whale, Utah.	Sept. 5	Sept. 25	0.05
Wolf Mt. Copper, Utah.	Aug. 2	Sept. 6	0.005
Wonderful, Ida.	Aug. 30	Sept. 20	0.001

Stock Quotations

SAN FRANCISCO Aug. 28	
Name of Comp.	Bid
Alta	.03
Andes	.08
Best & Belcher	.05
Bullion	.01
Caledonia	.30
Challenge Con.	.03
Confidence	.15
Cons. Imperial	.01
Con Virginia	08
Gould & Curry	03
Hale & Norcross	06
Jacket-Cr. Pt.	06
Mexican	16
Occidental	.70
Ophir	21
Overman	04
Savage	.05
Seg Belcher	.02
Sierra Nevada	25
Union Con.	.66
Utah Con	.01
Belmont	4 15
Jim Butler	84
MacNamara	04
Midway	19
Mont.-Tonopah	26
North Star	.15
Rescue Eula	.23
West End Con	80
Atlanta	09
Blue Bell	.01
Booth	.12
C O.D. Con	.03
Comb. Frac.	06
D'field B.B.	02
D'field Daisy	03
Jumbo Extension	49
Pitts.-Silver Peak	‡ 12
Round Mountain	42
Sandstorm Kendall	05
Silver Pick	14
Central Eureka	03
Argo	15
Ariz. Central	15
Big Jim	90
Lazy Boy	13
Oatman No. Star	10
Tom Reed	1 60
United Eastern	3 87½
United Western	08

LONDON	Aug. 17
Alaska Tre'dwell	£5 15 0
Burma Corp.	3 3 9
Cam & Motor	0 11 6
Camp Bird	0 8 6
El Oro	0 8 6
Esperanza	0 11 3
Mexico Mines	3 10 0
Nechi, pfd	0 13 0
Oroville	0 17 0
Santa Gert'dis	0 13 0
Tomboy	1 2 6

SALT LAKE Aug. 28	
Name of Comp.	Bid
Alta Con	‡.21¼
Black Jack	‡ 10
Colorado Mining	.15¼
Crown Point	.02½
Daly-Judge	.75
Emma Cop	68
Gold Chain	‡ 20
Grand Central	66
Iron Blossom	1 57½
Lower Mammoth	.05½
May Day	.10
Opohongo	‡ 01½
Prince Con	1 45
Seven Troughs	‡ 03¼
Silver King Coal'n	2 95
Silver King Con.	3.35
Sioux Con	.09¼
Uncle Sam	.05
Yankee	‡ 17

COLO. SPRINGS	Aug. 29
Acacia	‡.03½
Doctor Jack Pot	.10½
Elkton Con	16
El Paso	60
Findlay	.03¾
Gold Sovereign	.06½
Golden Cycle	2 14½
Granite	.75
Isabella	.19¼
Jack Pot	05
Jerry Johnson	‡.03¼
Mary McKinney	.28
Portland	1.65
Vindicator	1 99¾

TORONTO	Aug. 28
Adanac	‡ 75
Bailey	07½
Chambers Ferland	17
Coniagas	4 75
La Rose	60
Peterson Lake	22
Right of Way	05½
Seneca Superior	25
T. & Hudson Bay	55 00
Temiskaming	59
Trethewey	‡ 21
Wettlaufer-Lor	.11
Dome Exten	.34
Dome Lake	43
Foley O'Brien	55
Hollinger	27.90
Jupiter	.27
McIntyre	1 31
Newray	.59½
Porcu. Crown	65
Preston E. D.	‡ 03
Vipond	38
West Dome	[illegible]

N. Y. EXCH. Aug. 29	
Name of Comp.	Clg.
Alaska Gold M	13⅜
Alaska Juneau	7¾
Am.Sm.&Ref.,com	97⅛
Am. Sm. & Ref., pf	112⅛
Am. Sm. Sec., pf. A	94½
Am. Sm. Sec., pf. B.	85
Am. Zinc	33¾
Am. Zinc, pf	66½
Anaconda	85
Batopilas Min.	1½
Bethlehem Steel	484½
Bethlehem Steel, pf.	135
Butte & Superior	66⅛
Chile Cop.	20
Chino	51½
Colo. Fuel & Iron.	47½
Crucible Steel	75½
Dome Mines	24
Federal M. & S.	16
Federal M. & S., pf.	39
Great Nor., ore ctf	37¼
Greene Cananea	45½
Homestake	130
Inspiration Con.	55¾
International Nickel	40⅝
Kennecott	49¼
Lackawanna Steel	75½
Miami Copper	34⅝
Nat'l Lead, com.	65
National Lead, pf.	113
Nev. Consol.	19⅜
Ontario Min.	6¼
Quicksilver	2⅝
Quicksilver, pf	4½
Ray Con.	24¾
Republic I&S, com.	52¼
Republic I&S, pf.	113½
Sloss-Sheffield	47
Tennessee Copper	24
Utah Copper	82⅜
U. S. Steel, com	96
U. S. Steel, pf.	118
Va. Iron C. & C.	45

N. Y. CURB	Aug. 29
Beaver Con.	41
Buffalo Mines	85
Butte & N. Y.	1¾
Butte C. & Z.	5½
Caledonia	.61
Can. Cop. Corpn.	1⅝
Cashboy	.04
Cerro de Pasco	36½
Con. Ariz. Sm.	1½
Con. Coppermines	2⅝
Con. Nev.-Utah.	28⅛
Crystal Cop.	1 1/16
First Nat. Cop.	4¼
Florence	.70
Goldfield Con.	.81
Goldfield Merger	.08½
Granite	21
Hecla Min	5½
Howe Sound	4½
Jerome Verde	1½
Joplin Ore & Spel.	59
Kerr Lake	4⅞
Magma	15½
Majestic	56¼
McKinley-Dar-Sa	60
Mother Lode	.36½
Nevada Hills	.16
N. Y. & Hond.	15¼
Nipissing Mines	7
Oro	.03
Ray Hercules	3⅝
Rochester Mines	.60
St. Joseph Lead	16¾
Standard S. L.	1 3/16
Stewart	.25
Success	.34
Tonopah	5 9/16
Tonopah Ex.	5⅝
Tribullion	5/16
United Zinc	5
White Knob, pf.	1⅞
White Oaks	5⅜
Yukon Gold	2

BOSTON EXCH Aug. 29	
Name of Comp.	Bid
Adventure	3½
Ahmeek	99
Algomah	1½
Allouez	67½
Ariz. Com., ctfs.	9¼
Bonanza	.25
Butte-Ballaklava	¾
Calumet & Ariz	71¼
Calumet & Hecla.	574
Centennial	18
Copper Range	61
Daly West	2½
East Butte	15½
Franklin	8
Granby	86½
Hancock	13½
Helvetia	25
Indiana	3¼
Island Cr'k, com.	45
Island Cr'k, pfd.	88½
Isle Royale	28¾
Keweenaw	4
Lake	12½
La Salle	4
Mason Valley	2¼
Mass.	12½
Mayflower	3¼
Michigan	3¼
Mohawk	88
New Arcadian	6½
New Idria	12
North Butte	21½
North Lake	1¾
Ojibway	1⅝
Old Colony	2
Old Dominion	69
Osceola	86¼
Quincy	90
St. Mary's M. L.	73
Santa Fe	2
Shannon	8¾
Shattuck-Ariz.	28¼
So. Lake	6¼
So. Utah	22
Superior	16
Superior & Bost.	3¾
Tamarack	37¼
Trinity	5½
Tuolumne	40
U. S. Smelting	70¼
U. S. Smelt'g, pf.	51
Utah Apex	3 15/16
Utah Con	14
Utah Metal	‡8
Victoria	2¾
Winona	4¾
Wolverine	53
Wyandot	1¼

BOSTON CURB	Aug. 29
Bingham Mines	9¾
Boston Ely.	98
Boston & Mont.	75
Butte & Lon'n Dev.	62
Calaveras	5½
Calumet-Corbin.	02½
Chief Con.	2
Cortez	.40
Crown Reserve	.40
Davis-Daly	2¼
Eagle & Blue Bell	1 13/16
Houghton Copper.	1½
Iron Cap Cop. pf	5½
Mexican Metals	.37
Mines of America	2¼
Mojave Tungsten	3¼
Nat. Zinc & Lead	1
Nevada-Douglas.	1 3/16
New Baltic	1⅞
New Cornelia	15
Ohio Copper	.07
Oneco	.75
Raven Copper	.07
Rex Cons	.20
Rilla	.16
United Verde Ext.	33½

‡Last Quotations.

Monthly Average Prices of Metals

SILVER

Month	New York			London		
	1914	1915	1916	1914	1915	1916
January	56.572	48 855	56.775	26.553	22.731	26.960
February	57.506	48 477	56.755	26.573	22 753	26.975
March	58.067	50.241	57 935	26.788	23.708	27 597
April	58.519	50.250	64 415	26.958	23.709	30 662
May	58.175	49.915	74.269	26.704	23.570	35.477
June	56.471	49.034	65 024	25.948	23.267	31 060
July	54.678	47.519	62 940	25.219	22.597	30 000
August	54 344	47.163	......	25.979	22.780	.....
September	53.290	48.680	...	24.260	23 591	.....
October	50.654	49.385	......	23 199	23.925	......
November	49.082	51 714	......	22.703	25.094	......
December	49.375	54 971	......	22.900	26.373	......
Year	54 811	49 684	.....	25.314	23 675	

New York quotations cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

COPPER

Month	New York		London			
	Electrolytic		Standard		Electrolytic	
	1915	1916	1915	1916	1915	1916
Jan.	13.641	24.008	60.756	88.083	65.719	116.167
Feb.	14.394	26.440	63 494	102 667	*	133.167
Mar.	14.787	26.310	66.152	107.714	*	136.000
April	16.811	27.895	75 096	124 319	*	137 389
May.	18.506	28.625	77.600	135 457	*	152.522
June.	19.477	26.601	82 574	112 432	95.333	137 455
July	18 796	23.865	76 011	95.119	91.409	125 500
Aug.	16.941	......	68.673	....	82.333	......
Sept.	17.502	......	68 915	....	85.250	....
Oct.	17 686	......	72 601	....	88 000	.....
Nov.	18.627	......	77.744	....	93.273	......
Dec.	20.133	......	80.773	....	100.43	....
Year.	17.275	......	72 532	....	.....	.....

TIN

Month	New York		London	
	1915	1916	1915	1916
January	34 260	41.825	156.550	175.548
February	37.415	42.717	176.925	181.107
March	48.426	50.741	180.141	193.609
April	47.884	51.230	166.225	199.736
May	38.790	49.125	162.675	196.511
June	40.288	42 231	167 636	179 466
July	37.423	38 510	167 080	168.357
August	34.389		151 440	.....
September	33.125	.....	152.625	......
October	33 080	.....	151 554	......
November	39 224	....	167.670	....
December	38.779	....	167 000	....
Av. year	38 590	......	163 960	.....

LEAD

Month	New York		St. Louis		London	
	1915	1916	1915	1916	1915	1916
January	3.729	5.921	3.548	5.826	18.606	31.167
February	3.827	6.246	3.718	6.164	19.122	31 988
March	4 053	7.136	3.997	7.375	21 883	34.440
April	4 221	7.630	4.142	7.655	21.094	34.368
May	4 274	7.463	4.182	7 332	20.347	32 967
June	5.932	6 936	5.836	6 749	25.170	31 011
July	5.659	6 352	5.531	6.185	24 611	28 137
August	4 656	.....	4.520	.....	21.946	......
September	4 610	......	4 490	......	23.151	......
October	4 600	......	4.499	....	23.994	......
November	5.155	.....	5 078	...	26.278	......
December	5.355	......	5.266	......	28.807	.....
Year	4 673	......	4.567	......	22.917	......

SPELTER

Month	New York		St. Louis		London	
	1915	1916	1915	1916	1915	1916
Jan.	6.386	16.915	6.211	16.745	30.844	89 810
Feb.	8.436	18.420	8.255	18 260	39.819	97 762
Mar.	8.541	16.846	8.360	16.676	44.141	95 048
April	10.012	16.695	9 837	16.525	49.888	99.056
May	14 781	14 276	14.610	14.106	68.100	94 217
June	21.208	11 752	21.038	11 582	100 614	68 591
July	19.026	8.925	18.856	8.755	97.250	50.750
Aug.	12.781	......	12.611	......	67.786	......
Sept.	13.440	......	13.270	......	67.841	......
Oct.	12.800	......	12 596	......	66.536	......
Nov.	15.962	......	15.792	......	88 409	......
Dec.	15.391	......	15.221	......	89 400	......
Year	13.230	......	13.054	......	67.553	......

New York and St. Louis quotations, cents per pound. London, pounds sterling per long ton. * Not reported.

PIG IRON IN PITTSBURGH

Month	Bessemer‡		Basic‡		No. 2 Foundry	
	1915	1916	1915	1916	1915	1916
January	$14 59	$21.60	$13.45	$18.78	$13.90	$19 70
February	14 55	21.16	13.45	18.93	13.90	19.51
March	14.55	21.81	13.45	19.20	13.95	19.45
April	14 55	21 65	13.45	18.95	13 95	19.45
May	14.61	21.78	13.60	19 11	13 83	19.58
June	14 70	21 95	13.67	18 95	13.77	19 34
July	14.94	21 95	13.91	18 95	13.68	19.20
August	16.01	......	15.31	......	14 75	.....
September	16 86	......	15.95	......	15 70	.....
October	16 95	......	15 96	......	15 80	......
November	17 57	......	16.47	......	17 20	......
December	19.97	......	18 44	......	18 95	......
Year	$15.82	......	$14.76	......	$14.95	......

‡As reported by W. P. Snyder & Co

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The Patiño Tin Mines, Bolivia

By Benjamin L. Miller* and
Joseph T. Singewald, Jr.†

SYNOPSIS—A description of the tin mines owned by Patiño, who was formerly a day laborer, but whose conviction of the possibility of mining tin ore in Bolivia raised him to the position of the wealthiest man in Bolivia and placed tin mining at the head of the Bolivian mining industry.

The history of mining is replete with stories of spectacular discoveries and suddenly enriched miners. In almost every country one finds wealthy families whose fortunes can be traced back to some remarkable mines. In some instances these fortunes have been acquired through good luck entirely, but in most cases some men possessed greater foresight than others and were willing to stake all they possessed on their beliefs. To the latter class belongs Simon I Patiño, the Tin King of Bolivia. From an ordinary day laborer in the mines, in a few years he became a multimillionaire, the wealthiest man in Bolivia; and his entire fortune is due to his conviction that tin ore could be profitably mined in Bolivia.

The world had come to look upon tin as a product in which Cornwall, the Malay Peninsula and adjoining islands and Australia were almost the sole sources of supply, and thus the tin ore encountered in Bolivian silver mines was ignored and discarded as waste. Patiño, however, realized the possibilities of these Bolivian ores. He secured options on numerous mines and old dumps rich in cassiterite ore, and through persistance was able to obtain the necessary capital to prove his contention. To him Bolivia owes much, as tin mining now occupies first place in the mining industry of the country, followed by copper, bismuth and silver; 36,321 tons of tin barrilla carrying from 60% to 65% Sn was exported during 1915. One of the Patiño mines, the Salvadora

THE TOWN OF UNCIA, BOLIVIA

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*Professor of geology, Lehigh University, South Bethlehem, Penn.

†Associate in economic geology, Johns Hopkins University, Baltimore, Md.

at Uncia, contributed more than 25% of the total, according to figures at hand, and continues to hold the record as Bolivia's premier tin mine.

Señor Patiño has not only enriched himself through his profits in tin mining, but by his support of various enterprises has done so much for the development of his country that he well deserves the gratitude that he receives from the Bolivians. It must be admitted, however, that several of his industrial and agricultural ventures have not been successful. He has spent most of his time in Europe in recent years, leaving his mines in charge of Maximo Nava, who unquestionably is one of the ablest mining men that Bolivia has produced. Patiño's principal mines are located at Uncia and Huanuni.

La Salvadora and Llallagua, the two greatest tin mines of Bolivia, are located in the same mountain 42 mi. southeast of Machacamarca, a station on the Antofagasta-LaPaz R.R., a short distance south of Oruro. Patiño owns La Salvadora, while Llallagua is owned by Chilean capital operated under the name of Compania Estañifera de Llallagua. Patiño had built a railroad from Machacamarca to Kilometer 40 (Punta de Rieles) and had the roadbed graded several kilometers farther toward Uncia when the European War depressed the tin market and temporarily halted the work. It will no doubt be completed before very long. The railroad passes through Huanuni, the other important tin-mining district controlled by Patiño.

At the terminus of the railroad, passengers are taken by stage to Uncia, a distance of 18 mi. over rough roads through a very hilly country. It requires 5 hr. for the trip and costs 12 bolivianos a passenger ($3.60). Supplies for the town of Uncia which has a population of about 8,000 people, are mainly brought from the railroad by llamas; the country itself is arid and treeless and produces very little. Fortunately, the scant, coarse grass is sufficient for the llamas and alpacas, the two animals on which the country is dependent for fuel, wool, meat and transportation.

The hill from which almost one-half of Bolivia's annual production is obtained is composed of a central mass of porphyritic rhyolite which has been intruded through a thick series of slates and shaly sandstones in most places decidedly carbonaceous and dark in color, but near the town of Uncia there is considerable red shale. No fossils were found in these sedimentary rocks, but they belong to the great series of shales so prominently developed in the Eastern Cordillera and generally believed to be of Devonian age. In view of our discovery of widespread Tertiary shales in the vicinity of Potosi it seems probable that the Uncia shales may also be found to be of much more recent age, and it is hoped that fossils may be found. The shales outcrop on the lower flanks of the mountain.

Within the rhyolite there are occasional small dikes of basic rocks, which in places are in close association with the ore veins and suggest some relationship with them. However, ore veins are found where the dikes are not present, and vice versa. A series of faults or a fault zone about 20 m. in width displaces the veins of both mines. The only other evidence of movement is gouge material along the veins.

THE PATIÑO MILL, UNCIA

Throughout the mountain there are numerous veins, the most important of which have received names. The main tunnel of the Salvadora mine, Socavon Patiño, cuts in order the following veins: Victoria, Animas, Bismarck, San Miguel, Salvadora, Demasias, Inca and One A. In the Llallagua about 15 veins have been found, of which the Reggis, Blanca and San Jose are the most important. In general the veins have approximately parallel strikes, about N. 30° E., with steep dips to the Northwest or Southeast. Several of the southeasterly dipping veins of the Salvadora mine pass into the ground owned by the Llallagua company, while some of the northwesterly dipping veins of the latter company enter the ground owned by Patiño. If the apex law were in force in Bolivia, there would, no doubt, be endless litigation between the two companies. Even without it there was much trouble between them for several years, and both companies made liberal purchases of firearms for defense. But their difficulties have all been adjusted now, and they are coöperating in the construction of a tunnel that will drain both properties.

The veins are extremely variable in width. Within a few yards a vein may be found to widen from a few inches to several feet and perhaps entirely disappear a few yards beyond. Naturally, stoping is confined to the wider portions of the veins only.

The veins are in part true fissure fillings and in part the cemented fragments of breccia along fracture zones. The principal ore mineral is cassiterite of very dark color, practically black. In the true veins it is fine-grained and compact, but in the breccia there are numerous open cavities, or vugs, lined with cassiterite crystals. In places the cassiterite crystals in the vugs have been formed on quartz crystals previously formed. Some of the cassiterite ore crumbles very readily, almost making a powder when broken.

Considerable bismuthinite occurs in the ore, but as yet no attention has been given it. While the bismuth content is not as great as one may think from a casual examination of the ore, due to the thin-bladed crystals of the bismuthinite determining the place where the ore breaks and consequently showing prominently on the surfaces of the ore fragments, yet there is little doubt that some pieces of rich bismuth ore could be sorted out by hand with profit.

Wolframite and scheelite are present, but until recently no efforts were made to separate them from the cassiterite. In March, 1916, the first shipment of tungsten concentrates was made. It assayed 56% tungstic acid, and the company was at that time obtaining 500 lb. a day. A little native copper and some chalcopyrite have been found, but not in economic quantities.

Pyrite is almost the sole gangue mineral, with small amounts of marcasite, arsenopyrite, pyrrhotite, quartz, siderite and aragonite. Most of the quartz is in the vugs. In the upper part of the mountain where the veins have now been almost worked out there was considerable oxidized ore, *pacos,* of porous character and stained with limonite. Some pockets of unusually rich tin ore were encountered in these early workings near the top of the hill, but in general the veins in the oxidized zone carry just about the same values as in the sulphide portion. In weight the *pacos* ores are richer, due to the removal of most of the gangue materials by oxidation and solution.

MINING BY TUNNELS AND DRIFTS

The first mining was done by open-cut in some of the veins outcropping near the summit of the mountain. Later a tunnel was run into the mountain at an elevation of 14,446 ft. This tunnel is still in use; during 1915 about 150 tons of ore a month came from it. The main workings are now carried on through the Socavon Patiño, which cuts the veins at an elevation of 13,200 ft. This tunnel is 7,312 ft. long and cuts the different veins. From it drifts have been run following the veins and stopes driven where the veins are sufficiently wide to pay. A new tunnel has been started 90 ft. lower than the Patiño but, on account of the water, work has been stopped until the completion of the joint tunnel, previously mentioned. Above the level of the Salvadora tunnel the ore was mainly oxidized, but little *pacos* has been obtained from the workings of the Socavon Patiño.

Aërial trams connect the Salvadora and Patiño tunnels with the mill. At the mouth of the tunnels Cholo women sort out some of the richest ore, called *guia,* which is shipped without further concentration. The Salvadora mine produces monthly about 50 tons of *guia,* containing from 6% to 65% Sn.

Professor Copeland and Mr. Hollister last year described the milling of the ores at Llallagua very fully in the *Journal*[1], so it is unnecessary to describe the methods employed at the Uncia mill in detail as the two mills are similar. After passing over trommels the coarse ore goes to ball mills equipped with 19-lb. steel balls. The resulting product is sized by trommels into three grades. The oversize, greater than 5 mm., goes to two jigs, the material from 2 mm. to 5 mm. to two other jigs, and the finest to a hydraulic classifier. The further treatment is by regrinding the coarser materials from the jigs, further treatment on Ferraris and Humboldt tables and finally in buddles. In the new mill, now in process of construction, the treatment will be somewhat modified. The old mill produced about 900 tons of tin barrilla a month, while the new mill is expected to produce from 1,200 to 1,500 tons monthly.

The barrilla is put in bags and transported to the terminus of the railroad by carts or by llamas. Roughly, about two-thirds is carried by llamas at a cost of $10 a ton for the distance of 18 mi. Each llama will carry about 100 lb. and will only make from 10 to 12 mi. a day, as the llamas get their entire sustenance from the coarse grass along the route and so must be permitted to stop and graze at frequent intervals.

PLACER TIN WORKINGS OF UNCIA

The streams near Uncia and Llallagua have long carried down much tin ore from the lodes previously described, and rich placer deposits have accumulated. Below the town of Uncia are two alluvial terraces where considerable placer work has been done. At the time of our visit the lower one was being actively prospected under the management of a brother of S. I. Patiño, but sufficient work had not been done to determine the average tin content of the gravel. A shaft 90 ft. in depth had been sunk through the gravels to the underlying slate. The water is taken from the lower workings through this shaft by means of a cowhide bag.

The richest gravels have been found at the contact with the underlying slates, but pay-streaks were also found at depths of 45 and 55 ft. The cassiterite pebbles are mainly less than 1 in. in size, yet a few cobbles as much as 4 in. diameter have been found.

The Huanuni mines of Patiño were purchased about four years ago from two companies which had long worked the same veins and fought each other. So bitter was the feeling between the workmen of the two companies that, it is said, a number of lives were lost in underground fights. The purchase price of the two properties is reported to have been approximately $2,000,000; as yet no dividends have been paid, and the future of the mines is somewhat uncertain. With the exception of one small operation, Patiño controls all the workable deposits of the Huanuni section.

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[1] "Eng. and Min. Journ.," Vol. 100, pp. 461-464, 513-51 555-558.

The main workings are located on the south side of Mount Posoquoni, a mountain which rises to the elevation of 14,638 ft., situated along the line of the Patiño railroad, 30 km. from Machacamarca. Placers have been worked in the valley, while mining has been carried on through a number of tunnels. The lowest, the Socavon Patiño, has an elevation of 12,984 ft., while the highest, the Socavon Harrison, has an elevation of 13,460 ft.

THE GEOLOGY OF MOUNT POSOQUONI

Mount Posoquoni is composed of gray to pink compact quartzitic sandstones with interbedded bluish-gray shales and shaly sandstones. An adjoining mountain is capped with a flow of porous porphyritic rhyolite, some of which occupies part of the depression between the two mountains. The mineralization of the region is unquestionably related to this extrusion of igneous rock, although no rock of this character has been encountered in the mines.

The sandstones and shales have been folded, jointed and shattered, yet in the main the strata have a north-south strike, dipping steeply to the east while the veins cut across the strata at high angles. In the vicinity of the veins the joints that are parallel to the veins may easily be confused with the bedding planes where the rocks are fairly homogeneous. The age of the rocks remains uncertain, as our efforts to find any fossils were unsuccessful, although we were told that occasional specimens had been observed.

VEIN SYSTEM WELL DEFINED

The veins of the mountain are numerous, although only a few are persistent and have received names. The main vein is the Cataricagua, which was worked by open-cut almost at the crest of the mountain and has been located in all the lower tunnels with the possible exception of the Patiño. Its general direction is N. 55°-60° E., with an average dip of 45° to the southeast, although in places almost vertical. In reality it consists of two parallel veins which are, in most places, rather close together yet separated by a wall of firm rock that in one place had a maximum thickness of 450 ft. In the upper levels a steeply dipping offshoot from the Cataricagua is known as the Veta Medina. A third vein of importance outcropping lower down on the mountain is the Veta Tanitani. Many other veins have been worked with profit for short distances, but cannot be depended upon.

The veins vary greatly in width up to 30 ft. and also vary in their tin content, so that it is not profitable to stope in more than a small part of the drifts. The veins are shattered zones filled with sandstone fragments and cemented by the introduced ore and gangue minerals. The brecciation is more pronounced in the oxidized zone where the removal of the pyrite has left large open spaces and permitted fragments of the wall rock to break away. These have been cemented by limonite formed from the pyrite, yet less firmly than in the sulphide zone where open spaces, or vugs, are rather rare.

Some cross-faults have dislocated the veins, shifting all of them down the hill, but as yet these have not been thoroughly mapped. Indeed, careful geologic examinations are greatly needed in these mines as well as in many other Bolivian mines. So long as the operations paid good dividends the necessity for such work did not arise, and the mine owners did not object to expensive prospecting work prosecuted on the hit-or-miss plan.

Until recently only oxidized ore was mined, but this is now largely exhausted and in the future the sulphide ores must be mainly depended upon to maintain the production. A large tonnage of oxidized ore still remains, yet most of it is too low grade to be profitably mined. As is true in most of the Bolivian tin mines, no fixed line can be drawn between the oxidized and the sulphide ores. Even within the same vein some oxidized ores have been found at a depth of 300 m., and elsewhere sulphide ores are within 90 m. of the surface.

The oxidized ores are brecciated sandstone fragments cemented by cassiterite and so thoroughly coated with limonite that it is usually possible to distinguish between good ore and barren rock only by the specific gravity. In the best-grade ore some vugs lined with cassiterite crystals occur. Some specimens show small amounts of siderite and quartz. In the oxidized ore the highest values are found near the foot wall, probably due to the grains of cassiterite dropping there when released by the removal of the pyrite. That is, it is believed that this concentration is mainly, if not entirely, mechanical. The sulphide ores, as has been stated above, include fragments of sandstone with much pyrite, cassiterite, in places considerable sphalerite, and small amounts of quartz, tetrahedrite and siderite.

The tin values are about the same in both classes of ore. At the time of our visit the ore sent to the mill contained about 3% Sn, while the ore as mined probably contained about the same, although no data were available. When the ore reaches the surface it is hand sorted by Cholo women, who discard the waste rock and also pick out the pieces of rich ore, *guia*, which average 65% Sn and are shipped direct. Five to eight tons of *guia* are obtained monthly.

MINING THROUGH TUNNELS AND DRIFTS

Mining is done entirely through tunnels, of which there are several now in use—the Hulman, Barreno, Tanitani, Harrison, Patiño, etc. The tunnels crosscut the veins with drifts run along the veins. Where the ore is sufficiently rich, overhead stopes are driven, or in a few places winzes are sunk. The walls remain unsupported in most places, but here and there a little timber is required or walls of rock are constructed for support. We saw many large open stopes, the walls of which had been standing unsupported for many years. The ore is trammed to the mouths of the tunnels by hand and dumped on the sorting-floor, whence the milling-ore goes down the hill to the concentrating mill by aërial tram.

The Patiño tunnel is the lowest tunnel and entirely in the sulphide zone of the veins which it cuts. At the time of our visit the tunnel had been driven to the point where the main veins should occur if the dip remained the same as in higher levels, but only small veins had been found. On one of these a winze had been sunk for purposes of exploration and some ore of average grade obtained. This was carried in rawhide bags by Indian boys to the tunnel level. These boys, some of whom were no more than 10 to 12 yr. of age, would carry 60 lb. of ore at a time.

On the floor where the Cholo women pick out the *guia* and discard the waste rock there is usually considerable high-grade material of very fine size. This is screened, and the finest grade is concentrated in hand jigs at the mouth of the tunnel, yielding a small amount of high-grade *barilla*. At the time of our visit a new mill was in process of construction. The two mills then in use were treating the oxidized ores by means of jigs and round concrete tables with revolving arms. In the new mill it was planned to treat sulphide ores which would first be roasted and then treated on jigs and tables A large amount of middlings was being sorted awaiting the new mill.

In the latter part of 1914 the Huanuni mines produced about 350 tons of *barrilla* and *guia* a month, while in July, 1915, the mills were treating about 300 tons of ore a day and the mines producing only about 100 tons of *barilla* and *guia* monthly. The old mill was making only about 65% recovery from 3% Sn ore, but it was hoped to materially improve this in the new mill. At Huanuni the miners in 1915 were paid 75 to 85c. a day, the boys 45c., and the women 30c. The miners were compelled to furnish the oil for their lamps, at a cost of about 6c. a day. These wages are about half what was paid before the European War demoralized the Bolivian tin industry.

Butte & Superior Mining Co.

Butte & Superior Mining Co. reports the following comparison for the first and second quarters of 1916:

	First Quarter, 1916	Second Quarter, 1916
Dry tons of ore milled	164,500	161,270
Average zinc contents, %	15.692	15.9709
Average silver contents, oz. per ton	6.844	6.7041
Zinc concentrates produced, tons	45.121	45.194
Average zinc in concentrates, %	53.122	52.9956
Total zinc in concentrates, lb.	47,938,530	47,901,445
Average silver in zinc concentrates, oz. per ton	22.018	21.8757
Mill recovery, % zinc recovered in concentrates	92.855	92.989
Mining costs per ton	$4.0341	$4.4971
Milling costs per ton	$1.5763	$1.7610
Total cost per ton, mining and milling	$5.6104	$6.2581

The tonnage is but slightly lower in the second quarter than the record first quarter, but costs were greatly affected by higher-priced labor and material. About the end of the quarter the No. 3, or new main hoisting shaft was connected through to the series of raises from the 1,400-ft. level, thus providing a continuous and permanently timbered shaft from the surface to that level. Construction of stations for this new shaft as well as that of foundations for new shafthouse and equipment progressed satisfactorily and will be finished well in advance of the delivery of machinery and steel building material, which will begin within a few weeks. Good progress was also made in sinking the new No. 2, or new manway, shaft and on construction of the new crushing plant and improvements in ore-bin facilities. Active development work was commenced on the 1,700- and 1,800-ft. levels, and while the extent of this work is not great as yet, the size, character and grade of the orebodies disclosed are fully as favorable as those of the levels above. Most of the work on these lower levels was confined to drifting, but even with the limited amount of crosscutting that was done, the addition to ore reserves was substantial and, taken together with the additional reserves blocked out on the 1,600-ft. level and above, constitute a total addition to reserves for the quarter about 30% in excess of the tonnage mined. Developments to the east and beyond the end of the Black Rock claim have been especially gratifying, and the outlook is that for some time in the future the additions to ore reserves resultant from the usual amount of development work done in connection with mining operations will be much more rapid than the reduction of these reserves through ore extraction. Owing to the urgent necessity of rapid progress in the construction of the new shafts and the large tonnage of waste necessary to be handled, it has been impossible to do any exploratory or extraordinary development work, and consequently such work as has been and is being done is confined to that necessary in regular mining operations.

The financial results of operations for the second quarter as compared with those of the first quarter, are as follows:

	First Quarter, 1916	Second Quarter, 1916
Net value of zinc concentrates (at mill)	$4,337,412.99	$2,879,568.45
Net value of lead concentrates (at mill) and of residues	264,302.75	246,341.54
Miscellaneous income	21,427.21	22,772.34
Total net value	$4,623,142.95	$3,148,682.33
Operating costs, taxes, etc.	1,068,203.27	1,086,653.00
Profits	$3,554,939.68	$2,062,029.33

After the payment of the regular quarterly dividend of 75c. per share and an extra dividend of $10 per share payable to stockholders on June 30, the company had net quick assets of approximately $3,900,000.

Sales of spelter have been made for future delivery covering a substantial portion of the production for the balance of this year. These sales have been made at a lower price than that applying to the second quarter.

Approximately one-third of the production of concentrates is sold under a contract, and settlement is made on the basis of current quotations of the *Engineering and Mining Journal* and these quotations have been at a very much lower price for the past quarter than the price at which future sales were made early in the year applying to current production. The average price for spelter used in determining the profits of the quarter is 11.41c. per lb.

"Wood Tin" Found in Nevada

A curious ore of tin, called "wood tin" from its concentric banding resembling the annual growth rings of wood, has been recently discovered in Nevada. An employee of the Rassell cattle ranch, situated 20 mi. north of Battle Mountain, a town on the Southern Pacific R.R. in northern Lander County, brought a sample of the ore into town, where it was eventually recognized by an engineer who had seen similar material in Mexico.

At the request of Senator Key Pittman, of Nevada, this ore deposit has been examined by Adolph Knopf, a geologist of the United States Geological Survey.

The ore, which is an oxide of tin, occurs in narrow veinlets in rhyolite lavas, which were erupted in middle Tertiary time. In places the veinlets are sufficiently numerous to form low-grade lodes, but because of the small development work so far done not much is known as to the size, extent and richness of these lodes. The indications of the stronger lodes, taken in connection with their geology, are, in the opinion of Government geologists, such as to warrant further exploration.

The deposits resemble closely those of the Mexican states of Durango, Zacatecas and Guanajuato, but are wholly unlike all other tin deposits, most of which are associated with intrusive granites. Not only has the tin ore been found in place at a number of localities over a considerable area, but placer tin ore has been found in all the gulches heading in this area, and also in some of those at the north end of Shoshone Mesa.

Black Hawk Silver-Cobalt Ores

By Albert A. Leach*

Among the old silver camps of New Mexico that are being reopened since the rise in price of silver, is one that is likely to prove of interest to mining men because of its unique type of deposit. It is the old camp of Black Hawk, lying 12 mi. northwest of Tyrone in Grant County, which is interesting because of its deposits of nickel and cobalt arsenides in commercial quantities together with massive native silver and argentite. The ores are identical with those of Cobalt, Ont., and so far as I have been able to ascertain, are the only important deposits of this type in the United States.

The camp is an old one, having been discovered and worked in the early eighties, and intermittently up to 1893, when the mines were closed and allowed to fill with water. Since that time no work of importance has been done in the camp until recently, when the high price of silver again awakened interest in these long-abandoned camps.

During the short period of operations, the camp produced rather heavily considering that only the high-grade ores were handled. The cyanide process was not then in general use and no effort was made to treat the low-grade ores, which were thrown onto the dumps with the waste rock. The production of the camp is variously estimated. The United States Geological Survey gives the production of the camp as $1,000,000. The mine owners say this figure is too low and that the camp produced upward of $1,500,000. Much difficulty was experienced with high-graders and it is claimed that their operations were so successful at some of the mines as to rob the owners of all profits. Much of the ore was massive native silver which, it is stated, averaged the high-graders from $800 to $1,000 a sack.

The Black Hawk mine is the deepest in the camp, having attained a depth of 750 ft. on the vein. Its production is estimated at $650,000. The mine was closed in 1888 because of litigation and remained idle up to February, 1916, when the litigation was settled for a cash consideration and the property bonded to Minneapolis capitalists. Work was commenced at once on the mine, and the shaft is now being dewatered and retimbered preparatory to further explorations. The property is under the management of E. D. Lidstone, who is thoroughly familiar with the Black Hawk deposits, having made a careful examination of the mine prior to the shutdown. It is claimed that valuable ores were exposed in several places in the mine when it was closed and it will probably be producing steadily in a short time. A cyanide plant will be installed to treat the old mine dump and the low-grade ore.

Sufficient information is lacking regarding the mineral associations at this mine to enable a statement as to whether the nickel and cobalt ores were of any particular importance. The native silver here was very massive and was mined literally in sheets weighing up to 200 lb. Specimens of the ore resemble globs of melted coin, and one piece that went through the rolls (the nearest approach to a mill the old timers had), was flattened into a huge shaving-like slab of almost pure silver.

The Alhambra mine was an important producer of cobalt and nickel ores as was also the Old Rose mine. The Alhambra was worked to a depth of 400 ft. and made a production of $300,000. Its ores were chiefly native silver and niccolite carrying from 300 to 2,000 oz. silver per ton. Considerable smaltite was noted, also some millerite, all carrying silver. It is reliably stated that the niccolite ore streak was from 2½ to 3 ft. in width. The whole vein matter carries from 10 to 50 oz. silver per ton, but the native silver ore usually occurs in a chute, whose pay streak is from 8 to 24 in. wide and assays from 400 to 6,000 oz. silver per ton. Argentite occurs as filling in fractures and as crystals on the niccolite and spar gangue. Some hand specimens show niccolite, smaltite, millerite and crystals of argentite with crusty masses of erythrite and annabergite.

At the Old Rose mine, which was exploited to a depth of 200 ft., a large percentage of the ore was smaltite and chloanthite with high silver content. The upper stopes are said to have produced chiefly cerargyrite. The total production of the mine was about $150,000. Work was suspended before any real development work was accomplished and only a small part of the workings are now accessible.

The geology of the camp is simple. The country rock is pre-Cambrian gneiss cut by monzonite porphyry dikes which radiate from the main porphyry mass on the northwest side of the camp known as Twin Peaks. The veins usually parallel the dikes or are otherwise associated with them, and are of the true fissure type, ranging in width from 2 to 5 ft. They are all of the same general type, having a spar gangue, usually calcite or barite, and invariably present an intensely brecciated appearance.

There is considerable activity in the camp at present and some of the newer prospects are showing up so well they may be expected to enter the producing class any day. Some large chunks of very rich native silver float picked up on the east side of the camp recently have stimulated prospecting somewhat and the camp seems to be demonstrating its ability to come back.

Data on American Petroleum Oils

The Bureau of Standards, Department of Commerce, has just published a report which gives an account of the experimental work on which are based the expansion tables of Circular No. 57, "United States Standard Tables for Petroleum Oils." It gives a description of the methods and apparatus employed in the determination of the density and thermal expansion of petroleum oils from the various fields in the United States. Copies of this report, Technical Paper No. 77, may be obtained without charge upon application to the Bureau of Standards, Washington, D. C.

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Manganese and Manganiferous Ores, the annual statement of the Geological Survey, Department of the Interior, 1915 is now available for distribution. During the year 801,290 long tons of manganiferous ores were produced in the United States.

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*Chief geologist, Burro Mountain Copper Co., Tyrone, N. M.

Concentration at Inspiration--II[*]

SYNOPSIS—Though not the largest in capacity of the country, the Inspiration concentrator is undoubtedly the most uptodate in the treatment of low-grade chalcocite ores. Marcy ball mills grind the ore from the maximum 2-in. cube product of the Symons disks to 60% — 200-mesh at the rate of 400 tons per day. Total power consumption in grinding and transportation from mine bins to flotation cells is 10.729 kw.-hr. per ton exclusive of railway transportation. Other features of the mill are the drag classifier handling 800 tons daily, and the 200-ft. diameter Dorr thickener, the largest yet built.

The product of the Inspiration-mine crushing plant, loaded into cars for transportation to the concentrator, has been crushed to pass a 2-in. opening of the disk crushers, assays about 1.75% copper and has a moisture content of about 2.5%. Delivered to the concentrator, a mill recovery of 90% of the total sulphide is made, or about 85% of the total copper content.

Although the Inspiration plant is not quite the largest in the country it embodies what is today the latest practice in the treatment of low-grade chalcocite ores. In certain departments considerable pioneering has been done, which has resulted in marked economies, advantage of which will no doubt be taken where similar conditions make them applicable.

FIG. 1. TAILINGS STORAGE DAM

FIG. 2. WATER RESERVOIR, 3,000,000-GAL. CAPACITY

Model Grinding-Floor Space Economy

One of the most novel features relative to the layout of the plant is the arrangement of the grinding floor. With all due regard for the individual capabilities of the machines used, it is nevertheless a fact that the arrangement has been of paramount importance in bringing about the excellent results that are obtained. The following will serve to show that the method, besides being efficient in the work it is doing, is very conservative of floor space as well: Capacity of installation, 15,000 tons crushed per day from 2-in. disk crusher opening to 1½% on 18-mesh screen; area of grinding floor exclusive of motor platforms, 300x66 ft., or 19,800 sq.ft.; floor space per ton of capacity, 1.32 sq.ft.

The scheme can be briefly described as a parallel-series arrangement having two circuits, each with a ball mill and classifier in series, as shown in Fig. 3, being in parallel, the oversize from each classifier being returned to the mill opposite for regrinding. The mills are symmetrically arranged in two rows extending the length of the mill, as seen in Fig. 4, with their feed ends facing each other, just enough room being left between them to accommodate the Dorr classifiers. The classifiers act as elevators, and since all return is handled by them, the whole department is confined to a single level. There is a main runway between the mills above the classifiers, from which branch runways lead to the motors, between mills, etc. This arrangement gives the attendant an excellent opportunity to watch his machines and to reach them when necessary.

The conveyors bringing the feed to the mills are terminated in hoppers on a platform high enough above the mills to allow of a 15° slope for the launders leading to the feed boxes. The motors for driving the conveyors, classifiers, etc., together with their control apparatus, are located on this platform, shown in Fig. 4, as are also the control panels for the ball-mill motors. The switchboard attendant thus has a commanding view of the whole grinding floor. The floor is served by a 60-ton electric traveling crane which transfers the mills to and from the repair floors located at each end of the building. An inclined skipway along one side of the building serves the whole concentrator, the cranes on each floor making direct connection with it.

Ball Mill Grinds 400 Tons per Day

Experiments with the ball mill in the test plant led to the conclusion that 400 tons of coarse-crushing plant feed could be crushed with each mill in 24 hr., to 2% on 48-mesh screen and 60% — 200. Now that the Inspiration mill is running with all sections, it has been shown that the test figures were correct. Not only has 400 tons per mill been crushed, but with 18 sections running the average daily dry tonnage for the month of May was 15,358. A test section of two mills showed for a short period a tonnage rate of 1,000 tons per 24 hr. While this is by no means the average, it indicates what may be done in the future.

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[*] Excerpt from "The Inspiration Plant, Concentrator and Other Surface Equipment," by H. Kenyon Burch, chief engineer of the Inspiration Consolidated Copper Co., Miami, Ariz., to be presented to the September meeting of the A. I. M. E.

In view of the character of the ore and the fact that much of it is tough and more difficult to crush than the ordinary porphyry ores, the power consumption for the crushing plants is considered very satisfactory. The power consumption at the coarse crushing plant for the month of May, taking mine-run of ore and crushing it through gyratories and disk crushers, conveying and delivering to the railroad bins was 0.329 kw.-hr. per ton. This ore is delivered to the mill, and the average kw.-hr. per ton for the ball mills, including power for feeders, conveyors and classifiers, during the month of May was 10.4. Therefore the total power consumed per ton for the month of May on ore taken from the mine bins, crushed and delivered to the flotation machines was 10.729 kw-hr. One section of the ball mills has been in operation for a period of 10 days that has taken a power consumption of 8.53 kw.-hr. per ton. This amount added to the power used at the coarse crushing plant and that required by the conveyors gives 8.88 kw-hr. per ton of mine-run feed delivered to the flotation machines. The foregoing does not include the power required for transporting the ore by steam road from the mine to the mill. The crushing of the ore and its delivery for concentration is a matter of great importance and one which absorbs a large portion of the operating costs in the treatment of ores, and too much attention cannot be given it. Many experiments in connection with the crushing problem are now being conducted including tests of different types of steel for wearing parts and modifications which influence tonnage and cost of production. Ball mills have been equipped without the grates, and the results of the mills so equipped have shown that ball mills equipped with grates have advantages in increased tonnage and efficiency, so that the results of the experiments with the different shapes of pebble mills, subsequent experiments with the ball mills, and finally the monthly operation, lead again to the conclusion that a good choice was made in the selection of the present grinding machinery.

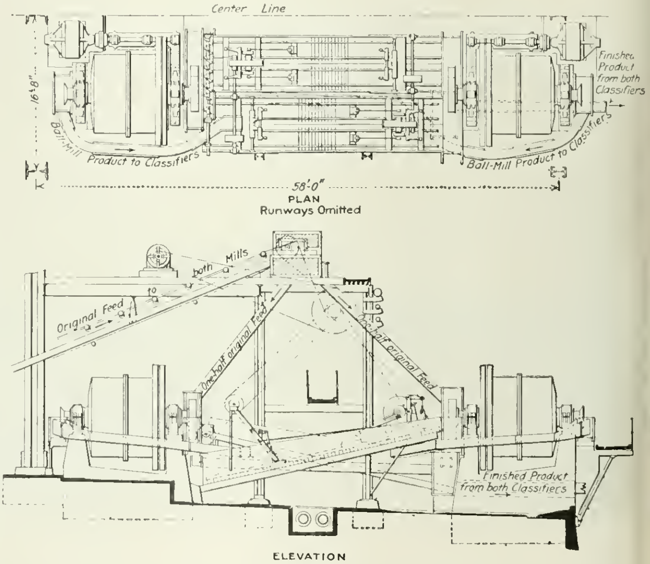
Center Line
16'8"
Ball-Mill Product to Classifiers
Finished Product from both Classifiers
Ball-Mill Product to Classifiers
58'-0"
PLAN
Runways Omitted
both Mills
Original Feed
One-half original Feed
One-half original Feed
Finished Product from both Classifiers
ELEVATION

FIG. 3. MARCY MILLS IN CLOSED CIRCUIT WITH DORR CLASSIFIERS

The flotation department requires a large volume of low-pressure air. This is supplied by the four single-stage centrifugal compressors occupying one end of the flotation floor, shown in Fig. 5. The rating of these compressors is as follows: Capacity, 23,000 cu.ft. of inlet air per min.; discharge pressure, 5.75 lb. per sq.in.; revolutions per minute of impellers, 3,850; power of driving motors, 720 hp. The step-up to the impellers is made through Alquist gears. One unit of the four is held in reserve.

The drag classifier, which is being used on the flotation tailings for separating sand from slime, is the result of experimental work in the test mill. It is worthy of a detailed description not alone on account of its ability as a classifier, but also because of its large capacity. Except for the concentrates taken out by the flotation cells, each machine handles the entire tonnage of one unit, or 800 tons per day. The classifier consists essentially of two 18-in. belts, running parallel to each other and so arranged that the return belts run entirely clear of the settling surface, the rough classification being carried on sufficiently far below the surface so as to cause no disturbing currents. This is made possible by the use of four pulleys—one at the discharge end, two at the feed end (one vertically above the other), and one at the center near the bottom, where the slope begins. The distance between head and tail pulleys is 39 ft. The direction of travel of the return belts is horizontal, but on passing over the upper tail pulley it becomes vertical. The belt thus enters the pulp perpendicular to its surface. At the bottom of the tank its direction is again changed by the lower tail pulley to the horizontal. It travels thus to the center of the tank, where the belt with its load passes under another pulley and starts up a 20° slope toward the discharge end. All pulleys are of 32-in. diameter.

An adjustable overflow launder on each side of the tank, having a combined lip length of 52 ft., carries off the slimes. The effective settling area of the tank is 25x4 ft., or 100 sq.ft. The overflow is 5 ft. above the bottom horizontal belt. The two sets of submerged pulleys are mounted on shafts running in watertight bearings supported by the sides of the tank.

TAILING SYSTEM USES 200-FT. DORR THICKENER

The conservation of the water supply is imperative, and it was for this reason that the extensive tailing-settling and return-water system was installed. The water is reclaimed at the concentrator and at the tailing dams. The equipment at the concentrator consists of three 100-ft. and one 200-ft. Dorr thickeners, and a large dewatering box 17x109 ft. The overflow from the 80-ft. concentrate tanks is also turned into the return system. The dewatering box handles only the table tailing, the overflow from it being further settled in three of the 60-ft. Dorr thickeners. The overflow from all tanks goes to a 210,000 gal. concrete sump, from which it is pumped to a 60-ft. diameter steel tank of like capacity on the shop level above the concentrator.

The return-water pump equipment consists of four vertical triplex pumps direct-driven through gearing by 100-hp. synchronous motors. Each pump has a capacity of 2,000 gal. per min. and works against a head of 113 ft.

The water reclaimed from behind the dam, shown in Fig. 1, is at present handled by a 3,000-gal. two-stage centrifugal pump so arranged that it can be moved up a skidway as the water level of the pond behind the dam rises.

DORR THICKENER OF 200-FT. DIAMETER

The 200-ft. Dorr thickener is the largest single unit that has ever been installed and is therefore interesting from a mechanical standpoint. The thickener has not yet been erected, but at this time the designs are complete. It consists essentially of a reinforced-concrete tank 200 ft. in diameter with the bottom sloping toward the center and having a depth at the outside of 7 ft. 3 in. The feed is delivered to the center of the tank through a launder supported by a 107-ft. steel truss. At the center of the tank is a steel-plate pivot, 18 ft. high upon which is mounted the drive drum. To this drum are fastened four short rakes (two 24-ft. and two 35-ft.) and the driving truss, which in turn carries two long rakes, 10 ft. apart and 100 ft. in length. The slope of the bottom of the tank varies, being $2\frac{3}{16}$ in. per ft. near the center, 1¾ in. per ft. for the length of the short rakes and the inner 16 ft. of the long rakes, and the remainder 1 in. per ft. The driving truss is completely submerged except the outer end, which rests on a circular track on the tank wall. The driving mechanism is placed at the outer end and consists of a 5-hp. motor connected through gearing to a single 24-in. plain tread driver. Two similar wheels are placed 10 ft. on each side of the driver to distribute the weight. The weight of the driving truss provides the necessary traction. The thickened product is drawn off through an annular opening at the center and the overflow at two diammetrically opposite points on the periphery of the tank.

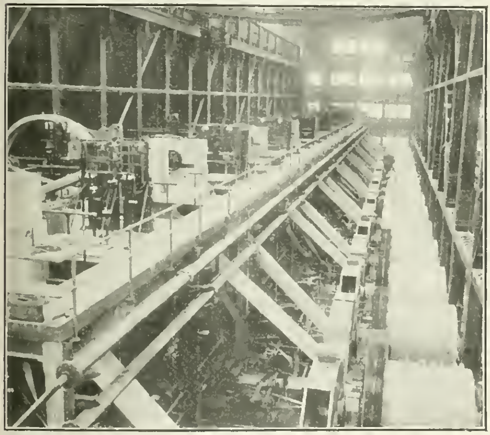

FIG. 4. BALL-MILL AND MOTOR-CONTROL FLOORS

Various possibilities were presented for furnishing water to this plant. To insure a supply, sufficient ground and water rights were early purchased at Wheatfields, about 12 mi. from the mill site and 1,000 ft. lower in elevation. Before developing this supply, however, it was decided to prospect on the flat below the tailing-storage site. Wells were sunk at various points until the best location had been determined, which is 2¼ mi. from the mill, 430 ft. lower and at the junction of two fair-sized drainage channels receiving their supply from the Pinal Mountains some 10 mi. away and 1,000 ft. higher. Here six wells have been sunk and 24-in. multi-stage turbine well pumps installed. These deliver through wooden pipe lines to a common steel sump tank having a capacity of 235,000 gal. Each well pump is belt-driven by a 150-hp. vertical motor and delivers a maximum of 1,200 gal. per min. Near the sump tank is the pumping station, which contains six 1,200-gal. pumps delivering into a common 20-in. pipe line. These pumps are horizontal, duplex, double-acting and are direct-driven through herringbone gears by 300-hp. synchronous motors taking current at 6,600 volts. Power for the pumping station and wells is supplied by the Inspiration-International power house. A 10-ton crane serves all parts of the building, and is an exceedingly useful addition for changing or repairing.

The 20-in. pipe line is 14,600 ft. long with a rise of 520 ft., and delivers water to the storage reservoir near the concentrator, shown in Fig. 2. From this reservoir water is delivered to all parts of the property. It is about 80 ft. above the concentrator, 1,200 ft. away and has a capacity of 3,000,000 gal. An oval excavation about 20 ft. deep was made in the top of a hill, and the sloping sides and bottom were lined with concrete. Two 14-in. pipe lines deliver the water to the concentrator, fully supplying all needs.

There are two separate outdoor transformer stations, one at the concentrator and one at the mine plant. As the two sources of power are received at different voltages, each station requires two sets of transformers. Both sources of power are 25-cycle three-phase, the Reclamation energy being delivered at 40,000 volts and that of the power house at 6,600 volts, both being stepped down to 2,200 volts for distribution about the plant. Both high-tension transmission lines are in duplicate circuits.

SKIPWAY CONNECTS CONCENTRATOR WITH SHOP

All shop work except that for the mine is done at the concentrator shops, where a very complete equipment is installed, comprising some thirty different machine tools, all with individual motor drives, a 40-ton electric crane traveling the entire length of the building, the necessary facilities for locomotive repairs, several welding outfits for various classes of work, and a forge shop equipped with both oil and coal forges. The warehouse and electric shop and the locomotive roundhouse occupy opposite ends of the shop building. A standard-gage track through the center of the building permits running cars either into the shop or through the shops into the warehouse.

The shop level is 22 ft. above the upper floor of the concentrator. Communication is had between the two buildings by the inclined skipway which occupies one end of the concentrator, this connecting to the shops by a well through which material can be transferred either into the shops from the mill for repairs, or into the mill from railroad cars.

SWITCHBACKS AND RAILWAY EQUIPMENT

The railroad facilities comprise the main line and several spurs, the total length being about 10 mi. All equipment is standard gage. The lines connect the several units of the surface plant; the pumping plant and the Live Oak Division, however, are reached via the Arizona Eastern. On account of the topographical conditions, it was necessary to use switchbacks to make the grade between the Arizona Eastern on the flat and the concentrator, some 400 ft. higher. The switchbacks provide for handling six cars. The extremes of grade and curvature on this line are 4% and 12° respectively. The line that connects the mine and the mill has a grade of 0.3% in favor of the load.

The six-wheeled, side-tank type of locomotive is used. Two are used on the mine line (these have a weight on the drivers when loaded of 112,000 lb.), and a third is used on the low line which has a corresponding weight of 200,000 lb., the latter being equipped with a superheater and Walschaert valve gears, oil burners being used on all. The ore cars are of the Ingoldsby patent dump type, have a capacity of 60 tons and a train length of 33 ft. They are of all-steel construction and weigh about 22 tons each.

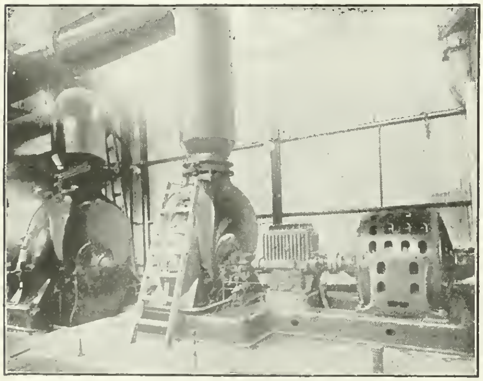

FIG. 5. CENTRIFUGAL AIR COMPRESSOR

Electric haulage on the mine division was at one time considered, but for the sake of uniformity of the several lines the idea was abandoned.

Sheet-Mica Production in 1915

The quantity of sheet mica, rough-trimmed and cut, produced in the United States in 1915 is smaller than that for any of the 12 preceding years, but the value of the product is the highest ever recorded. Statistics collected by the United States Geological Survey, recently published, show that high prices have produced a prosperous condition in the mica-mining industry in certain parts of the country.

The average price of sheet mica in 1915 was 68c. per lb., compared with 50c. per lb. in 1914 and 21c. per lb. in 1913. The total value of all sheet and scrap mica produced in 1915 was $428,769, a value exceeded, though but slightly, only by that for 1913. Scrap mica did not change much in value. North Carolina produced more than half the output, New Hampshire, Idaho and South Dakota being relatively the next largest producers. There was a small production of lepidolite (a lithia mica) in California, of clinochlore (a chlorite related to mica) in Georgia, and biotite in Colorado.

The report on mica in 1915, by W. T. Schaller, can be had by applying to the Director of the United States Geological Survey, Washington, D. C.

Deblooming Mineral Oils by Ultra-Violet Light

An interesting method of deblooming mineral oils (depriving them of their power of fluorescing) has recently been patented by T. T. Gray, of Elizabeth, N. J. (U. S. Pat. No. 1,158,205). The hydrocarbon to be treated is subjected to the simultaneous action of oxygen and ultra-violet light in a still. The temperature is somewhat elevated, from 50° to 300° C. according to the character of the oil, and pressures exceeding normal are also often used. Certain catalytic agents, such as finely divided or reduced metals and salts, also assist the conversion, caustic soda and potash being very active. As the ordinary trade method of detecting adulteration of animal and vegetable oils with mineral has been to look for fluorescence, it is evident some other test will have to be depended on if the Gray process becomes widely used.

Right to Follow Mineral Vein

By A. L. H. STREET*

A zone or belt of limestone lying between a hanging and a foot wall of quartzite and through which a mineral streak containing orebodies can be traced is a vein, within the rules of law which permit the owner of a mining claim in which a vein apexes to follow it on its dip, held the United States Circuit Court for the District of Utah, in the case of Wall vs. United States Mining Co., just reported on page 613, 232 Federal Reporter. But it is also decided in the same case that where a fissure changing the formation of the land crosses a mineral vein, the owner of the claim in which the vein apexes is not entitled to pursue it beyond the fissure.

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Tungsten Ore Exports From the Federated Malay States in 1915 included 234 tons of wolframite and 57 tons of scheelite, according to the annual report of Mine Warden W. Eyre Kenny. The exports were about the same as in 1914 Tungsten ores aggregating about 405 tons were imported from other countries and reëxported after treatment, and are not included in the above-quoted figures. Mr. Kenny remarks that it is not generally realized that tungsten ores do not occur in the Federated Malay States in defined deposits and that by far the greater bulk is found in small quantities, irregularly intermixed with tin ore and valueless matter. These facts render it impossible to obtain any large increase in output. Every effort has been made to stimulate production. Export duty has been suspended, special terms have been given to prospectors, and also as regards mining rights, though the high price that ruled would under different natural conditions have been sufficient to augment production.

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*Attorney at law, 829 Security Building, Minneapolis, Minn.

Driving a 1,200-Ft. Raise

By S. Ford Eaton*

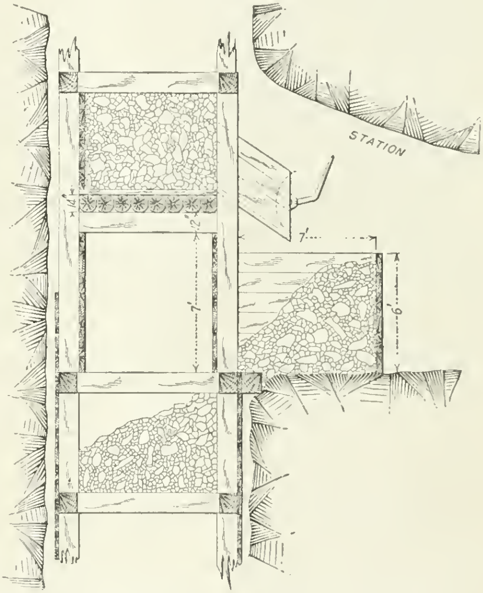
SYNOPSIS—Discussion of work as it progressed, giving the methods that had to be abandoned and the reasons why, and the new methods adopted. Least advance for one month for 10x20-ft. raise was 68 ft., and maximum advance was 128 ft.

The driving of a shaft raise was undertaken by contract for the Britannia Mining and Smelting Co., Britannia Beach, B. C., at its Tunnel Camp. Before and during the prosecution of this undertaking we were unable to avail ourselves of the advice or assistance of anyone who had had actual experience along this line on so large a scale. Needless to say, we encountered innumerable problems and difficulties, solutions of which we had to work out ourselves. Some of these were solved quickly, but others required considerable time. Changes in methods were made constantly during the first few months, progress being slow at times, but after the 400-ft. level was reached, consistent improvement took place. When our contract was canceled, owing to conditions caused by the present war, we were at about the 900-ft. mark, and to the best of my knowledge the completion of the work involved no further serious difficulties. Looking backward, we see what our lack of experience meant in the way of expense and lost time, so it is with the hope that someone else may be able to gain profit from a detailed account of some of our experiences that I submit these details.

The contract called for the driving of a raise 10x20 ft. in the clear, 1,200 ft. high; candles, all tools, blacksmith work and compressed air to be furnished by the company; contractor to supply powder, caps and fuse, labor for breaking ground and placing muck in the chute; company to remove muck, do all timbering, maintain pipe lines, furnish hoistmen and do all tramming. The original plan was to have the contractors' men work during the afternoon and graveyard shifts, timbermen employed by the company to work on the day shift. This plan was discontinued almost immediately owing to the timbering interfering with the drilling and vice versa. The contractors then put on three shifts of men doing both drilling and timbering, the time required for the latter being charged to the company. There were four of these men on each shift. My partner and I (the contractors) each came on for eight hours, but so arranged that we supervised the work for the major portion of each of the three shifts.

The raise was divided into two compartments and manway; the manway was maintained as such throughout, carrying ladderway, 4-in. air line and 16-in. ventilating pipe from a suction fan. The middle compartment was used as a chute and the remaining compartment for hoisting. Six-foot sets were used, 10x12-in. wall and end plates, 10x12-in. dividers, 12x12-in. corner posts, 10x12-in. wall posts and 6x8-in. center or guide posts. Sets were lagged with 2x12-in. material and middle or chute compartment lined with 3x12-in. The only serious damage that occurred to the timber consisted of two broken-wall plates and one broken divider. Chute lips were built of 3x12-in., equipped with halfmoon or arc gates operated with 5-ft. levers.

The first two sets above the tunnel-level station set were hoisted by hand, block and tackle being used. The first hoisting equipment consisted of a small air hoist, 5/8-in. cable and 600-lb. bucket. The cable passed under a 5x18-in. roller on the front wall plate of the station set, up through an 8-in. snatch block hooked on a chain around the center bulkhead piece and down to the bucket. The original bulkhead was of 12x12-in. timber 8 ft. long over the hoisting compartment and 5 ft. long over the manway. This bulkhead was laid from the dividers to the end plates. Over the chute compartment from wall plate to wall plate were placed three round timbers 12-in. diameter; one at each side to protect the dividers and one in the middle, forming a grizzly. This grizzly prevented large rocks from falling into the chute and causing trouble at the gate. It did its work so well that on a number of occasions after blasting, access to the raise was obtained only after hours of breaking and barring down some of these same large rocks. Continued blasting eventually destroyed these three round timbers and they were never replaced, the chute compartment being left open. Big-breaking ground was encountered at times, but was taken through the chute lips by barring and light bulldozing.



METHOD OF BREAKING CONTINUITY OF ROCK CHUTE AT 200-FT. INTERVALS BY ROCK PENS AT STATION SETS

The first serious problem to engage our attention was that of the bulkhead and muck. After blasting a round of holes, the muck was found piled up over the manway end about 6 ft. high and about 8 ft. on the long bulkhead.

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*Foreman Vantrent Mining Co., Vantrent, Calif.

In the desire to crowd the work, the men hurried back after the blasting and by working in the bad air their efficiency was so decreased that it required between three and four hours to clean off the muck. Later with a 30-min. allowance for the air to clear, this same type of bulkhead was cleaned in from 1¾ to 2 hr., and the men were in much better shape for the rest of the shift.

The length of time required for this operation caused us to devise a slanting bulkhead. Over the corner posts on the manway end were placed, on end, two 12x12-in. blocks, 20 in. long, and on these a 12x12-in. stringer, 9 ft. long was laid. Bulkhead pieces, 1 ft. longer than formerly used, were laid from this stringer to the divider and at the edge of the chute compartment and wedged in place to prevent sliding. The same was done with the longer bulkhead over the hoisting compartment, 30-in. blocks being used. The muck banked up to a certain extent on this type of bulkhead, but aided by the inclines, the men were able to clear it in about 45 min. However, the time required to construct and dismantle these inclines more than counterbalanced the gain in mucking time. Incidentally there were two more large timbers to be handled and disposed of during timbering operations. Another feature caused delay: in the confusion incidental to timbering, the 20- and 30-in. blocks were not watched carefully and one or more might be used in blocking the new set. This would not be discovered until the time to rig the bulkhead again, and considerable time would be lost sending down for new ones. It was suggested that they should have been painted a bright red. After a fair trial we reverted to the original flat bulkhead, which was used from then on.

Timbering with the first hoisting equipment was a slow procedure. I shall later describe the same operations with the equipment installed when we reached the 400 level. A comparison will show what a large amount of time was lost by the first methods, and our experience proved that the better system could have been used after the raise was up 35 or 40 ft.

During the bulkhead-clearing period the rock in the chute was naturally kept drawn down and care was taken to have the muck about 8 ft. below the level of the top set at the completion of this operation. The bulkhead was then torn up, the shorter sections being double-decked over the manway and the longer pieces laid crossways over the chute from wall plate to wall plate. During the period of using the grizzly and slanting bulkhead, this pile seriously discommoded the timbermen. A few trials enabled us to arrange these timbers so as to clear the daps for the posts and not require moving until the lagging was put in. At this time the bulkhead was raised to the top of the new set and timbering completed.

It was found advantageous to lay a flooring of 2x12-in. planks beneath both bulkheads, and since these were of different lengths from the regular lagging, they were easily kept track of and carried up with the bulkhead. These flooring planks prevented the final sifting of fine muck from falling down the raise, gave the men secure footing for handling the heavy bulkhead, and were used for temporary staging around the hoisting compartment during timbering operations.

Prior to cleaning the bulkhead—with the muck over the hoisting compartment furnishing a footing—a temporary hoisting stull of round timber 6 or 8 in. diameter was placed in position over the center of the hoisting compartment as close to the back as possible, giving an average clearance above the top of the last set of about 12 ft. A light chain was fastened around the middle of this stull. All but the center piece of the long bulkhead having been disposed of, the cable was pulled up and the snatch block moved up from the chain around the bulkhead timber to the chain on the hoisting stull. An eyebolt was soon substituted for the chain around the bulkhead timber. For the first hundred feet this cable-hoisting operation entailed no difficulties, the crew of four being able to do it by hand. Later, the bucket was landed on a staging three sets from the top, the block and tackle attached to a sling above the hoisting stull, a special cable clamp bolted on the lead line of the cable 20 ft. down, the block hooked into this clamp and the cable pulled up the required distance to slip over the snatch block.

The posts were hoisted first in the bucket, two at a time, and placed in position. Next came the wall plates. For these the bucket was taken off and the cable hooked to a timber clevis in the lower end of the plate. The timber was held in a vertical position by a rope lashed around the cable and plate at the upper end. To aid in pulling back the cable, a 150-lb. weight was attached by chain and hook. The wall plate was then hoisted until the the upper end cleared the last set about 8 ft., the rope around the upper end then being removed. Further hoisting pulled the plate to a horizontal position across the bulkhead piled over the chute. The manway end was then placed on the corner post and the plate swung into position with the aid of the hoist.

The end plates and dividers were handled in the same way but, being shorter and lighter, were readily placed in position after being hoisted to the top. Wedges and blocks were then hoisted in the bucket, requiring about five trips. The set having been blocked, the bulkhead, grizzly, etc., were raised to the top of the new set, thus making room for piling and putting in the lagging. At first the bulkhead was lifted by hand, but later by the use of a hook and chain, this was done with the hoist. Eight trips were required for the 2x12-in. material. Next the center or guide posts were put in—one trip for these—and finally the 3x12-in. chute lining, taking six trips. When putting in this lining two pieces were left out on the manway and two on the hoisting-compartment side of the chute. Between these two openings 2x12-in. lagging was laid over the chute and on this was placed a short ladder which furnished convenient access to the top from either side. In the manway a small platform of 2x12 plank was maintained on the second set for storing various tools when not in use.

Drilling with Waugh Stopers

The timbering completed, the cable hoisting operation was reversed, platform and bulkhead placed in position and another round drilled. At this point another advantage of the 2-in. platform became evident. In the event of the back not being high enough for good drilling from the bulkhead, a section could be moved to one side and the leg of the machine set on the flooring. Thus a 12-in. variation in the height of the drilling platform was always available.

The machines used were of the 16V Waugh stoper, sprayer-attachment type using 1⅛-in. cruciform steel. The average round was 38 holes, ranging from 6½-ft. corner and end holes to 8-ft. cuts. An ordinary V cut was used, two machines drilling in each end, the cut holes practically meeting over the chute. This style of round was used throughout. Holes were fired with time fuse and the entire round blasted at once. The amount of powder used for each round averaged 200 lb. of 40% low-freezing gelignite, which proved to be the most satisfactory. The drilling offered no serious problems, and with the exception of some hard ground encountered between the 400 and 600, was always done in reasonable time. During this stretch some rounds required from four to six shifts to drill. Frequently, however, rigging was pulled up with drilling completed and the machines down within an 8-hr. shift. The best time made on a complete cycle of operations—drilling, blasting, mucking and timbering—was a trifle over 24 hours. The aim was to break a 6-ft. round, thus advancing the back the height of a set of timber. The experiment was tried of breaking two and three rounds and then timbering, to save time in mucking off the bulkhead. Again the original plan was found to be the better, as the time required to put up and dismantle a substantial stull staging capable of supporting four men, machines, steel, water kegs, etc., was greater than that required to do the mucking.

Level stations were cut every 200 ft.; the 200, 400 and 600 being in the hanging wall and the 800 in the foot wall. The last was cut with no difficulty. In cutting the 200, we advanced the raise to about the 220-ft. mark, timbered to the level of the station, then came back and cut out the station with piston machines. The size of this hanging-wall face caused it to slab off rather badly, practically to the back of the raise, and the ground had to be watched carefully during the drilling and timbering. At the 400 and 600 the raise was carried only about 10 ft. above the station level and then the entire station was cut out. The raise was then advanced 10 ft. more and the raise station sets put in. Next, the back of the station was plugged off carefully with the stopers and the station timber put in. This method did away with the trouble previously mentioned.

Breaking the Continuity of Rock Chute

About the time we reached the first level at 200 ft., a chute problem developed. When drawing the muck, it was found that the rock did not move down the chute gradually except at the lower part. The upper 150 ft. subsided as a whole in a series of falls, the entire column of broken rock, roughly 6x7x150 ft., dropping a foot or two at a time. The effect of these blows or jars was received for the most part on the lowest sections of the chute. Eventually the dividers showed signs of giving way and the query naturally arose: "What will happen when we have a 600- and 800-ft. column of rock doing this?" It was finally decided to break the chute at each level, dividing the whole into units of 200 ft. Also the lower sections had to be reinforced by putting in spreaders or braces in both manway and hoisting compartments. Round poles about 8 in. diameter were placed between dividers and end plates, 12 in. from the wall plates and parallel to them. This decreased the area of the hoisting compartment considerably, but did the work. The break in the chute, illustrated by the accompanying sketch, was made in the following manner: The raise station set posts were 14 ft. long, and so 7 ft. above the dividers of the collar set were placed two 10x12-in. bearers, supported by 3x12-in. lagging spiked to the inside faces of the wall posts. Across the chute compartment on these two pieces was laid a bulkhead of 14-in. round timber. This was covered at right angles with a floor of 3x12-in. From this floor up the regular chute lining was put in except at the station side. On this side a chute similar to the one at the tunnel level was built. The fine muck from subsequent rounds formed a bottom on the bulkhead. Rock drawn from this chute fell to the floor of the station. Directly under this chute was constructed a three-sided pen extending out into the station 7 ft. from the raise station set, of the same width as the middle or chute compartment and 6 ft. high; 3x12-in. plank were used. The side toward the raise being open, rock falling on the floor of this corral formed an inclined bottom and rolled back into the chute compartment below.

This system made each 200-ft. unit independent of the others except that the first unit had to be pulled before the second could be drawn, the second before the third and so on. Occasionally some of the lining boards broke, but these were reinforced from the outside. About the fifth month of work the lining of the first two units was found to have worn very thin. The lowest chute was emptied, and a new lining 2x12 in., 12 ft. long, was spiked on over the old. The work was done from the bottom up, access to the chute being gained by knocking out two of the lining boards on the hoisting-compartment side every other set. The first unit having been repaired, the second was fixed in a similar manner. Breaking the continuity of the chute thus relieved the excessive strain on the timber. The reinforcing braces, however, were put in throughout. The completion of each unit meant another chute to be operated, but there was ample time to do all the necessary drawing during the drilling operations, the rock in the chutes being lowered sufficiently to accommodate that broken by the next round. Experience enabled us to gage this quite accurately.

Ventilation gave us practically no trouble. The 16-in. ventilating pipe was kept within 6 to 18 ft. of the bulkhead in the manway. The suction fan always being in operation, there was a steady current of air passing up the hoisting compartment, across the chute compartment in the last set and down the manway into the ventilating pipe. Just before blasting, the end of one air hose was fastened inside the chute compartment pointing upward and protected by blocks or wedges nailed around it. The compressed air turned on from this hose after the fuses had been spit started the smoke and gas downward, and immediately below the level of the bulkhead it was caught by the cross-current of air mentioned and carried away by the ventilating pipe.

Improved Hoisting Gear

Work was carried on for two months or so with the bucket, then we put into use what we called a "go-devil." This was simply a cage or framework of strap iron, 14x26 in. by 6 ft. 6 in. This "go-devil" traveled the same as the bucket, no guiding apparatus being used. Hoisting was facilitated to a certain extent, lagging, blocks, wedges, steel, etc., being sent up in larger quantities. At the time the 400 station was completed, new hoisting equipment was installed, consisting of a much larger single-drum air hoist, 3,000 ft. of 3/4-in. cable and a cage. The cage was similar in construction to the ordinary mine cage with 32x50-in. floor space. A new head gear was constructed of 8x10 in. timber carrying a 22-in. sheave-wheel. A 22-in. traveling sheave replaced the roller at the foot of the raise. "Business picked up" immediately in the hoisting operations. The head gear, called the "cathead," was kept on the second set from the top, supported by the wall plates. This allowed the cage to be pulled up level with the fourth set of plates from the top. A portable 12-ft. ladder hung by iron hooks or dogs from the "cathead" set enabled the men to climb from the cage to the hole in the chute lining. Four men proved to be just the right number to pass various tools and materials to the top. Timber-hoisting methods were now changed considerably. The increased weight of cable and cage prohibited the use of the hoisting stull and snatch block as before. The hoisting stull was put up, but with it was used a four-way block and tackle to raise timber from the cage to the top. The eight posts were first taken up at one trip, the two wall plates at one trip, end plates and dividers at one trip, blocks and wedges at one trip, 2-in. lagging one trip, and center posts and 3-in. lining at one trip. Six trips were required compared to thirty the old way. Inasmuch as the cage ran on guides, the hoisting time on each individual trip was materially reduced.

The wall plates naturally were the most difficult to handle. During the bulkhead-clearing operations, the hoistman, with one man to help him, stood these upright at the foot of the raise in the hoisting compartment, one at the rear and one at the front in diagonally opposite corners. By attaching a chain to the cage and hooking the lower end around the plate, it was readily pulled into this position with the hoist. The plates were stood on 3-in. blocks, which brought the lower end level with the floor of the cage when landed at the bottom of the raise. From this position they were readily moved onto the cage with the aid of a pinch bar. After being stood on the cage, the top ends were lashed to the hoisting cable, a separate rope being used for each plate. The cage was then pulled up until the upper ends of the plates barely cleared the "cathead." A short chain was hitched around the plates, one at a time, the block and tackle from the hoisting stull having been hooked to this chain and the timber was pulled up the remaining distance by hand. The landing of the plate was practically the same as described before. All the other heavier pieces were taken up from the cage in a similar manner, blocks, wedges, lagging and lining being passed up by hand.

Maneuvering the Hoist Cable

Hoisting the cable and the "cathead" was the next problem. By this time the weight of the cable had increased to such an extent that the old method employed was inadequate. A diminutive air hoist with about 100 ft. of ⅜-in. cable was installed on the 400 level. Two sets above the station set a snatch block was hung on one of the reinforcing braces on the same side as the lead line of the main hoisting cable. This brace had to be strengthened with angle braces. Another snatch block was hooked into an eye-bolt placed in the collar-set wall plate at the station level on the station side. The timbering having been completed, the ⅜-in. cable, which had a hook clamped on the end, was passed through these two snatch blocks and pulled down to the station level. One man riding on the cage did this adjusting. The cage was then pulled to the top and landed on two lagging thrown across the hoisting compartment. Next the hook on the ⅜-in. cable was hooked into a stout clamp placed on the lead line of the main cable. At a prearranged signal the big hoist was released and the main cable pulled up about 20 ft. by the small hoist; the brake was then locked on the latter. At the same time the crew at the top pulled up the slack in the hoisting cable by hand, and secured it with a rope. The block and tackle from the hoisting stull was then hooked into two chains passed around the "cathead," two being used to maintain a better balance, and it was pulled up another set and placed in position. To allow the "cathead" to pass the wall plates, it was found necessary to swing it diagonally across the hoisting compartment and tilt it slightly lengthwise so that one end moved up first.

The "cathead" having been placed in its new position, the cable hoisting operations were reversed, the cable being placed in the sheave wheel before the small hoist was entirely released. Slack was then taken up by the main hoist, the cage cleared, and the ⅜-in. cable taken down and wound up on the small hoist out of the way. When the 800-ft. mark was reached, the small hoist was transferred to the 800 station and operations were carried on as described before. This cleared the deck, as it were, for the drilling of another round. A little time was saved in hoisting steel, as all that was required for the usual round was hoisted at one trip. This was pulled to the top and passed by hand from the cage to the bulkhead. After passing the 600-ft. level the "cathead" began to show signs of strain. To relieve this, two iron stirrups were made to fit the 8x10-in. timber, and these were connected by two ⅞-in. turnbuckles to eyebolts placed in the middle section of the bulkhead. When hoisting the "cathead," these were of course removed, but not until the cage had been landed, as described heretofore, and replaced before the "cathead" again took the weight of the cable and cage.

This, as I look back on the work, was about the last of our problems, the advance of the raise then being a matter of routine. The poorest month's footage was 68 ft. and the best 128 ft. Station cutting interrupted the work too frequently to make a better record.

* * *

Bolivian Tungsten Exports

During the first three months of the present year Bolivia exported 11,950 Spanish quintals (1,211,730 lb.) of wolfram. The average price for 65% WO_3 was approximately $160. Of the total amount exported 75% went to the United States and 25% to Europe, according to the United States Commerce Report.

Oruro produced 69.52% of the wolfram, La Paz 19.14% and Potosi the remainder. The bulk of the shipments were made from the port of Antofagasta because of its direct communication with Oruro.

The above data refer only to the exportation and do not indicate the amount of production. It is said that considerable quantities of the ore are being purchased and stored until the close of the war in Europe.

Although antimony had always occupied a place of secondary importance in Bolivia, in the first three months of 1916 the exports amounted to approximately $1,500,000. The custom-house records show an exportation during this period of 6,524,000 kilos (14,382,950 lb.) of sulphate compound, whereas during January-March, 1915, the production was only 462,000 kilos (1,018,535 lb.)

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Graphite exported from Ceylon after July 22 is to be subject to a government ad valorem export royalty of 3%, according to "Commerce Reports" of July 31. The former royalty was equivalent to 7.24c. per 100 lb.

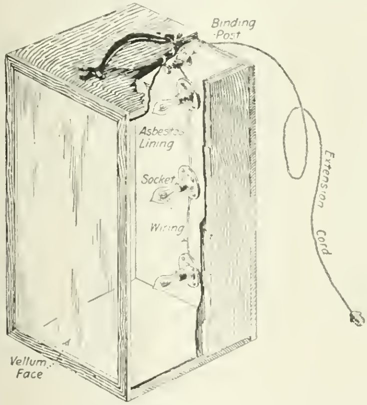
Details of Practical Mining

A Handy Light for Mine Surveying

By Albert E. Hall*

In carrying a transit line down a shaft it is usually desirable to make long sights, but this is often impossible on account of lack of light on the foresight. Where electricity is available in a shaft, this difficulty can be overcome very easily. The following description is that of a light used by the mine-surveying department of the Canadian Copper Co. With this light it is possible to make exceptionally long sights. At 800 ft. the sight is very clear, and by putting stronger lights in the bug after the limit of its present lights is reached, there is no reason why it should not be good for any sights necessary in mine surveying.

In the light described three 100-watt tungsten lamps were used, which were so arranged in a box constructed for the purpose that the light was concentrated within a small area. An ordinary powder box, such as is always available around a mine, was cut down so that the dimensions were about 24x12x8 in. It is more convenient to leave one side of the box off until the inside work has been completed.



A HANDY BUG

As considerable heat is developed by the lamps and as some white material is needed in the inside to reflect the light, the box was lined with asbestos. After that had been done three sockets were put in place in the bottom of the box and wired in parallel. An extension cord was carried out through the back of the box and a plug attached to its extremity. If a long extension is necessary for any reason, it is better to make it in two parts. This can be done by putting a plug at the end of about 15 ft. of extension cord and making the next section of the extension with a socket at one end and a plug at the other. This arrangement makes it easier to carry the bug around in the mine.

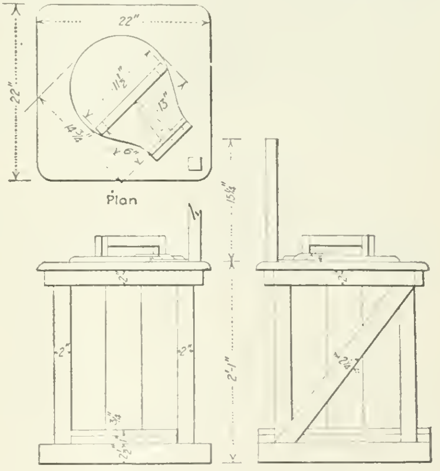
When the interior of the box has been finished, the remaining side is put on, having first lined its interior with a sheet of asbestos. Various materials have been tried for giving backsights and foresights, but it was found in the present instance that vellum, which is usually to be found around an engineering office, was an excellent material, so that its use is advocated for covering the front of the bug. A few holes bored for ventilation and a handle put on the top completed the light.

Sanitary Mine Latrines

By R. S. Bonsib*

A cheap mine latrine in underground workings is necessary, but owing to the nature of the workings, underground latrines such as are used by the United Verde Copper Co. or the Mond Nickel Co., are impractical in Virginia iron mines.

The following simple type has been found satisfactory. The frame consists of four 2x2-in. posts, preferably of hardwood, held together by eight ½x2-in. boards and braced by two pieces ½x2¼ in. The post at the back of the frame comes through so that it may serve as a handle by which the latrine may be moved from place to place, and it also serves the purpose of making the lid self-closing. An empty 100-lb. carbide can rests on three ½x2¼-in. cross-pieces and is held in place by ¾-in. boards cut out circularly so as to fit the bottom of the receptacle. Chloride of lime solution (1 lb. to 8 gal. of water) was found to be an excellent disinfectant, costing only about one cent per gallon. The cost of this closet including labor and material was only $2.78.



Plan

Front View

Side View

DETAILS OF CONSTRUCTION

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*517 West 171st St., New York City.

*Mining engineer, Low Moor, Va.

The contrivance has the advantages of cheapness, durability and utility, and is easily handled. It can be hoisted out of the mine in a bucket or skip, due to its small size.

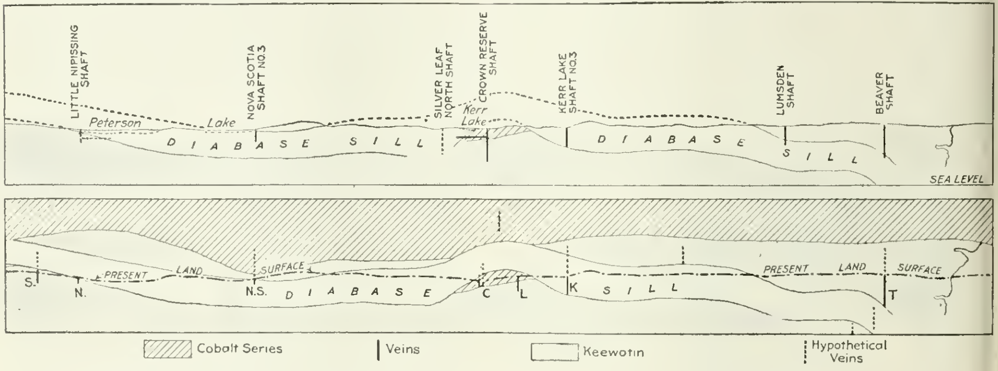
* * *

Geological Explorations at Beaver and Temiskaming

The annual report of the year ended Feb. 29, 1916, of the Beaver Consolidated Mines, Ltd., Toronto, gives some interesting comments on geological developments at the Beaver and Temiskaming mines in Cobalt. The directors say the mine is approaching a most interesting period. Careful study of the geology of the Cobalt camp has revealed conditions which, in the early period of the camp, it was not believed existed. Upon the discovery of silver in Cobalt, the Provincial Geologist of Ontario, Dr. Willett G. Miller, made an exhaustive study of geological conditions in Coleman Township, and in 1904 proved beyond question the existence of a diabase sill which intrudes both the Keewatin and Huronian formations. Fig. 1 shows the present land surface of the Cobalt area; Fig. 2 gives a concise idea of this section of the country before the glacial period and before erosion took place. These are reproduced from report of Ontario Bureau of Mines, Vol. XIX, Part II, p. 5. The rock formation of the surface of the Beaver property is Keewatin, and the illustration clearly indicates that to the northwest the diabase sill has come through the Keewatin to the surface. The Beaver shaft was sunk in Keewatin formation and at a depth of about 500 ft. encountered the contact between the Keewatin and diabase. Along this contact, both above and below, the richest ore was found. Diamond drilling (the expense of which has been shared equally by the Beaver and Temiskaming companies) has proved the thickness of the diabase sill to be a little over 1,100 ft., consequently the lower contact of the Beaver property would be between 1,600 and 1,700 ft. from the surface. The illustration shows Kerr Lake shaft No. 3, which is about 1 mi. from the Beaver shaft. The Kerr Lake shaft was started in the diabase sill, encountering the lower contact at a depth of about 300 ft. from the surface. Several companies—the Kerr Lake, Lawson, Drummond, O'Brien and others—have mined along the lower contact, winning millions of ounces of silver. However, the lower contact has not been penetrated southeast of the Kerr Lake shaft except by the diamond drilling that has been done by the Beaver and Temiskaming. It would seem that the theory of eminent mining engineers, that the silver came up with this diabase flow which formed the sill and deposited along both the upper and lower contacts, has been proved by the ore that has been won by the Beaver and Temiskaming along the upper contact and by the Kerr Lake and other properties along the lower contact, the upper contact of these latter properties having been eroded away.

With the knowledge that the Beaver has two contacts, along the upper of which its richest ore was recovered, together with the knowledge that the lower contact has produced such immense amounts of ore at these other properties, the Beaver company deemed it advisable to explore the lower contact. The main shaft is down to a depth of over 1,400 ft., leaving about 200 ft. of sinking to be done before commencing the development of the lower contact.

The Beaver and Temiskaming properties lie side by side, and the same aggressive policy of development is being pursued on both. The Beaver is a large owner of stock in the Temiskaming company.



GENERALIZED VERTICAL SECTION THROUGH THE PRODUCTIVE PART OF THE COBALT AREA

The section shows the relations of the Nipissing diabase sill to the Keewatin and the Cobalt series and to the veins. N represents a type of vein, such as No. 26 on the Nipissing, in the Keewatin below the eroded sill, and L a type such as one under Peterson Lake, in the Keewatin footwall, but not extending upward into the sill; K, a vein in the sill itself, such as No. 3 on the Kerr Lake property; T, a vein such as that on the Temiskaming or Beaver properties, in the Keewatin hanging wall and extending downward into the sill

* * *

How To Avoid Tramming Accidents was one of three questions asked of members of the Safety Bear Club by the mine-safety department of the California Industrial Accident Commission. The best answer was as follows: "To avoid car accidents, see that the track is kept in good condition and do not place timbers too close to the track. If you tram by hand do not ride the car unless you have a brake and then always ride on the back end. Couplings made on a curve should always be made from the outside of the curve where there is more room. Keep your ears alert for passing cars when you are walking on the track. Cut out 'flying switches' underground. If you are driving a mule be decent to him; he might get bad and ditch you. It is bad practice to ride between loaded cars, because a car behind you might jump the track and jam into you." The answers are from working miners and published in Safety Bear Letter No. 4, issued by Edwin Higgins, chief mine inspector. The organization of the club and the circulation of the letters among the members has created an interest in mine safety that should reduce the number of fatalities in California mines.

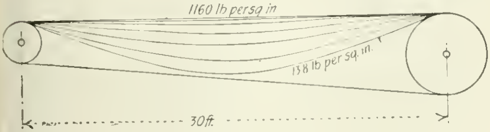
Details of Milling and Smelting

The Matter of Slack Belts*

By W. F. Schaphorst†

We often read about slack belts and their advantage over tight ones, but we seldom see real "figures" relating to such belts aside from the increased arcs of contact. The accompanying sketch shows how the arc of contact increases with slackness. In some cases I have known the increase to amount to over 30%, which is considerable, and is one of the reasons why a slack belt pulls so well.

The questions that remain unanswered are: What change in initial belt tension occurs with the increase of contact? Is that change worthy of consideration? In the figure I show a drive that has common everyday dimensions—30 ft. between shaft centers; a 3-ft. pulley driving a 6-ft. pulley; a belt that is 1 sq.in. in section (equivalent to a single-ply leather belt 4½ in. wide); and I have varied the sag of the slack side all the way from ½ in. to 4 ft. The enormous change in belt tension is interesting and instructive, as shown in the table.



SLACK-BELT DIAGRAM

CHANGE OF BELT TENSION WITH SAG

Sag, In.	Corresponding Tension, Due to Weight of Belt, Lb per Sq In.	Sag, In.	Corresponding Tension, Due to Weight of Belt, Lb. per Sq In
½	1,160	6	97
1	580	12	49
2	290	24	25
3	193	36	17.4
4	145	48	13.8

As a little study of the figures will indicate, the tension varies inversely as the sag in an almost exact proportion. That is, 1,160 ÷ 2 = 580; 580 ÷ 2 = 290; 290 ÷ 2 = 145 (see 4-in. sag); 145 ÷ 6 = 24⅙ (see 24-in. sag); and so on.

The formula used for solving any tension for any sag, any material (steel cables, electric cables or wires, ropes, suspension bridges, belts, etc.) and with any distance between points of attachment is

$$\frac{PL^2}{8D} + PD = \textit{tension in lb. per sq.in.}$$

where P equals the weight of the material under consideration 1 ft. long and 1 sq.in. in section. (For leather such as used in belts, P equals 0.43, the value used in obtaining the figures given); L equals length of span in feet; D equals sag, measured in feet.

It is hoped that this formula will prove useful in connection with problems of rope and belt drives. Offhand I should say that 1,160 lb. is too high an initial tension for a 4½-in. belt. It means over 250 lb. pull per inch width of belt, whereas we generally figure a useful pull of only 40 or 50 lb. per inch of width for the sake of safety—to "keep the belt from slipping." So why should we permit a tension of 250 lb. per inch of width on the "slack" side in order to get 300 lb. tension on the tight side? The useful pull then is 300 lb. — 250 lb. = 50 lb.

Traveling at a speed of 800 ft. per min., each inch in width therefore transmits $\frac{50 \times 800}{33,000} = 1.2$ hp. Do you get the drift of my argument? You will immediately see that I am not exaggerating common drives a bit when you recall the well-known belt rule, "One inch width of single belt running 800 ft. per minute will transmit one horsepower." I have been good enough here to permit 1 in. to transmit 1.2 hp. Initial tension of 580 lb. is too much also and 290 and 193. Why not permit 24-in. sag and reduce the tension to 25 lb.? If it can be done without belt slip, I say do it. Many a drive is operating successfully today with that much sag and without slip. In fact, I know of an installation where a 16-in. belt is transmitting 300 hp. at a belt speed of 2,340 ft. per min. The tension per inch of width is 265 lb., and yet the belt sags 30 in. If this belt were pulled up tight, figure for yourself how its useful strength might be wasted. In addition there is the bearing friction to consider.

The common method nowadays in putting on a belt is to "make a guess" as to the amount to be sliced out, take out "one inch or so more" for good measure and then force the belt onto the pulleys as tights as a fiddle string. We then get enormously high tensions, much higher than we think. According to the rule of thumb given, we can allow 185 lb. "useful pull" on our 4½-in. single belt, indicated in the sketch.

With a tension of 1,160 lb. on the "slack" side, we must therefore have 1,160 + 185 = 1,345 lb. pull on the tight side. The total pull, then on one shaft must be at least 1,160 + 1,315, or 2,505 lb. which, expressing it mildly, is enormous.

On the other hand, with a sag of 2 ft., the tension on the slack side is only 25 lb. and on the tight side it is 25 + 185, or 210 lb. In this case the total pull on each shaft is 25 + 210, or 235 lb., and just as much or more work is being done. We now see why there is such a difference in transmission efficiency. The friction of the slack-belt bearings is less than 10% of the tight-belt bearing friction; 235 ÷ 2,505 = 9.1%. Isn't that worth while?

If you wish to figure the power consumption of your bearings due to tight belts only, here is a fair formula: Horsepower lost in journal bearings as ordinarily fitted and well lubricated equals $\frac{0.000367\,dWN}{33,000}$; where d equals diameter of shaft in inches; W equals total belt pull, or load on bearing, in pounds, and N equals revolutions per minute. After weighing all these things, one cannot help being impressed with the folly of intensely tight belts, especially since they are so unnecessary. Imagine the much longer life of a belt stressed only 210 lb. as compared with being stressed 1,345 lb.

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*Copyright, 1916, by W. F. Schaphorst.

†Engineer, Woolworth Building, New York.

"Unreasonable," you may say. "If a belt can endure a pull of 1,345 lb. without breaking prematurely, it should be made to pull its full strength all the time." Well, there's some logic in that too, and rather than buy new and larger belts in installations that are being enlarged, I recommend increasing the stress in slack belts so long as they pull easily without slip. It may even be a good plan to install an idler pulley to prevent slip in extreme cases. All these points tend to prove the "beauties" of the slack belt. You can usually add more load on them. Tight belts, though, cannot be overloaded.

⁂

Automatic Oil and Acid Feeder

With the object of eliminating variations in the performance of flotation machines due to an irregular supply of frothing agent fed to the agitation cells, the machine described below was devised to feed regularly a given quantity of acid or oil into the ore stream.

The frothing agent is contained in the lead-lined tank *A*, Fig. 1, and regardless of the height of its upper level so long as it is kept above the minimum line *x-x*, a uniform quantity is fed into the mill-stream supply pipe *B* via the lead launder *C* by the small lead buckets *D* attached to the revolving bronze disk *E*. This lead launder clears the path of the buckets, as best shown in the plan, Fig. 2, through the manner of its support by the bracket *F* and its outward curve as it approaches the pipe *B*.

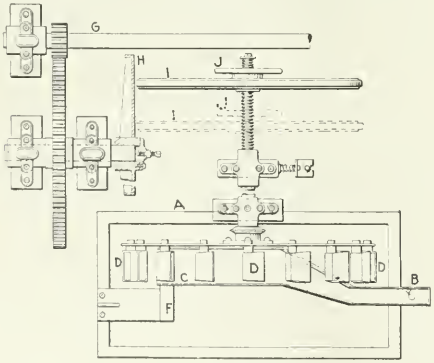


Fig. 2

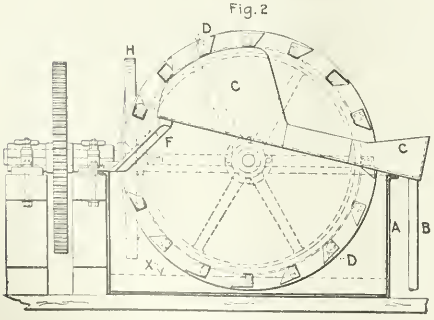


Fig. 1

AUTOMATIC OIL AND ACID FEEDER
Fig. 1—Elevation. Fig. 2—Plan

The bucket-carrying disk is rotated from the lineshaft *G* through the gears driving the friction disk *H*, which in turn is pressed by the friction wheel *I*. The latter is adjustable to any point along the threaded portion of the shaft, it being obvious that the closer the point of contact of *I* and *H* approaches the hub of the latter, the slower the speed of friction wheel *I*. This wheel does not rotate upon the threaded portion of the shaft, since it is feathered to it and hence revolves with it. Adjustment of this wheel to any point along the threaded portion of the shaft is effected by hand rotation of the wheel *J*, which is loosely held to the hub of *I* by an annular ring revolving in a groove. A pin lock holds these wheel hubs together immovably, insuring against accidental changes of speed. Whenever it is desired to change the supply of frothing agent, a slight movement of the lock pin allows wheel *J* to be rotated by hand and move the friction wheel to a new point of contact on the friction disk, thereby effecting the desired changes in the speed of feeding.

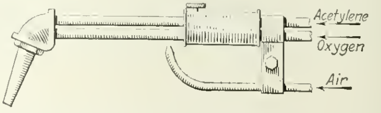
The hand adjustment of wheel *J* can be made while running, so that it is not necessary to shut down to make changes in the supply of frothing agent.

This machine is the invention of Albert Campbell, of Anaconda, Mont., granted patent No. 1,190,721 on July 11, 1916.

⁂

Oxyacetylene Welding Kink

An oxyacetylene welding equipment, such as has been widely and successfully used heretofore, says J. D. Cumming, in *American Machinist*, Aug. 17, 1916, is described as consisting of an air hose and a short piece of plugged pipe with a number of small holes drilled in it. The pipe is laid on the bench or work under the hands of the welder, and the air protects his hands and face from the intense heat. The disadvantages of this device are that it does not follow the movements of the worker, is easily shifted or knocked off the bench or work and, if laid on the heated article being welded, tends to cool it.



OXYACETYLENE WELDING TORCH WITH PIPE
An apparatus easily handled

The illustration here shown is an arrangement consisting of a ¼-in. pipe connected by a light hose to the air line. The pipe is bent to surround the hand of the welder and is fastened by a light bent-iron clip to the torch. By this means the welder can keep his hands and face cool without any of the disadvantages of the other method. The arrangement works well and is satisfactory from all points of view.

⁂

A Method of Correcting Worn Platinum Weights is given in "Chemical Abstracts," July 20, 1916. A sufficient amount of a 1% solution of $AuCl_3$ is decomposed by heating with a small flame on the light platinum weight until the weight of the deposited Au a little exceeds the shortage. A trace of borax is then added and the weight heated momentarily in a blast lamp, after which the weight is ground down to the proper size on a carborundum stone.

Company Reports

Barnes King Development Co. reports a loss of $26,157 during the second quarter of 1916, giving a loss for the first six months of the year of $145. During the period the cash was reduced from $185,000 to $60,000 by the loss noted and by payments on the property.

* * *

The Lake Milling, Smelting and Refining Co., Michigan, reports a readjustment of capital stock which makes the holdings more nearly conform to the stamping requirements of the holders. Control is now held as follows: Allouez, 36,164 shares; Isle Royale, 18,836; Superior, 18,836; Centennial, 16,164; Hancock, 10,000 shares. The Lake Milling company now has six heads at Mill No. 1, Point Mills, and two heads at No. 2, formerly the little Tamarack mill, Hubbell.

* * *

Consolidated Interstate-Callahan Mining Co., operating in Idaho, reports for the quarter ended June 30, 1916, a total tonnage mined of 37,217, a total milled of 32,782 tons and a zinc production of 16,853,320 lb. The crude shipping ore carried 52.08% of zinc, the milling 26.08%, while the average silver content of the crude ore was 20.88 oz. per ton, the milling ore 2.20 oz. per ton. The total tonnage of crude ore and concentrates shipped was 18,069. The average zinc content of the concentrates was 48.51% and the silver contents of the tonnage shipped was 20.71 oz. per ton. The mill made a recovery of 80.99% at a cost of $1.492 per ton. Mining costs were $4.972 per ton. The three-compartment Interstate shaft has made connection at No. 6 level with the Amazon-Manhattan workings and will be continued to the 700 level, which it should reach in August. Plans are being developed for the installation of a flotation plant which should add approximately 400 tons per month to the company's production.

* * *

Schumacher Gold Mines, Ltd., operating at Porcupine, Ont., was organized in 1914 to take over 160 acres bounded on the west by the McIntyre and Acme mines in the Porcupine district of Ontario. A mill of 140 ton's capacity was begun in April, 1915, and completed in September, 1915. To June 30, 1916, the company reports 820 ft. of sinking, 2,570 ft. of drifting, 3,505 ft. of crosscutting, 400 ft. of raising and 1,585 ft. of diamond drilling. Ore reserves are estimated at 64,900 tons valued at $396,700. This includes both material underground and on the dumps. To July 1, 1916, the mill had reated 30,120 tons of ore at an operating cost of $131,719 with a bullion recovery of $161,949. In addition solutions were estimated as being worth $1.703. After allowing for interest charges a working profit of $31,933 is shown to July 1, 1916.

* * *

La Rose Consolidated Mines Co., Cobalt, Ont., reports for he year ended Dec. 31, 1915, a production of 1,135,143 oz. of silver at a cost of 31.64c. per oz. and a return of 50.88c. There were 254.6 dry tons of silver-cobalt-nickel ore, 3.6315 tons of nuggets, and 1,482.3 tons of concentrates shipped, asaying 1,229.8 oz. per ton; 19,282.8 oz. and 464.5 oz. respectively. Mining costs were $108.01 per ton of shipping ore; concentration, $82.15; marketing expense, $5.45; corporation and traveling expense; $0.85; total, $236.34. In addition there were advances to the University Mines, Ltd., amounting to $2.52 per ton and credits, ground-rent, discount, royalty of $23.75 per ton of shipping ore. There were 54,404.8 tons of ore milled, carrying 15.28 oz. of silver per ton, from whichh 1,381 tons of concentrates were produced, carrying 459 oz. per ton. The tailings carried 3.49 oz. per ton, or an extraction of 76.70% on a 39.2:1 concentration. There was 4,393 ft. of underground work done during the year. On Jan. 1, 1915, ore reserves were estimated to contain 860,000 oz. in mine and dumps. The year's production was 1,135,000 oz., but there was on Jan. 1, 1916, only a small amount of rich ore in sight in pillars and about 10,000 tons of milling ore.

* * *

McIntyre Porcupine Mines, of Schumacher, Ont., report a profit of $327,524 for the year ended May 31, 1916. From the treatment of 105,758 tons having a gross value of $7.71 per ton the total recovery amounted to $779,991, or $7.37 per ton, indicating an extraction of 95.6%. Since the beginning of milling operations in 1912 to date, the property has produced $1,800,241 in gold bullion, which was recovered from 237,891 tons of ore averaging $8.10 per ton. Development work consisted of 99 ft. of stations, 302 ft. of shafts, 26 ft. of sumps, 4,006 ft. of drifts, 1,162 ft. of crosscuts and 989 ft. of raises, making a total of 6,585 ft. for the year. Diamond drilling amounted to 5,787 ft. To date, 25,672 ft. of development work and 10,337 ft. of diamond drilling have been performed on the property. The total cost per ton was $4.28, as shown by the following table:

OPERATING COSTS

General Charges:	Cost per Ton
Taxes, insurance and workmen's compensation	$0 1582
Administration and head-office expense	1513
Office and storehouse expense	1586
Interest and exchange	0221
Operating dwellings	.0027
Discount on bonds sold	.0851
Camp maintenance	1023
Roadwork and surface improvements	0297
	7100
Bullion-marketing charges	.0427
Mining:	
Exploration	0726
Development	8064
Breaking and stoping	1 6326
	2.5116
Milling	9682
Maintenance of plant and buildings	0491
	$4 2816

ANALYSIS OF MINING COSTS AT McINTYRE PORCUPINE MINES

	Transportation of Ore	Stoping	Drifting	Crosscutting	Raising	Sinking Stations Sumps	Total Cost	Cost per Ton
Labor	$2,898.03	$46,774 76	$14,997.93	$4,281.83	$5,404.85	$11,630.71	$85,988 11	$0.8132
Supplies	313.80	22,904 16	7,629 17	2,244 54	2,281.30	1,253.18	36,626.15	.3063
Hoisting and tramming		44,703 72	8,281.24	2,255 40	2,297.29	2,457.53	59,995.18	.5673
Timbering		13,444 69	809.47	177.72	917.71	2,113.74	17,463 33	.1650
Rock-drill maintenance		3,855.95	664.46	180.10	184.95	239.25	5,124.71	.0495
Air supply	173.03	17,573.02	2,838 56	801.29	1,946.77	1,285.46	24,618 13	.2328
Sharpening and handling steel		10,394.34	1,740.07	488.64	481.29	148,43	13,552.77	.1281
Tracklaying			852 64	303.15		...	1,155.79	.0109
Pumping and ventilating		2,217.24	348,46	103.98	100.30	116.16	2,886.14	.0273
Assaying and sampling		3,961.31	1,218 16	361 24	286.95	192.11	6,019.77	.0569
Surveying and engineering		3,447.17	579 67	157.73	156 90	173.34	4,514 81	.0427
	$3,384.86	$169,276.36	$39,959.83	$11 355.62	$14,058.31	$19,909.91	$257,911.89	$2.4390
Exploration							7,677.04	.0726
							$265,621.93	$2.5116

Ore reserves are estimated to contain 201,920 tons of ore averaging $11.12 per ton. It is stated that the worked-out blocks in the estimates of March 31, 1915, have produced 21% more ore than was estimated in these blocks. In the estimate just given, the veins in No. 9 shaft have been extended to 40 ft. below the 600-ft. level. No allowance has been made for extension of veins beyond the present working faces. No. 5 vein has been extended to 100 ft. below the 700-ft. level, three diamond-drill holes having penetrated the vein below the 700-ft level and indicating that ore will continue to that depth. An extension of 35 ft. has been allowed beyond each face in ore on this vein. The orebodies in the contract zone have been extended 50 ft. below the 700-ft. level, and in 714-715 drifts a width of 11 ft. has been substituted for the width of 62 ft. shown in 7 D crosscut. The advance in the price of all supplies has increased the milling cost 16.5%. Expenditures on permanent additions to plant amounted to $93,630, of which $48,062 was for new mill addition.

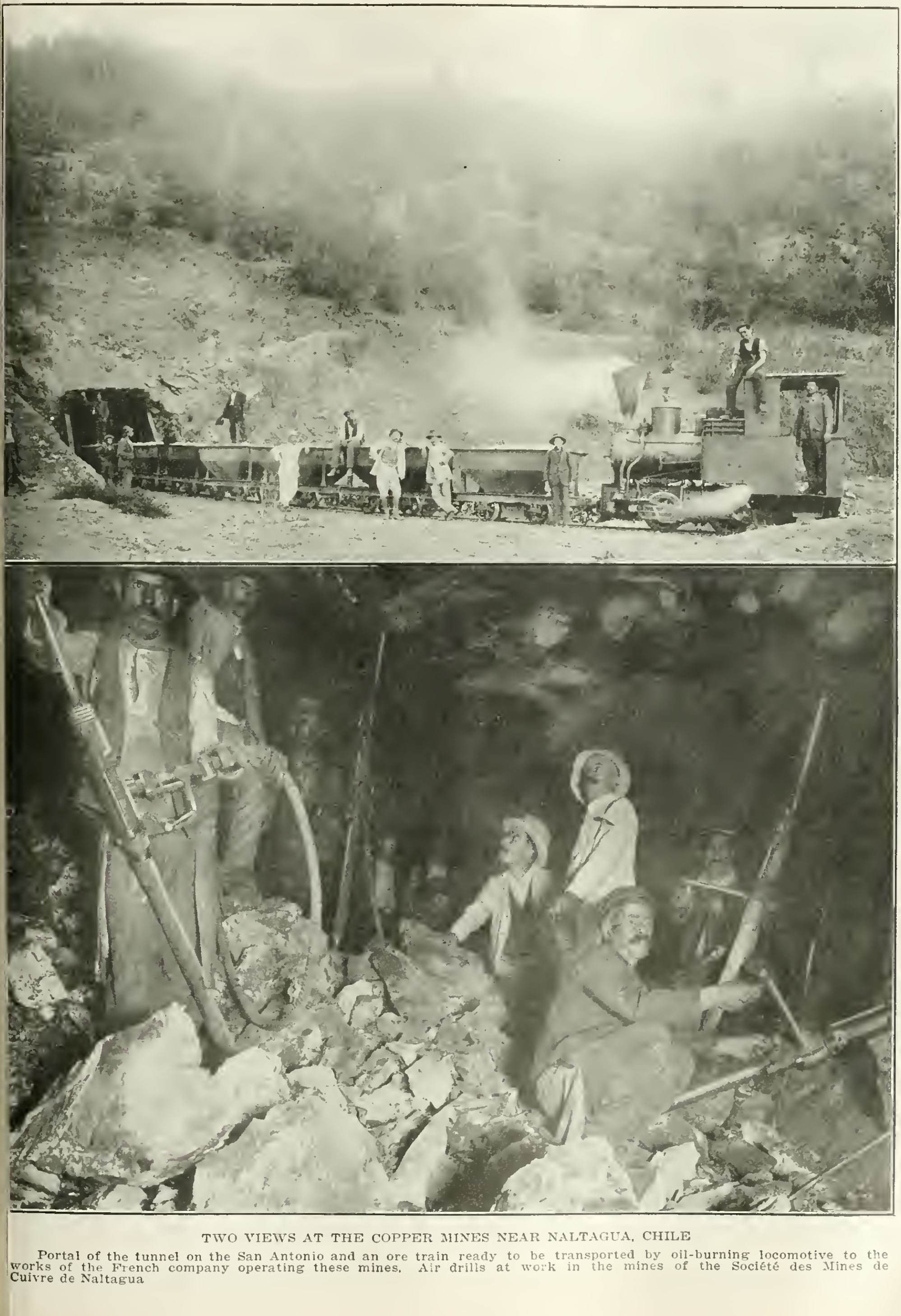
Photographs from the Field

THE CRESSON, ONE OF CRIPPLE CREEK'S FAMOUS GOLD MINES

Control of the Cresson Consolidated Gold Mining and Milling Co., owning the mine of vug fame, recently passed to a group of Colorado men. Its shares have lately been in demand at about five times their par value

A RECENTLY COMPLETED MILL IN THE JOPLIN DISTRICT

The Onamena No. 3 plant was completed about Aug. 1. It is in the Duenweg section of the southwest Missouri zinc field



TWO VIEWS AT THE COPPER MINES NEAR NALTAGUA, CHILE

Portal of the tunnel on the San Antonio and an ore train ready to be transported by oil-burning locomotive to the works of the French company operating these mines. Air drills at work in the mines of the Société des Mines de Cuivre de Naltagua

Correspondence and Discussion

Revision of Mining Laws

Being intensely interested in the mining laws, particularly regarding location and its details, I take the liberty of expressing my views on your editorial in the Aug. 26 issue of the *Journal*. Certain of the paragraphs ask questions that I am not prepared to answer, but the following ones, on which I touch, I should be very much interested in seeing discussed further.

6. The number of claims locatable by one person or association should be unlimited. What plausible reason is there for limiting this?

10. What reason should there be for allowing more than three months' time for recording location? A year's lapse or more might indicate one's lack of interest.

11. The annual assessment should be $5 per acre, as it is today.

12. It should be permissible that an equivalent sum of money could be deposited with (not paid) to the United States Land Office in lieu of the performance of assessment work until such time as the holders are in a position to spend an accumulation of money (amount to be left to the holders of claims) at one time, thereby deriving more benefit out of the assessment work. This is especially the case where property is inaccessible and where it is costly to get work started for such a small expenditure as $100, or where the owner is away for several years and cannot entrust the work to anyone, or where $100 spent, for instance, on one claim would do absolutely no good toward development or proving a location.

13. A person or association holding a group of contiguous claims should be permitted to do the assessment work upon any one of them and thereby hold the group, unless paragraph 12 be substantiated, and in that case assessment work should be done on each claim.

14. My answer to paragraph 14 would naturally be analogous to that of paragraph 12, as it should make no difference whether the assessment work be done before or after it becomes due.

15. It should be provided that in performing assessment work the equivalent of a given cubical excavation must be made per claim annually as exists today, but that a standard be established regarding the kind of rock excavated. In other words, I have seen dozens of annual assessment workings on as many lode claims consisting of nothing more than the removal of the required 240 cu.ft., but in soft earth or gravel or even decomposed lime or other soft rocks, all easily excavated in a few hours by one man; and seldom is this done for any other purpose than simply to comply with the law regarding annual assessment work. This paragraph particularly should apply to the man or prospector who does his own assessment work, but it should be required that he must record a sworn statement of what work was done.

16. Those who give contracts for their work should be required to file annually a record, sworn to by the contractor, of his assessment work, accompanied by vouchers. It should also be required that assessment work done per claim annually must consist of at least — cubic feet of solid rock excavating. This amount should be determined by arbitrators, separately in each case, in case of litigation. The blank for cubic feet excavation, as far as the law is concerned, is a question on which much can be said before determining it.

It would no doubt be a difficult matter to discriminate between the classes of claim holder and therefore paragraphs 16 and 15 should be brought under the same paragraph. The claim holder should in all cases have the option of doing the work as and when due, or in advance, or as outlined in paragraph 12.

The laws are decidedly too lax in connection with this point, and the State should enforce the point more rigidly. Many claim holders who have 20 to 30 claims, whether adjoining or not, seldom spend anywhere near the required amount of money annually (especially if the properties are not being operated). This is my reason for wishing to see the law require a sworn statement, with vouchers, to be filed.

This brings up another point—that of the validity of a sworn statement made by the contractor who does the work. The claim holder in this case should not be held liable if the contractor's sworn statement be false.

STUART OTTO.

1876 Broadway, New York City, Sept. 1, 1916.

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Determination of Copper in Low-Grade Ores

I think the article on "Determination of Copper in Low-Grade Ores," by F. O. Hawley, published in the *Journal* of Aug. 12, is of extreme interest to chemists who have to deal with low-grade, impure ores and slags that carry impurities interfering with the ordinary electrolytic assay. At the best, the straight electrolyzing of the acid solution of a slag after treatment with HF and H_2SO_4 is an unsatisfactory estimation. On some slags good results are obtainable—that is, within three or four hundredths of the correct copper content—but on a works treating custom ores one never knows when one is going to encounter dirty ores. A slag carrying 40% SiO_2 with 5 to 7% CaO and 8 to 10% Al_2O_3 will give 40% FeO (= 31% Fe) and can be run in acid solution with rotating anodes without any difficulty. This is not so, however, when a slag like the following is on hand: 62.1% FeO = 48.4% Fe and 31% SiO_2. Such a slag I have seen produced in a blast furnace concentrating low-grade matte where no lime was used in the smelting. On such a slag straight acid-electrolytic determination is unsatisfactory, especially in view of the time limit usually given for getting out results.

Mr. Hawley quotes examples on a heavy sulphide ore. I think there must have been an error in the statement that the ore contained about 60% pyrite; I believe it should be 90% pyrite. Some months ago I was with Mr. Hawley at the International Smeltery at Miami, and this method was in use on ores of following composition: Fe, 12%; S, 48%; Cu, 3%; with 5% SiO_2 and Al_2O_3. I have found the method of advantage on many such ores as those in the following two examples:

Ore A			
Electrolytic assay in acid solutions using rotating anodes	7.37	7.37	7.42
Electrolytic assay in acid solution using stationary anodes	7.20	7.26	
Hawley alkaline method	6.99	7.00	
Permanganate assay	6.96	6.98	
Ore B			
Electrolytic assay in acid solution	8.11	8.12	8.34
Hawley alkaline method	7.92	7.92	
Permanganate assay	7.90	7.92	

The impurity in ore A was arsenic, and in ore B was bismuth.

On first reading the method, one might be led to the conclusion that the time factor was all against it, but it will be found that this is not so. The result can be out within 1¾ hr. of weighing the sample, or rather the set of samples. If six or 8 slags are decomposed in either platinum or porcelain dishes by means of HNO_3, HF and H_2SO_4, evaporated to strong fumes, cooled, taken up with water and the requisite acid added, then estimated at a low amperage to get coppers as clean as possible, it will not be done in any less time than by the alkaline method given and there will not be the same accuracy in all cases. HARRY A. B. MOTHERWELL.

Clifton, Ariz., Aug. 21, 1916.

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Increased Cost of Explosives

One hears an increasing number of complaints these days from mine leasers concerning the great and increasing cost of explosives and other mine supplies. It seems pretty well established locally that the prices of most supplies have risen at least 100% in the last two years. I have no data, but would be glad to see the *Journal* publish anything illuminating the subject. I presume the Joplin district is not the only one in which the pinch of high prices is felt. LEASER.

Joplin, Mo., Aug. 10, 1916.

[From the number of inquiries of similar nature received, it is evident that the Joplin district has not been singled out for trouble over high prices. From Alabama to Alaska the story is practically the same—high prices everywhere and fear of still further advances.

It is a peculiar coincidence, some correspondents evidently think, that prices of supplies should have risen so rapidly just as the miner seemingly had the chance of a lifetime to make material profits as the result of high prices received for mine products. As a matter of fact, hints at a general conspiracy to raise prices are foolish, as even a cursory examination of the situation will show.

The following is fragmentary data readily available without research into all prices up to date. First, as regards steel supplies for the mine, such as drill steel, rails, track supplies, etc., it is probable that an average advance in all districts of from 30 to 40% prevails at present over prices of about Aug. 1, 1914.

Mill-supply steel of common grades, such as shoes and dies, is included in the same price range, but for pipe and pipe fittings the increase is apparently from 60 to 75%. Prices for special grades of steel have of course gone out of sight owing to war conditions needless to detail. Tool steel, for instance, has advanced over 500%.

For explosives the price increase in the East and Middle West has been from 66 to 75% for 40% dynamite and from 90 to 92% for 50%. Detonating caps have advanced from 94 to 100% and ordinary grades of fuse about 10%. We presume the increases in the West and other sections have been about the same, but have no data available. With our American manufacturers rushed with European war orders for explosives and forced to pay greatly increased prices for their raw materials, the situation is obvious.—Editor.]

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Belt and Bucket Elevators

The article by Arthur O. Gates in the *Journal* of July 1, 1916, is a timely and, in the main, practical discussion of that much-neglected and much-abused mechanism, the bucket elevator. In the matter of the proper speed at which an elevator should be run, however, Mr. Gates' theoretical discussion leads only to a general rule that he has embodied in the chart, and that in no sense gives sufficiently accurate results for the designer.

Materials of different sizes, different percentages of moisture and different physical properties require different speeds in order to properly discharge the buckets over the head pulley, and because of this it is difficult to see how a chart can be constructed to cover in a satisfactory manner the speed range necessary for even the most commonly handled materials, in relation to the size of the head pulley.

I have for several years used a formula in which the coefficient is easily determined and which is based on the simple assumption that the same centrifugal force is required to give a satisfactory discharge in all similarly constructed elevators handling similar material. Let

R_1 = Radius in feet of head pulley on elevator No. 1 (measured to center of gravity of cups);
R_2 = Radius in feet of head pulley on elevator No. 2;
V_1 = Necessary speed in feet per minute of elevator No. 1;
V_2 = Necessary speed in feet per minute of elevator No. 2.

Then from the familiar formula for centrifugal force,

$$F_1 = \frac{W\left(\frac{V_1}{60}\right)^2}{gR_1} \qquad F_2 = \frac{W\left(\frac{V_2}{60}\right)^2}{gR_2}$$

and from the foregoing assumption.

$$F_1 = F_2, \text{ or } V_2 = \left(\frac{V_1}{\sqrt{R_1}}\right)\sqrt{R_2}.$$

The term $\left(\frac{V_1}{\sqrt{R_1}}\right)$ may be taken from an existing elevator and may be used in the formula for all other elevators as assumed. In my notes are values for this term ranging from 241 for chain elevators handling damp slack or ashes to 386 for belt-and-bucket elevators handling dry crushed quartz ⅛ in. and under. Any engineer can easily compile a table of the constants needed in his practice. Of course Mr. Gates' analysis points the way to improved practice and should be studied by all having to do with elevators.

I am not sure that this method of solving the problem of the proper speed of bucket elevators in practice is original with me, but I do not recall having seen it in print and I simply present it for what it may be worth. THOMAS A. STROUP.

Salt Lake City, Aug. 21, 1916.

The Sterling Iron Mines*

One of the earliest iron-mining operations in the United States was at the Sterling mine, in Rockland County, New York, between Tuxedo and Greenwood Lake. This mine was opened in 1745 by the "Sterling Iron Works," William and Abel Noble, and later, Noble, Townsend & Co., being the proprietors. The mine is of historic interest, being the source of iron used in making the chain that was stretched across the Hudson River, near West Point, to prevent the passage of the British fleet during the Revolutionary War. The mine is still in operation under the ownership of the Sterling Iron and Railway Co.

In 1776 Washington saw three British ships of war pass up the Hudson without suffering any interruption from the obstructions that had been placed across the river, nor from the fire of Fort Washington and Fort Lee. All he could do was to send warning to General Clinton, in the Highlands, and the other American forces farther up the river, to be ready. In October, 1777, the iron chain that had been stretched across the river between Fort Montgomery and Anthony's Nose was broken by the British ships, the enemy captured Fort Montgomery and Fort Clinton and sailed on up the river to burn the town of Kingston. A second barrier had failed to stop the enemy, and it was too late to save the river towns.

When the defeat of Burgoyne at Saratoga prevented the union of the two British forces—Burgoyne from Canada, and Sir Henry Clinton, who had ascended the river as far as Kingston, but was obliged by Burgoyne's defeat to return to New York—one more chance remained to keep the British out of the Hudson Valley, which was the master key to the colonies. To make safe this final chance, Washington made it clear that no effort must be spared. He wrote to General Putman: "I request you, in the most urgent terms, to turn your whole force and all the means in your power for erecting and completing, as far as it shall be possible, such works and obstructions as may be necessary to defend and secure the river against any future attempts of the enemy. You will consult Governor Clinton, General Parsons and the defense engineer, General Radière, upon the occasion. By gaining the passage you know the enemy have already laid waste and destroyed all the houses, mills and towns accessible to them. Unless proper measures are taken to prevent them, they will renew their ravages in the spring or as soon as the season will admit, and perhaps Albany, the only town in the state of any importance remaining in our hands, may undergo a like fate and a general havoc and devastation take place. To prevent these evils, therefore, I shall expect that you will exert every nerve and employ your whole force, in future, while and whenever it is practicable, in constructing and forwarding the proper works and means of defense."

To carry out these instructions no halfway measures were possible, and after a conference and discussion with Robert R. Livingston and several others of the most highly qualified men, it was decided that West Point, where the Hudson makes a double turn, should be chosen as the place for the obstructions and fortifications.

This being determined upon, it remained for a means of obstruction to be found that would be sure. At the direction of Washington the matter was taken up by Peter Townsend, proprietor of the Sterling Iron Works, who held the opinion that an iron chain could be made strong enough to prevent any ship from passing up the river. Accordingly, the iron for this chain was mined from the Sterling mine, smelted at the Sterling furnace, wrought at the Sterling forge into bars varying from 2½ to 3½ in. square, and finally was welded there into links about 2 ft. long. The workmen engaged were exempt from military service. The chain was 500 yd. long and weighed 186 tons. It was of course too heavy to be taken to the river whole, so it was carried over the mountains two or three links at a time, on ox-carts and on muleback. Forges at the river welded the links together. The chain, supported on logs at just the proper distance below the surface and anchored firmly with anchors of Sterling iron, was placed between West Point and Constitution Island on Apr. 30, 1778. It did its work well, and no British ships gained access to the upper Hudson by breaking or evading it. When it was removed in 1783, after the declaration of peace, it was unbroken, and the links are still to be seen at West Point, at the

A SKIP DUMPING AT THE MINE BIN

THE ENTRANCE TO THE STERLING MINE

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*Excerpt of an article by J. W. Ritchings, Jr., in "The Telephone Review," July, 1916.

home of Mr. Coxe at Southfield, and at various other places in New York State. The mine that supplied the great West Point-Constitution Island chain is in operation to this day.

The Sterling Iron and Railway Co., operates the branch railroad from Sterlington, N. Y., on the main line of the Erie Railroad, to the mine, and it traverses a section of Rockland and Orange Counties for a distance of about 7 mi., passing en route Sterling furnace, erected in 1848 at Sterling Pond. The ruins of this furnace are still to be seen near the highway, about midway between the Sterlington railroad depot and the Sterling mine.

The old Sterling furnace, where the chain was forged, was erected in 1751 by William and Abel Noble, and its ruins may be seen today at the south end of Sterling Lake. Here the Daughters of the American Revolution have placed a tablet in commemoration of the furnace and the making of the chain.

The possibilities of productive iron mining on this site were first adjusted in about 1735, when Cornelius Board, in the employ of a London company, while prospecting for gold and other valuable metals in what was then known as "Northern New Jersey," came upon iron ore in great quantity and of a very high grade, at what is now the Sterling mine. About ten years later, 1745, a company was organized as the Sterling Iron Works.

In those early days, dynamite, caps, fuses and drills were unknown and a primitive method of mining was in vogue. Black powder was placed on the spot that was o be blown up, a long straw was lighted, and the unighted end was placed over the powder. In due time he powder would become ignited, and part of the time, at least, the desired result was obtained.

The mine shaft, sloping at an angle of 18°, descends 3,000 ft. and has a vertical depth of 500 ft. under the center of Sterling Lake. Two shifts of about 90 men each, with improved electrical equipment, handle about 500 tons of ore per day. The ore and rock is brought to he crusher and sorting house by means of skips and conveyors, where it is sorted and the ore deposited in arge cars ready for shipment. Practically the same number of miners is employed today as 50 years ago, but because of the introduction of modern machinery and electricity, the annual production has been increased from 2,000 to over 100,000 tons of ore.

Until recently steam pumps, steam hoists, etc., were in use, but today they are replaced by modern electrical equipment. Electrical power is furnished by the Harriman power plant, at Harriman, N. Y., and is brought to the mine across the mountains, a distance of 10 mi. The ore is made into iron which is used for foundry iron, for making anchors, chains, nails, etc., and is put to practically the same uses that it was in the early days.

A SECTION OF THE ORIGINAL CHAIN THAT WAS STRETCHED ACROSS THE HUDSON RIVER AT WEST POINT

The chain is now on the lawn of the Hewett Homestead, Ringwood, N. J.

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Marigold All-Steel Dredge

Marigold No. 5 dredge began digging in the Yuba Basin field, Yuba County, California, on May 7, 1916. Active construction was begun Dec. 26, 1915. This is the first all-steel dredge installed by the Marysville Dredging Co. It is equipped with 86 California type buckets of 16-cu.ft. capacity and designed to dig 68 ft. below the water line, handling over 10,000 cu.yd. of material in 24 hr. The drawings, machinery and material were furnished by Union Iron Works, of San Francisco. The dredge was constructed by the Marysville Dredging Co., which maintains shops at Marigold. T. D. Harris is manager of the company. The design and construction were patterned after Yuba No. 14, built by the Yuba Construction Co., but with special changes and improvements.

The hull is 155 ft. 6 in. long, 58 ft. beam and 5 ft. overhang on each side, 11 ft. 6 in. deep. The well-hole is 8 ft. 3½ in. wide in the clear; the bow end of well-hole pontoons 24 ft. 8¼ in. wide. The hull is painted inside and outside with bitumastic enamel.

The digging ladder is 132 ft. long from center to center of the tumbler, built in four sections, the heaviest section weighing 70,100 lb.; total weight 250,000 lb. The ladder complete, with rollers, weighs 300,000 lb. The buckets each weigh 4,200 lb. plus 425 lb., weight of the pins. The total weight of the bucket line is 398,000 lb.

The lower end of the digging ladder is covered with heavy wearing plates on the under side. The upper tumbler is six-sided, weighs approximately 20,000 lb. and has 42-in. pitch; the lower tumbler is round and weighs approximately 26,000 lb., cast in one piece. Both tumblers are of manganese steel.

The bow gantry is constructed of 30-in. I-beams. The bow deck is covered with checkered plates. The bucket idler is cast in one piece, lined with manganese wearing plates.

The tailing stacker, without idlers or belt, weighs 46,000 lb. The conveyor belt is 145 ft. long, center to center of drums, and 42 in. wide. The stacker-ladder deck slopes down each side from the center at 45° angle, and a wellway through the hull at the foot of the stacker catches the spill off the belt.

The revolving screen is 50 ft. long and 9 ft. inside diameter. The longitudinal bars on the screen are flat instead of angle iron. The screen is equipped with twenty-six 2-in. nozzles fitted to the spray pipe with saddles in such manner that they can be adjusted at any angle, the pipe extending through the length of the screen. The spuds are 62 ft. long, 60 in. wide and weigh 82,000 lb. each. The digging spud is made of four Bethlehem steel I-beams, bolted together instead of riveted.

The main drive has all cut gears. The first set are of herringbone type; the master gears are 14 ft. in diameter with 14-in. face split through the center. The main drive and ladder-hoist motor is of 400 hp.; the swing winch motor, 50 hp.; stacker motor, 60 hp.; screen motor, 75 hp. Screen and stacker motors drive through chain belts. The swing drums are 30 in. in diameter and are placed at the head of the main winch so that the remainder of the winch can be cut out by a clutch when not in use.

The pumps are Yuba Construction Co. type, made by that company. There are one high-pressure 14-in. 150-hp. pump and one low-pressure 14-in. 75-hp. pump; one 6-in. 2-stage priming pump, 50 hp.; one 8-in. bilge pump, 10 hp.

The housing is constructed of 4-in. channels, two sheets of light iron with asbestos filler between; the roof is galvanized iron sagged between deck channels with $1\frac{1}{4}$-in. decking.

Chronology of Mining for August, 1916

August 1—United Verde Extension paid initial dividend.

August 3—Strike of asbestos miners in Thetford Mines, Quebec.

August 10—South Hecla Mining Co. paid initial dividend.

August 12—Walker Mining Co.'s property in Plumas County, California, passed to International Smelting Co.

August 14—Rosiclare, Ill., fluorspar mines resumed after idleness of one month, due to strike.

August 15—Utah Metal and Tunnel Co. paid initial dividend.

August 16—First coal train from Matanuska coalfield, Alaska, over Government railway, left Goose Creek for port of Anchorage.

August 24—Calumet & Hecla increased its dividend to $20 per share.—Centennial Mining Co. declared initial dividend.

August 30—Ohio Copper Mining Co. sold for $750,000 to E. H. Sykes, of Sullivan & Cromwell, New York representing the bondholders.

The Promontory District, Utah[*]

The Promontory district is in Boxelder County Utah, near the south end of the range that forms a long promontory on the north shore of Great Salt Lake. The area in which ore has been produced is 3 to 4 mi. north of the Southern Pacific cutoff and at an elevation about 1,000 to 1,500 ft. higher. The connecting wagon road has a gradual grade in favor of the load for most of the distance, but is rather steep near the camp. Wagons and motor trucks were used in hauling ore to the railroad and supplies to the camp. The range supports a rather scanty growth of cedar and other scrubby trees which are available as a fuel supply. There are some springs on the south end of the promontory, but none near the camp. Water was brought in on the railroad for the section crew at Saline and the Lake View mining camp. An attempt will doubtless soon be made to develop a near-by supply of water. The camp of the Lake View Mining Co., owners of the only producing claim in the district, is on a bench of Lake Bonnerville, the predecessor of the present Great Salt Lake.

LITHOLOGICALLY SIMILAR TO TINTIC

According to Hague, the basal formation of the range is made up of Archæn schists. This formation is overlain by a great series of quartzites whose thickness has not been determined, but is several thousand feet. The quartzite series is believed to be the equivalent of the Cambrian and Algonkian quartzites and shales in the Wasatch Range, which vary in thickness but in big Cottonwood Cañon exceed 10,000 ft. Above the quartzite comes a succession of shales, impure limestones and sandstones, with some beds of rather pure limestone toward the top of the series. This group attains a thickness of 700 to 800 ft. Above this series there are heavy bedded limestones which attain a thickness of several thousand feet.

Lithologically and paleontologically the rocks between the quartzite and the upper limestone series closely resemble the series of shale and limestone occurring at a similar horizon at the Wasatch, Oquirrh, Tintic and other ranges, though both the shales and the limestones are more abundant in the promontory mountains than in any of the other ranges mentioned. Limestone is, however, even more abundant at this horizon in northeastern Utah.

The upper part of the quartzite series is doubtless of Cambrian age, and the lower part may be Algonkian, though this has not been determined. The limestone and shale series overlying the quartzite is of Cambrian age. The age of the upper limestone probably ranges from Cambrian to Carboniferous.

No igneous rocks were observed in the vicinity of the mineralized area. Samuel S. Arentz states that a dike

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[*] Excerpt from Bulletin 640-A of the United States Geological Survey.

4 ft. in width and traceable for about 150 ft. cuts the heavy bedded limestone east of the Lake View property. In the hand specimen this is a dark green rock apparently having the composition of a rather basic diorite, or possibly diabase. Similar rocks are said to cut the quartzite west of the Lake View property.

The general structure of the range at the south end is monoclinal. The beds strike about N 10° W and dip 30 to 40° N. This apparent monocline may be the eastern limb of an anticline from which the western portion has been removed by erosion. Some indication that such is the case is given by a small area of westward-dipping sediments near the south end of the promontory. Minor faulting in northerly and easterly directions has taken place, but so far as observed the displacement is at most but a few feet. Prospecting in the range until recently had been largely confined to two localities, both near the southwest side of the promontory. For several years there has been some prospecting of copper deposits in the quartzite series on the west side of the promontory about 1½ mi. northwest of Saline. In 1907, 14 tons of hand-sorted ore, averaging 3.85% of copper and 1 oz. silver to the ton, were shipped. The present activity is confined largely to the zinc-lead deposits. In December, 1914, workmen doing some assessment work on a placer property walked up the wash to the limestone beds outcropping above. Boulders of lead-zinc carbonate were discovered in the talus and traced to the outcrop of ore in place found at the top of the 100-ft. bed of limestone, forming the so-called middle bed in contact with shale. Locations were then made, and a few holes were dug on the outcrop. After an examination made in February, 1915, by Samuel S. Arentz, of Salt Lake, a fifth interest was negotiated for and obtained in March. Mr. Arentz began operations as one-fifth owner and under contract to manage the mine for one year. The net weight of ore shipped to Aug. 1, 1915, was 1,961,900 lb., averaging as follows:

ORE FROM THE LAKE VIEW MINE

	%		%
Lead	7.7	Zinc	32.75
Iron	1.1	Sulphur	0.2
Silver	0.2	Moisture	1.9
Gold	Trace	Insoluble	16.0

The gross returns for 21 cars were $35,636.75. The company reported that it had paid dividends of $8,119.75 o Aug. 1 and had a balance of $7,180.14.

Zinc More Abundant Than Lead

Prospecting of zinc and lead deposits has been confined almost entirely to the middle limestone bed. This is 50 to 75 ft. thick, included in members composed pre-ailingly of shale. The ores have been formed by replacement of this limestone near the north-south fissures. The argest deposit thus far disclosed occurred just beneath he overlying shale, though development has shown that considerable mineralization has taken place at lower horizons in the ore-bearing limestone. Present developments show that zinc is far more abundant than lead.

Prospecting has been carried on along the outcrop of the middle bed for a distance of about 4,500 ft., and bodies of ore are shown in numerous openings. In the development of the property the managers seem to have followed the conservative policy of determining the amount and character of the mineralization along the utcrop before beginning extensive developments at depth, nd at the time of visit the ore zone had nowhere been exposed more than a few feet below the surface. Sufficient data concerning the mineralization had been obtained, however, to warrant the planning of deeper development work. The region is one of considerable relief and suited to the development of the ore bed for several hundred feet below its highest outcrop by means of tunnels. Practically no work has been done on the lower limestone, though it is said to contain as much as 3½% of zinc on the outcrop.

Copper Deposits in Prospect Stage

The copper prospects of the Promontory district are about 1½ mi. northwest of Saline station. The deposits crop out on the crest of a ridge near the shore of the lake. The country rock is the quartzite near the base of the exposed sedimentary rocks of the south end of the range. The beds at this point strike N 45°-50° E and dip 16°-20° SE. The ore is disseminated in the quartzite. The primary mineralization formed chalcopyrite and possibly bornite, but at the surface the sulphides have been altered to carbonates.

The developments consist of two shafts about 200 yd. apart, sunk from the crest of the ridge, one having a depth of about 50 ft., the other 120 ft. At a lower point an inclined shaft was sunk on a westerly pitch nearly at right angles to the dip of the beds to a depth of 80 ft. Near the same point a tunnel has been driven eastward for about 100 ft. At a point near the shore of Great Salt Lake and about 200 ft. vertically below this tunnel another tunnel has been driven eastward for 152 ft. This was projected to intersect the downward extension of the ledge that outcrops on the ridge.

Some mineralized rock was observed in the prospect openings, and it is said that more valuable ore was encountered at some points which were not accessible when the investigation was made. The ore shipped was obtained from large blocks of mineralized quartzite at the surface.

NEW PATENTS

United States patent specifications listed below may be obtained from "The Engineering and Mining Journal" at 25c. each. British patents are supplied at 40c. each.

ALUNITE—Treatment of Alunite and the Like. Howard F. Chappell, New York, N. Y., assignor to Mineral Products Corporation, New York, N. Y. (U. S. No. 1,195,655; Aug. 22, 1916.)

CARNOTITE—Process of Concentrating Carnotite Sandstone Herbert N. McCoy, Chicago, Ill. (U. S. No. 1,195,698; Aug. 22, 1916.)

CLASSIFIER—Ore Classifier. William Henry Weigand, Trojan, S. D. (U. S. No. 1,192,806; July 25, 1916.)

COBALT OXIDES—Electrolytic Process for the Extraction of Cobalt Oxides. Kenneth S. Guiterman, New York, N. Y. (U. S. No. 1,195,211; Aug. 22, 1916.)

CONCENTRATION—Ore Concentrator. William Fagergren, Salt Lake City, Utah, and William D Green, Butte, Mont., assignors, by mesne assignments, to Metals Recovery Co. (U. S. No. 1,195,453; Aug. 22, 1916.)

COPPER PRECIPITATION—Method of Making Acid and Insoluble Metallic Compounds. George D. Van Arsdale, New York, N. Y. U. S. No. 1,195,421; Aug. 22, 1916.)

CRUSHER—Swinging Ore Mill. Jacob Lampert, Rapid City, S. D. (U. S. No. 1,192,535; July 25, 1916.)

ELECTRIC-ARC FURNACE. Emil Edwin, Christiana, Norway, assignor to Norsk Hydro-Elektrisk Kvaelstofaktieselskab, Christiana, Norway. (U. S. No. 1,193,882; Aug. 8, 1916.)

ELECTROLYSIS—Method of Preventing Disintegration of Anodes. George D. Van Arsdale, New York, N. Y. (U. S. No. 1,193,711; Aug 8, 1916.)

FURNACE. Utley Wedge, Ardmore, Penn., assignor to the Furnace Patent Co., Philadelphia, Penn. (U. S. No. 1,195,424: Aug. 22, 1916)

VOLATILIZING—Process of Volatilizing Metals. Selden Irwin Clawson, Salt Lake City, Utah. (U. S. No. 1,192 37 July 25, 1916.)

Editorials

How the Railway Strike Was Averted

The threatened railway strike was averted on Sept. 2 by Congress giving the labor leaders everything they wanted, although it was not the right of Congress to give, and the railway stockholders will have to pay. It was easy for Congress representing the people to give away what did not belong either to it or to the people.

The President, having found himself in an awkward predicament, appealed to Congress, asking it to enact a series of half-baked expedients in the closing days of the session. Congress, as was to be expected, discarded everything but what it knew would satisfy the labor leaders; namely, the enactment of a law requiring present rates of wages enjoyed by certain employees engaged in interstate commerce to be figured on the basis of an eight-hour day.

This bill was promptly passed in the House of Representatives. The Senate received it on Sept. 2 and had to enact it before sunset. All day long the labor leaders sat in the galleries watching the reverend senators, squirming in their consciousness of the injustice and indignity of the thing, vote an increase of wages to fewer than one per cent. of the population of the United States to protect the rest of the citizens and their families.

This action of Congress was probably illegal. Certainly it will be tested in the Courts. But before the Courts can render decision, the law will have been put into effect and the aristocrats of railway labor will have obtained their increases; and no matter how the Courts may decide, wages cannot be reduced, for it is now the accepted principle that wages may be advanced but never may be reduced. The President and Congress knew that on Sept. 1 and 2 they were doing a monstrous thing out of motives of political expediency. They committed a greater wrong than perhaps they know. They cowardly surrendered a great principle and dealt a blow to our republican form of government. No longer are we a free people. We know now that there is an empire within the republic—a power to which the mass of the people must defer. We rose against George III, but we cringe before Samuel Gompers. A week ago this would have seemed incredible. Today we stand aghast at the reality. If the railway labor leaders should decree that every non-union man of voting age must wear a pink necktie, there would be nothing to be done but obey.

Nothing to be done until we get some leaders who will stand firmly in another Lexington and fire a shot that will be heard from ocean to ocean. The time will come when the mass of the people, with brave leaders, will assert themselves.

In the meanwhile the laws of economics, which are as immutable as that of the conservation of energy, will operate silently but surely. If the railways of the United States are to be dominated by predatory politicians and eaten up by unionized labor, investors will not subscribe to their stocks and bonds and the extensions of railway facilities that are needed as the population increases will not be made. Even in an oligarchy people cannot be compelled to invest in what they do not want to.

The crime against democracy that was committed on Sept. 1 and 2 may be appalling in its consequences. In order to save the public some temporary inconvenience, the representatives of the people sold their birthright. What American, save the small percentage who by terrorizing imposed their will, can feel anything but shame today? We live now in a state of terror of a supreme power within our nation. New York City is already threatened with another and general railway strike. Next it may be the anthracite mine workers who will tell us to go cold this winter unless they be granted all they want. And so on. Let the people rise in self-defense!

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Revision of the Mining Laws

The most effective argument against abolishing the present prerequisite of discovery has been made by E. D. Gardner, of Montana, in an address delivered originally before the Montana Society of Engineers and republished in the bulletins of the Mining and Metallurgical Society of America and of the American Institute of Mining Engineers. Mr. Gardner points out that the abolition of this requirement will open the door to serious abuses in the acquirement of mineral land for other than mining purposes. He illustrates these by a variety of accounts of what has happened and suggestions of what might happen. Most of his illustrations are pertinent.

It is freely to be recognized that conditions in Mexico, where discovery is not required, and in the United States are different. In Mexico the government does not part with its ownership, but confers mining rights only so long as certain conditions, including the payment of taxes, are fulfilled. The taxes are a great deterrent to anybody locating claims simply to hold them for unearned increment.

In the United States the system has been designed to grant mineral lands in fee simple, and there has been no general demand for a departure from that system. Any ideas of change in this respect would doubtless be unpopular. The United States permits claims to be located and held, however, only upon condition that work to a certain amount is done annually upon them. This is equivalent to a tax, but instead of its being paid into the Federal treasury, it is supposed to be spent in the development of the property. That often it is not so spent is one of the evils of our present mining laws. An amended law should provide for the honest performance of assessment work and means for seeing that it is done. If the law be properly drafted in this regard, there will not be much locating and holding of claims for unearned increment, nuisance value, etc.

The strongest point against Mr. Gardner's arguments is that under our existing laws the discovery prerequisite is abolished by common consent. Many claims have been located during the last 40 years upon nothing but an alleged discovery, which everybody knows to be no true discovery, but nobody protests for the reason that some day he may want to do the same thing. Many claims have been held and patented without the $100 worth of annual assessment work ever being done upon them. The present laws encourage initial perjury and a repetition of perjury annually until patent is obtained, and the perjurer may rest in peace, awaiting a purchaser for his claim or for some neighbor to discover an orebody leading into it.

The arguments in favor of the abolition of the requirement of discovery are the removal of those evils and the simplification of the system. Mineral lands of all kinds—metallic, oil-bearing, stone quarries, salines—except, perhaps, coal ought to be locatable by one kind of claim and under one set of conditions. Abolishing the discovery prerequisite, moreover, renders unnecessary special provisions for locating mill sites and tunnel sites. The man who wants to drive a tunnel may simply locate a string of claims on its course.

Alaska Gold Mines Co.

On Aug. 31, after the price of Alaska Gold Mines Co.'s shares had been slumping for several days, Charles Hayden, president of the company, made a statement which cleared up the uncertainty about the affairs of this company that has been disturbing its stockholders during the last year, within which time the shares have declined from about $40 to about $12. The reason for this decline was the series of bad monthly reports, showing that the ore was assaying only about $1.17 per ton instead of the $1.75 that was expected. The explanations of Mr. Hayden and Mr. Jackling respecting this were that ore was being taken from lean parts of the mine, that the mine had not been sufficiently developed to furnish the immense tonnage of average grade that was planned, that the mine workings would soon be in the better ore and the monthly averages would increase. Mr. Jackling has reiterated repeatedly assurances that conditions and prospects were just as he had affirmed in his annual reports. We fear that neither Mr. Hayden nor Mr. Jackling have been quite frank in their statements about the developments in this property since its big mill was put in operation. The most generous interpretation of their attitude is that, while they may have had misgivings, they could not feel sure that their fears were correct and hoped that they were not.

In his last statement, wherein he frankly confesses disappointment, Mr. Hayden offers a rather confused explanation and, owing to his lack of clarity, lets a worse impression be formed than probably he intended or ought to be. He gives the idea of saying, "Well, we've had a good run for our money and we'd do the same thing again," which is not at all what he meant to say, we fancy. What he meant to say, or might have said, is: "We have misunderstood our mine and have got to alter our method of mining, which is going to result in some delay and some loss of work that has already been done in opening the mine."

Readers of the *Journal* will remember our previous remarks respecting the difference of opinion between the Alaska Juneau and Alaska Gastineau (Alaska Gold Mines Co.) managements with regard to the mining of the Juneau lode and the ways in which they were going about it. The Juneau lode (which we thus refer to for convenience rather than for accuracy) is not uniformly mineralized, but contains portions that are payable interspersed with portions that are barren. The payable portions are of such immense size that they are capable of mining by the most economical methods. Mr. Bradley, who was the pioneer in the district and acquired for the Alaska Juneau company what was regarded as the best part of the lode, had always a clear perception of this and laid out his mine for what may be called selective bulk mining, designing to leave the barren portions of the lode unmoved and obtaining a relatively fair grade of ore by selection. Mr. Jackling came into the district later and, inspired by the idea of doing things on the hugest scale, determined to remove the whole lode, from wall to wall. Even so he thought it would average $1.75 per ton. However, in the mining of about 1,200,000 tons this year, the average has been only $1.17 per ton. Apparently it is now recognized that a mistake was made and that it is necessary to shift to the Alaska Juneau system of mining. This, however, is going to take some time, and in the meanwhile a large quantity of ore already broken and lying in the stopes of the old system must be run through the mill.

As to the loss to the Alaska Gold Mines Co., this is chiefly the loss of time in bringing the enterprise to the profitable stage and the expense of breaking some 3,000,000 tons of ore that is not going to yield what was expected. When plans are revised, the company probably hopes to be able to mine ore of the grade reckoned and make the expected profit from it. The mine will not be found to have so much gold ore in it as was estimated, but the tonnage is probably so great that this will make no great difference in the calculations. Instead of there being 75,000,000 tons averaging $1.75, there may be that amount averaging about $1.20, or about 50,000,000 tons averaging $1.75. We do not know respecting the latter figures but suggest them merely as being illustrative.

Alaska Gastineau is a disappointment to its promoters and managers in the sense that they have found that they cannot break down all the ore from wall to wall—a width of hundreds of feet—and mill it at so much profit as they estimated; and it is a disappointment in the sense that they have found themselves mistaken in thinking that they could do so. This, however, is far from pronouncing the enterprise a failure—an enterprise in which about $10,500,000 has been expended, including about $3,000,000 for the purchase of the property. Its mining experience is simply what the Alaska Juneau engineers have been foreseeing.

American Investments in Russia

Not only are American bankers and manufacturers becoming interested in Russia, but also are American mining syndicates turning their eyes thither. Investigations of the mineral resources of the Siberian part of Russia are already being undertaken by some of the most important of American mining concerns.

Without any doubt, one of the results of the present world-wide upheaval is going to be a great extension of American interests abroad. In South America, American exploitation will be more important than ever. A great American enterprise in the development of gold mines in the Witwatersrand of South Africa has been under consideration. But more than anywhere, we anticipate, will there be American interests in Russia—a great undeveloped country which in all likelihood will emerge from the great war in a condition somewhat similar to what there was in the United States at the termination of the Civil War.

BY THE WAY

In commenting on the Bowena Copper Co. one of our leading financial papers remarks: "We are willing to become as enthusiastic as the projectors when the Bowena people dig tunnels, shafts, bunkers and concentrators." There is a well known saying about the blind leading the blind.

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Just before the Clifton-Morenci strike was called, a mucker went to his foreman at one of the copper properties in that district and said he would like to quit and desired "his time." The foreman looked at him with that "grouch" which is characteristic of all foremen, and said, "All right, but I knew you would not stay when I put you to work." The mucker had only been on that job 24 years and 7 months.

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The Boston *News Bureau* in attempting to answer "a general call for a clear statement of the lesson from Alaska Gold," offers the following: "Gold is never found deposited on the same lines as the lower metals, silver, copper, lead or iron. Gold is elusive and is most often deposited in gyrations or spiral forms not easily followed in large mining operations. Even where deposited in veins or blanket formations, the gold areas in the rock are in chutes not easily discernible except by careful analysis." These ideas will be interesting to mining engineers and geologists.

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An electric haulage system had been newly installed in the mine, and "the boys" were very much loath to accept the new order of things. The common trouble of current leakage had been experienced at first, especially in wet ground, and at the end of a week's work a number of the turbulent Irish miners were in a state of mind ready for anything. Malony had just received another minor shock from a wet tunnel wall and was organizing an expedition of protest to visit the office, when the manager himself appeared on the scene. Everyone talked at once, and the manager at first failed to discover the cause of the row. On finally securing a momentary silence while Malony luridly phrased the complaint, the manager caught the drift of his remarks and explained that the current leakage was already being remedied. Malony then consulted with his supporters and, returning to the manager, dramatically pointed to the glistening new copper trolley wire overhead and declared the verdict: "Begobs the b'ys sez to h—l wit' the job if yez don't paint that wire black."

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The American members of the joint commission to undertake settlement of differences between the United States and Mexico are Franklin K. Lane, Secretary of the Interior; Judge George Gray, of Wilmington, Del.; and Dr. John R. Mott, of New York City. The commission will, it is expected, hold its sessions at a New Jersey coast resort. The time and place of the meeting will be arranged by Secretary Lansing and Eliseo Arredondo, the Mexican Ambassador Designate. Probably the first problem taken up by the joint commission will be the proposed withdrawal of American troops from Mexico. As General Funston has recommended the recall of General Pershing's expedition, this is expected to be agreed to by the American members. Dr. John R. Mott, who is a close friend of President Wilson, is international secretary of the Young Men's Christian Association. He went to London in October, 1914, with the object, it was said, of bringing about peace through religious influence. He has been described as "a one-idea man," the idea being "the evangelization of the world in one generation."

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The doctrines of union labor are exemplified by some recent publications. The railway brotherhoods say: "Give us what we demand, or we will strike and paralyze the industries of the United States." When it was argued that the railway business of the country would not stand what they wanted, the brotherhoods published a statement, saying: "Don't kill the goose that lays the golden egg. Every day or so this old bromide is handed the railroad men. Railroad employees, who demand a workday that will give them some hope of expanding their working days and keep them a year or so longer away from the dead line and the bread line, are admonished 'Not to kill the goose.' We are accused of making a raid on the 'goosery,' and the bosses are warning not to kill off the goose nor even disturb her, for the goose is in a delicate way, and possibilities for excessive wear and tear on the goose-egg factory may mean ill health for the goose and rather than upset the even trend of things we'd better not insist upon another egg right now. This is old stuff; it used to be good stuff, but it is not good stuff any more. We have been feeding this goose until it has become some goose; where it has not been squeezed too much, it is a healthy goose, so there is not much alarm over its general health. It is also a fat goose, and viewing all the phases of the situation, railroad men believe the admonition 'not to kill the goose' means keep on feeding the goose ten hours a day and let the bosses gather the eggs, which may not hold to the high-pressure average if the goose is fed eight hours a day. For the sake of the health of the goose the men will take a chance on dieting the invalid on eight hours high-pressure feed. Anyhow, this goose business ought to be on a fifty-fifty basis so that one side of the house will not be all goose, and the other all 'goosed.'" The I. W. W. people are more advanced than the brotherhoods. They are now creating trouble at Broken Hill, N. S. W. According to the South Australian press these familiar and typical notices of the I. W. W. are posted at the mines there. "Don't scab upon the unemployed by working hard. Slow work means more jobs. More jobs means less unemployed, and less competition means higher wages. Less work—more pay. Slow down! Slow down! Don't be a slave. Be a man and join the I. W. W. How to make your job easier. Get wise to I. W. W. tactics. Don't be a pacemaker. Someone has to be the slowest. Let it be you. Join the one big union. Don't be a boss' man by trying to do more work than the other man. Fast workers die young. Live a long life. Join the Industrial Workers of the World, the Fighting Union."

PERSONALS

A. A. Jones, recently in Chosen, is now in London.

T. C. Hsi, lately in New York, has gone to Shanghai, China.

John Frank, lately at Jacksonville, Ill., has gone to Mayer, Ariz.

Don C. Billick has gone from Basin, Mont., to Alturas, Calif.

C. C. Smith, lately at Anaconda, Mont., is now at Cambridge, Mass.

S. A. Walker has gone to Leadville, Colo., from Rye Valley, Oregon.

A. J. McNab is at Fredericktown, Mo. He was recently in Nevada.

J. H. East, Jr., lately at Mammoth, Calif., is now at Hibbing, Minn.

Edwin W. Klumph has gone from Houghton, Mich., to Butte, Mont.

August H. Chatin, recently at Butte, Mont., has gone to Walsenburg, Colo.

Malcolm W. Clark is now at Billings, Mont. He was recently in Mexico.

J. A. Reid is now at the O'Brien Mine, Cobalt, Ont. He was recently at Toronto.

P. B. McDonald has left the editorial staff of the "Mining and Scientific Press."

A. E. Drucker has discontinued his practice in London, England, and is now in New York.

R. B. Brinsmade, of St. Louis, spent August in mine examinations in the State of Washington.

Wm. F. Jahn is now at the Tough Oakes Mines, Kirkland Lake, Ont. He was recently in Montana.

W. H. Rule has gone from Cornwall, England, to the Prestea Block A, Ltd., Gold Coast, West Africa.

John Gross, mining engineer, of Denver, Colo., has moved his offices from No. 523 to No. 423 McPhee Building.

Roy S. Bonsit, recently at Low Moor, Va., is now with the United States Metals Refining Co., at East Chicago.

George B. Holderer, recently manager of the Furlough Development Co. in Arizona, is now with the General Chemical Co., 25 Broad St., New York.

W. L. Hayes has been appointed manager of the wire mills of the American Steel and Wire Co. in the Chicago district in place of F. C. Gedge, deceased.

August Mann, manager of the Farrell Works of the American Steel and Wire Co., near Sharon, Penn., has been made manager of the plant of the United States Steel Corporation at Donora.

Thomas M. Skinner, Jr., has resigned as superintendent of Mid Continent Chemical Co., Sand Springs, Okla., to accept the position of assistant manager of Potash Products Co., Alliance, Neb.

W. S. Stothoff has been appointed general superintendent of Wm. Wharton, Jr., & Co., Inc., Easton, Penn., and the Tioga Steel and Iron Co., Philadelphia, in charge of plants and manufacturing.

E. W. Widdowson, provincial chemist and assayer, Nelson, B. C., gives notice that he is still in charge of his office, his application to enlist having been rejected, as he was unable to fill all the requirements.

W. Earl Greenough has resigned as managing director of the Marsh Mines Consolidated, Wallace, Ida., and will take up independent practice as consulting mining engineer, with headquarters at Spokane, Wash.

Ivan P. Tashof has resigned as instructor in mining and metallurgy at the College of Mines and Metallurgy of the University of Kentucky, and purposes to enter the practice of patent law with Byrnes, Townsend & Brickenstein, of Washington.

Hon. Dr. Roche, Canadian Minister of the Interior, has returned to Ottawa from a trip to the Yukon. He reports all the big mining plants busy and the output of gold well maintained. The war has greatly stimulated the copper industry and large shipments of ore are being made to British Columbia smelters.

Dr. Willet G. Miller, of the Ontario Nickel Commission, and **T. F. Sutherland,** chief inspector of mines for Ontario, who have been investigating the nickel industry of New Caledonia, sailed from Sydney, Australia, Aug. 31, on their return voyage. **George T. Holloway,** of London, England, chairman of the Nickel Commission, is expected in Toronto early this month.

OBITUARY

Alexander Fraser, metallurgist at the plant of the Compañia Minera de Augustias, Pozos, Guanajuato, Mexico, was killed on July 31 by revolutionists under Nateras. Fraser had been 20 years in Mexico. He was 48 years of age, and leaves a wife and two children in London.

John Hart Wilson, of Pittsburgh, died at Atlantic City, N. J., Sept. 2. He was for many years in business in Pittsburgh and was a director of the Union National Bank. He was interested in several mining enterprises. He was president of the Hidalgo Silver Mine Co., at Parral, Mexico, and was vice-president of the Parral & Durango Railroad Co. of Mexico. He was a member of many fraternal organizations.

SOCIETIES

American Electrochemical Society—The 30th semi-annual convention of this society, whose membership includes many well known electrochemists, will be held at New York, Sept. 27 to 30, at the time of the Exposition of Chemical Industries.

Society for Electrical Development—Arthur H. Halloran, vice-president and managing editor, "Journal of Electricity, Power and Gas," has been appointed Pacific Coast representative of the society. Mr. Halloran's headquarters will be in the Crossley Building, San Francisco. Mr. Halloran will represent the society in the States of California, Arizona, Nevada, Utah, Idaho, Oregon and Washington.

Iron and Steel Electrical Engineers—Central station power for steel mills, the operation of the Heroult electric furnace, the electric reversing blooming mill and portable electric tools in the iron and steel industry are among the subjects to be discussed at the annual meeting of the Association of Iron and Steel Electrical Engineers, to be held at the Hotel La Salle, Chicago, Sept. 18 to 22, inclusive. Following a business session on Sept. 18, there are to be afternoon and morning technical sessions and plant visitations, and many papers will be read.

Minnesota Joint Engineering Board—The engineers of Minnesota believe that through the coöperation of the various engineering societies that they can be more useful to their communities, and are attempting to bring about closer coöperation through the formation of the Minnesota Joint Engineering Board. The constituent societies represented on the Board are the Northwestern Association of the members of the American Society of Civil Engineers; Minnesota Section of the American Society of Mechanical Engineers; the Minnesota Section of the American Institute of Electrical Engineers; the Minnesota Surveyors' and Engineers' Society; the Engineers' Club of Minneapolis, and the Civil Engineers' Society of St. Paul. It is hoped that through this central organization the activities of the engineers of Minnesota may be more closely correlated and more accomplished for the public welfare. Geo. W. Rathjens, of St. Paul, is the secretary of the Board.

Spokane Mining Men's Club is organizing a four-days' excursion into the Nelson and Slocan districts of British Columbia, and the expedition will probably leave Spokane in a special Pullman train the night of Sept. 29, according to tentative plans that have been outlined by Secretary Frank C. Bailey; the return trip will be made the night of Oct. 2. The program provides for a joint meeting at Nelson of the Spokane and Nelson Mining Men's clubs, and it is hoped that a session of the Canadian Institute of Mining Engineers and the Columbia Section, American Institute of Mining Engineers, can be arranged at the same time, as many of the Spokane and British Columbia mining men are members of all four organizations. The special Spokane train will transport the excursionists to Kootenay Landing, on Kootenay Lake, where a special Canadian Pacific boat will be waiting to take them on to Nelson, and from the latter point special boats and trains will convey the party to the different mines that are to be visited, including those in the Sheep Creek, Ainsworth, Kaslo and Slocan districts.

Colorado Metal Mining Association has decided to continue its committee on legislation, which will carry on negotiations with the smelting companies in the interests of the mine operators and miners of Colorado. At the last meeting of the association the committee submitted the following report: "Resolved that the subject covered by the resolution adopted by the Colorado Metal Mining Association at its last annual meeting, proposing by legislation to place the smelters operating in the State of Colorado under the control of the public utilities commission, contemplates such a radical change, that your committee feels it should be continued and given time and power first to properly present the grievances of the members of the association and the miners of the State of Colorado, to the officers of the smelting companies, and obtain their answers, before your association uses its united strength toward the enactment of any constitutional amendment, or other legislation to this end." The committee on the multiplicity of corporation statements required under state laws, of which George C. Manley is chairman, was continued with power to consult with the Colorado survey committee appointed by Governor Carlson and suggest the enactment of a law by the next legislature which would enable all statements to be made in one report. The committee on taxation was continued and authorized to confer with a committee appointed by the Colorado Tax Commission for the purpose of reaching an agreement upon the proper taxation of ore-producing mines. The committee on revision of the federal mining laws, through its chairman, George E. Collins, reported that the adoption of the bill now before Congress would "leave the mining laws in a far worse condition than at present."

TRADE CATALOGS

Leyner Drill Sharpener. Ingersoll-Rand Co., 11 Broadway, New York. Pp. 24; 6x9 in.; illustrated.

Agitation, Thickening and Filtration Apparatus. H. R. Conklin, Joplin, Mo. Catalog. Pp. 12; 6x9 in. Illustrated.

Eureka Cyaniding-Precipitating Machine. Eureka Agency, 1531 18th St., Denver, Colo. Bulletin. Pp. 8; 6x9 in. Illustrated.

Chemical Balances and Weights, Hydrometers, Etc. L. Oertling, Turnmill St., London, E. C., England. Catalog; pp. 40; 8x10½ in.; illustrated.

Combination Gas and Oil-Burning Equipment for Industrial Heating. Tate, Jones & Co., Pittsburgh, Penn. Circular No. 155; pp. 8; 8½x11 in.; illustrated.

Steam Condensing Plants. Ingersoll-Rand Co., 11 Broadway, New York. Form No. 9024; pp. 32; 6x9 in. This bulletin describes the Beyer barometric type condensers.

Air Compressors. Ingersoll-Rand Co., 11 Broadway, New York. Form No. 3033; pp 28; 6x9 in. Imperial Type "XPV" duplex steam-driven compressors are described in this bulletin.

Electric Locomotives. The Jeffrey Manufacturing Co., Columbus, Ohio. Bulletin No. 115; pp. 4; 6x9 in. This bulletin is devoted especially to electric locomotives for smelting plants.

Electric Portable Tools. Chicago Pneumatic Tool Co., Chicago, Ill. Bulletin E-41; pp. 8; 6x9 in. This illustrates and describes the Duntley electric tools for street and interurban railways.

Electric Hoists. Sprague Electric Works, 527 W. 34th St., New York. Bulletin No. 48906. Pp. 32. 8x10½ in.

This illustrates and describes Type S-1, one-half ton and one-ton hoists.

Portable Conveyors. The Jeffrey Manufacturing Co., 974 North Fourth St., Columbus, Ohio. Bulletin No. 184; pp. 10; 6x9 in. This illustrates and describes conveyors for handling barrels, boxes, packages, bags, etc.

Refractories. Norton Co., Worcester, Mass. Catalog. Pp. 54; 5x8 in. This is the 1916 edition which is a complete revision of the old edition showing many new shapes of refractories and filtering apparatus.

Leadville Drill Column Hoist. The Hendrie & Bolthoff Manufacturing & Supply Co. Denver, Colo. Bulletin. Pp. 16; 6x9 in. Illustrated. This contains description of a new hoist known as the "Super-Leadville."

"National" Matheson Joint Pipe. National Tube Co., Pittsburgh, Penn. Pamphlet. Pp. 72. 8x10 in.

This is the third edition of this pamphlet, enlarged and revised and contains good illustrations of installations.

"Concrete Swimming and Wading Pools" is the title of a new publication of the Portland Cement Association, 111 West Washington St., Chicago. It describes the construction of simple pools, and may be obtained without charge upon request.

Boiler Tube Cleaners. The Lagonda Manufacturing Co., Springfield, Ohio. Catalog L-9. Pp. 36. 8x10 in. This illustrates and describes the different types of boiler cleaners and other specialties made by this company, including reseating machine, strainers, filter and grease extractor, etc.

Iron Cements, Paints, Etc. Smooth-On Manufacturing Co., 570-574 Communipaw Ave., Jersey City, N. J. Smooth-On Instruction Book No. 16; pp. 144; 4½x6½ in. This contains many new examples and illustrations showing the working of the different Smooth-On iron cements and ought to be useful to mining engineers.

Poppet Valve Engines. Nordberg Manufacturing Co., Milwaukee, Wis. Bulletin No. 28. Pp. 36; 8x10½ in. This describes three types, namely, full poppet, poppet-uniflow and poppet-corliss and tells which engine is best suited to plant conditions. Tables of tests and illustrations showing details of construction are included.

"Productos de la Ingersoll-Rand." Ingersoll-Rand Co., 11 Broadway, New York. This is a 124-page catalog printed in Spanish covering complete line of air and gas compressors, pumps, rock drilling, metal and coal mining, prospecting and quarrying machinery, pneumatic tools for machine, boiler shop and foundry work.

Insuluminum. Diamond Power Specialty Co., Detroit, Mich. Bulletin 118. Pp. 8; 7½x10½ in. This bulletin contains a number of photo-micrographs and describes the properties of this metal, which is a recent product of the General Electric Co.'s laboratories and which has very high heat resisting qualities. Application of this metal to the Diamond Mechanical Soot Blower System is also shown.

INDUSTRIAL NEWS

Morse Bros. Machinery and Supply Co., of Denver, has purchased the crushers, rolls, roasters and cyanide equipment of the Lord Byron mill at Sugar Loaf, Colo., and shipped them to Denver for resale.

The Crocker-Wheeler Co., Ampere, N. J., announces that its San Francisco district office, Mr. W. K. Brown district manager, has been removed from the Crossley Building, 619 Mission St., to the ground floor of 87 New Montgomery St.

Penn Development Co., 836 Real Estate Trust Building, Philadelphia, Penn., has been organized for the purpose of developing and financing mines and prospects and industrial enterprises. Propositions will be considered and examined.

Chemical Products Co., Washington, D. C., has recently started its new tungsten plant at Anacostia, D. C. The principal product is a ferro-tungsten powder higher in tungsten than ordinary ferro-tungsten and exceptionally low in carbon, sulphur and phosphorus. A typical analysis is 87.7% W, 0.11 C, 0.46 S and 0.022 P. Various tungsten alloys will be made later.

Morse Chain Co., Ithaca, N. Y., has lately increased its capital stock from $400,000 to $1,500,000 for expansive purposes in the form of new buildings and additions to old ones already under way. When these buildings are completed, the company will have a total floor space of approximately 7 acres, all of which will be devoted exclusively to the manufacture of Morse rocker-joint power transmission.

Nordberg Manufacturing Co., Milwaukee, Wis., has received orders for steam hoists for the Davis-Daly Copper Co.; two air hoists for the Anaconda Copper Mining Co.; electric hoists for the Elm Orlu Mining Co. and Butte & Superior Co.; two for Utah Apex Mining Co., and for St. Louis Smelting and Refining Co. and Phelps, Dodge & Co.; Globe and Nacozari; Federal Mining & Smelting Co.; Hercules Mining Co.; Cerro de Pasco Mining Co. and Furukawa Ashio Mining Co., Japan. The company also states that it is now building a number of Nordberg-Carels Diesel Engines for various mining companies in the West and Southwest.

Westinghouse Electric and Manufacturing Co. has received the order for the electrical equipment for the new mill of the Alaska Juneau Gold Mining Co., at Juneau, Alaska. The order covers an electrical apparatus for the mill and two substations, among which may be mentioned two 300-kw. rotary converters with transformers; two 18-ton tandem locomotives; two 400-hp., thirteen 225-hp., and thirteen 150-hp. induction motors; two 350-hp. synchronous motors and exciters; two 300-k.-va. synchronous motors; 15 smaller motors; one 100-kw. motor-generator set and a 17-panel switchboard.

Editorial Correspondence

SAN FRANCISCO—Aug. 30

Mother Lode Gold-Mine Owners of eleven properties in Amador County will post notices on Sept. 2 regarding a contemplated wage demand of employees. The owners declare that they will close the mines rather than increase present wages. The announcement follows. "It has come to our notice that some of the workmen in our employ contemplate demanding in the near future a material increase in wages and shortening of the hours of labor, and much as we regret it, we feel obliged to state firmly and positively that should such demands be made they will be refused, and if then insisted upon, we shall be obliged to close our mines indefinitely. Our reason for this stand is as follows: We recently made a voluntary increase in the wages of our employees, because we thought they were fairly entitled to such increase. While it is true that, because of the higher price obtained for their product, the copper mines in California are paying higher wages than are paid in Amador County, this constitutes no reason for an advance in the wages of gold miners. We are receiving no more for our product than at any other time, and on the other hand are burdened by a much greater expense for all classes of supplies; and, beside which, on the Mother Lode the average grade of the ore is low and the industry is generally conducted on a narrow margin of profit; for while a mine is sometimes profitable for a few months it may be operated at a loss at other times. We have shown our willingness to act fairly in the matter by dividing with our employees the burden due to a higher cost of living and feel that we have already done all that the state of the industry will stand." This announcement has been signed by the Argonaut Mining Co., Bunker Hill Consolidated Mining Co., Central Eureka Mining Co., Consolidated Amador Mining Co., Fremont Consolidated Mining Co., Kennedy Mining and Milling Co., Keystone Mines, Original Amador Consolidated Mines Co., Plymouth Consolidated Gold Mines, Ltd., South Eureka Mining Co. and Treasure Mining Co. [Later. Dispatch from Jackson, Calif., Sept. 5, states that secretary of miners' union announces report of contemplated strike entirely unfounded. No action contemplated by union.]

BUTTE—Aug. 31

Anaconda's Expansion continues. With the recent acquisition of the Walker copper mine in Plumas County, Calif., another state is added to those in which the Anaconda Copper Mining Co.'s ramified interests are active. Montana, of course, comes first containing as it does, the company's large copper and zinc mines, the enormous reduction works at Anaconda and Great Falls, the Butte, Anaconda & Pacific Ry. connecting Butte with Anaconda, extensive coal mines and large tracts of timber lands that supply its mines with the necessary lumber. Outside of Montana the company has an option on the Douglas zinc-lead property in the Cœur d'Alene district in Idaho. In Utah it owns and operates the International custom smeltery at Tooele. In Wyoming various coal mines. In Arizona it owns the new custom smeltery at Miami and control of the Inspiration mines at the same place. In Mexico it holds a stock interest in Greene-Cananea. In the East Chicago district the company owns the International lead refinery and at Perth Amboy, N. J., the Raritan copper refinery. In South America the company's subsidiary, the Andes Exploration Co., is developing a large disseminated deposit at Potrerillos, Chile, back from Chañaral. Anaconda also owns the United Metals Selling Co. in New York which markets about 600,000,000 lb. of copper per annum.

DENVER—Aug. 30

Fatalities in Mines, Mills and Smelteries of the state through accident have decreased 40% during the year ended July 31, according to figures compiled by M. B. Tomblin, deputy commissioner of mines. He ascribes the betterment directly to rigid enforcement of laws and rules regarding safety.

Abstention from Politics is to be the rule for employees and officials of the Colorado Fuel and Iron Co. Recently the board of directors published a statement that all employees and officials must keep absolutely out of "politics." The company will brook no interference with the political privileges of any of its men.

Cresson Consolidated in the Cripple Creek district is a common topic for discussion among mining-stock speculators. Brokers are carrying large "display ads" advising purchase of this stock and promise monthly dividends of from 8% to 10%. Par value of the stock is $1 but it is not offered at less than $5.10. Officials state that there is blocked ore to the value of $5,000,000. The dividend rate was one of the matters to be decided at a meeting of directors, Aug. 28.

Geologic Field Work Northwest of Twin Lakes, along the continental divide, has just been completed by J. V. Howell who has been in this region all summer, under the auspices of the Colorado Geological Survey, and will shortly prepare his report. His primary object was to discover sedimentary rocks in this region, none having heretofore been reported, and he succeeded to the extent of finding a considerable mass of blue limestone apparently entangled in a flow-mass of rhyolite. During the coming year, Mr. Howell will be connected with the geological staff of the Standard Oil Co., with duties probably in the mid-west.

Tungsten Legislation is to be presented to the next Congress. The Colorado Metal Miners' Association, through its president, Bulkeley Wells, has appointed the following prominent tungsten operators a committee to formulate proposed legislation relative to the protection of the American tungsten-mining industry: Harold Boericke of the Primos Mining Co.; Robert W. Kerry, of the Rare Metals Ore Co.; J. A. McKenna, of the Vasco Mining Co.; William Loach of the Wolf Tongue Mining Co.; and J. G. Clark of the Boulder Tungsten Production Co. Despite the depression in the tungsten market, development of mines and the equipment of new milling plants for concentration of tungsten ores continues in Boulder County. The Intermountain Tungsten Milling Co. is remodelling an old gold mill at Salina; while the Tungsten Mountain Mines Co., a concern closely allied with the Boulder Tungsten Production Co. and managed by "Jack" Clark, has been re-financed and will renew the work of driving a deep crosscut adit.

LEADVILLE—Aug. 31

The Robinson-Kokomo District in Summit County is in the midst of the greatest boom of recent years, as a result of the activity of the Progress Mining and Milling Co. The Progress company has taken over the old Wilson mill and a number of the large mines of the section. The mill has been entirely remodeled and is now equipped with a modern flotation process for the better separation of the lead-zinc ores of that locality. Ore is purchased from all mines in the district, offering a ready market for ores that for some time could not be handled profitably. It is stated that there are now fourteen mines operating in the district where a year ago there were but three or four. The most important ore discovery that has been made in the Robinson section in several years is the uncovering of rich gold-silver-lead ore in the old Columbine property. A 3-ft. vein has given assays as high as 4 oz. gold, 786 oz. silver and 10% lead. The finding of the ore was accidental. Men were employed digging a drain in the stope bottom and picked into the ore. Two shipments have been made by the Leadville men, who are operating the property.

Drainage has been the feature of this year's mining in Leadville. The draining of the Down Town basin is now complete. The big station pump and 650-hp. motor have been installed at the bottom level. Water column has been connected with the pump which is now throwing 2,000 gal. per min. to surface against a head of 870 ft. One sinking pump continues to operate in connection with the relief pumps at the 450-ft. level as the total flow in the property ranges from 2,500 to 2,800 gal. Mining is being undertaken throughout a large section of the property and hoisting is being done through two compartments. Surface rights around the Penrose have been purchased by the company for dump room. This territory was for the greater part occupied by residences which are being moved to other locations. At the Harvard shaft, Manager H. S. Lee is now lowering the water rapidly, after having reduced the flow to 300 or 500 gal. per min. by fluming the gulch water past the property. Preparations are being made to drain the Greenback mine, owned by Patrick Mulrooney. A Layne-Bowler centrifugal pump of 1,000 gal. capacity has been ordered for the unwatering. It will be driven by a 150-hp. motor now installed at the 900-ft. level. The shaft has been retimbered from surface to the 900 level and the station at that point has been enlarged for the reception of the motor. A large steam-pumping plant is installed at the 900-ft. station and will be used as a relief plant. The Greenback is the deepest shaft in this section, having been sunk to 1,350 ft. The draining of the Greenback is looked upon as one of the most important developments in the unprecedented mining revival that has prevailed throughout the past six months, as it means that the Leadville district is to be explored at great depth.

SALT LAKE CITY—Aug. 31

Increased Smelting Capacity is to be provided both at the Garfield and the Murray plants of the American Smelting and Refining Co. The increase to be made at the lead smeltery at Murray will include the enlargement of the furnaces and a new stack, 450 ft. high. This stack will be the second highest in the world. There has been an unusual congestion of ores at the Valley smelteries as the result of increased production induced by high metal prices, and the increased capacity will make possible larger shipments from mines that have lately been obliged to curtail their output.

Physical Property of Ohio Copper Co. was bid in for $750,000 by E. H. Sykes, of Sullivan & Cromwell, New York, counsel for the bondholders, at public sale taking place Aug. 30, following the order of Judge M. L. Ritchie of the district court denying the motion of persons seeking to intervene and postpone sale. Mr. Sykes made an initial bid of $500,000 for the property, against which there is a judgment of over $1,500,000. There were no other bidders, and to make the sale legal, a second bid for $750,000 was entered; and the property acquired. The bonds of $650,000 will be applied on the judgment of $1,500,000. Immediately after the sale a bill in equity, asking for the setting aside of the sale and the judgment in the foreclosure suit, was filed in Judge Ritchie's court. S. A. Maginnis, of counsel for the stockholders, who sought to prevent sale, said that the case would undoubtedly be carried to higher courts.

Transportation of Ores in Big Cottonwood Cañon by means of tractor trains has thus far proved unsatisfactory, and teams are again being introduced. A short time ago, through the coöperation of the mining companies with city and county, the cañon road was put in order, and hauling by tractors started, the object being to protect from contamination city water coming from the cañon. The Mines Transportation Co.—organized to haul ores from the Cardiff and Maxfield mines—having been unable, owing to the steep grade, to put on a sufficient number of trailers to make operation profitable, has made an assignment; and the mines are left with the problem of bringing their ores to market. Following a notice from the city water department, the Cardiff company informed a joint meeting of the city and county commission that, inasmuch as the city and county had failed to carry out their part of the agreement, the road not being in such condition as to permit the successful use of traction trains, the mining companies were not legally bound to observe their part of the contract requiring the exclusive use of tractors, and that they were proceeding to use horses, and would continue to do so, unless the teams could be successfully replaced by motor trucks. It was stated that the road could not be put in condition for the successful use of traction trains for less than $50,000 in excess of the $30,000 contributed by the city and county, and the mining companies jointly. Further procedure in the matter will be held in abeyance, pending a thorough examination by city and county physicians of sanitary conditions in the cañon.

SPOKANE, WASH.—Aug. 30

Marketing Department of Bunker Hill Smeltery is to be established at San Francisco under the direction of Myron A. Folsom, who has been widely known in the Northwest as a mining lawyer and for the last 17 years counsel for the company in the Coeur d'Alene region. Mr. Folsom will remove about Oct. 1 to San Francisco, where he will continue to handle the legal business of the company in addition to the work of the new department. It was largely through Mr. Folsom's efforts that the site at Kellogg, Idaho, was selected for the company's new smelting plant. He was commissioned by President F. W. Bradley to overcome the transportation difficulties and in this connection solved various other problems that were factors in the determination of the smelting-plant site, so that the works now under construction at Kellogg are a testimonial to his exceptional combination of business and professional ability, and his selection as head of the commercial and legal department the recognition of that talent.

The Day Interests, the controlling factors in the Northport Smelting and Refining Co., are extending their mining activities. Their principal interests in the Coeur d'Alene district include Hercules, the Ray-Jefferson and the Tamarack & Custer. Announcement is now made in the "Daily Press-Times," the Day organ at Wallace, Idaho, of their entrance into the Republic mining district in Ferry County, Washington, through the purchase of control of the Republic Consolidated Mines Co. holdings. These include the Lone Pine, Surprise and Pearl gold mines that had been considerably developed by the original company, the Republic Mines Corporation, which went into the hands of a receiver about three years ago. It is assumed that the ores are wanted for fluxing purposes at the Northport smeltery. The entrance of the Day interests into the Republic district is expected to result in further activities from other outsiders, as well as to stimulate some of the local interests of the camp.

JOPLIN—Sept. 2

No Concerted Shutdown of Mines was the decision reached by representative mine operators of the district at a recent meeting. With representatives from most of the camps, the proposition of shutting down, until the surplus ore now held in bins is taken up, was discussed from various angles and it was decided in the end that there would be no attempt to bring about a concerted shutdown. A number of individual operators, however, announced their intention of closing down.

The Purchase of the Franklin Mine for $50,000 by Lown & Hastings, of Duenweg, was one of the interesting events of the week. This is a sheet-ground property in the Duenweg section of the district but the mine has been in the hands of a trustee in bankruptcy for some time. The purchasers are experienced in the Duenweg field, having developed the Baltic mine, which they sold two years ago for $125,000.

Abandonment of Miners' Clinic now confronts the dispensary established by mine operators of this district at Webb City about three months ago. Dr. D. R. Hill, of Joplin, who has been connected with the dispensary since it started has resigned, and no one has been named to take his place. It is likely that the poor ore market will mean the abandonment of the plan to keep a physician at the dispensary daily, though a visiting nurse will be employed as before. The whole dispensary idea was the result of investigations by Dr. A. J. Lanza, of the Public-Health Service, and a report of his findings to the Southwest Missouri Mine Safety and Sanitation Association.

ISHPEMING, MICH.—Sept. 1

The Large Output of Iron Ore is exceeding the capacity of the boats to carry the product of the mines, although iron ore is moving to the docks at lower Lake ports at an unprecedented rate. Though numerous stockpiles are being cleaned up, there will be plenty of ore in stock on the Michigan ranges when navigation closes for the season. One operator stated the other day that his company had disposed of about 3,250,000 tons for 1916 delivery, but the ore in stock and the amount coming from the shafts would be considerable more than had been sold. More ore could have been disposed of if boats could have been secured to take the cargoes. This company has a large fleet of its own. The Steel Corporation early last fall chartered a lot of boats for this year and other years to come before the independents were aware of what was going on. It seems certain that there will be an increase in Lake freight rates next year, as the demand promises to be greater than ever. The mining men are also looking for an advance in iron-ore prices, as the increase for this year was not in proportion to the advances in pig iron. The prices for 1917 delivery will probably be made early, as will also the boat rates.

DULUTH, MINN.—Sept. 1

In the Strike District on the Mesabi Range the only important development this week, was the indictment of eight men for the murder of Deputy Sheriff James Myron, of Duluth, who lost his life when he went to serve warrants on several strikers in Biwabik. Five of those held are strikers. The other three are agitators who are held for inciting the strikers to commit acts of violence. The trial will start soon at Virginia. William D. Haywood, head of the Industrial Workers of the World, has been appealed to by the strike leaders to start a movement for a national strike, in the hope that a sympathetic strike will aid the cause of the men who are held for murder.

Ore Shipments for August from the head of the lakes were as follows: Over Duluth, Missabe & Northern, 3,380,066 tons; Duluth & Iron Range, 1,534,314; Great Northern, 1,694,899; Soo Line, 190,577; Northern Pacific, 64,870; total, 7,864,726 tons. The above includes only the shipments from Duluth, Two Harbors and Superior, and does not take into consideration the shipments from Ashland, Marquette and Escanaba. It is thought that the total movement for the month will be in excess of 10,000,000 tons.

The Mining News

ALASKA

ALASKA MEXICAN (Treadwell)—In July, mill ran 23.2 days crushing 14,385 tons, yielding $18,930 or $1.33 per ton; operating expense $22,094; operating loss $3,164; construction expense $2,424; net operating loss $5,588; other income $3,730.

ALASKA TREADWELL (Treadwell)—Crushed in July 77,721 tons yielding $155,890 or $2.03 per ton; operating expense $98,727; operating profit $57,163; construction expense, $12,326; net operating profit, $44,856; other income, $11,281.

ALASKA UNITED (Treadwell)—In July, crushed in Ready Bullion mill 23,660 tons and in 700-ft. Claim mill 21,350 tons, yielding $49,716 or $2.12 per ton and $23,595 or $1.12 per ton; operating expense $31,823 and $45,621; other income, $3,730. Ready Bullion operating profit $17,893, construction expense, $4,489, net operating profit $13,403; 700-Ft. Claim operating loss, $22,026, construction expense $6,848, net operating loss, $28,874.

ARIZONA

Greenlee County

SHANNON (Clifton)—August estimated production about 925,000 lb. copper.

Mohave County

KEYSTONE (Chloride)—Work to be started at once on 100-ton mill for this Mineral Park mine.

NORTH GEORGIA (Chloride)—Lead ore encountered in both east and west drifts on 100-ft. level. Now working three shifts.

TENNESSEE (Chloride)—Strike called Aug. 25, settled next day by increasing cagemen's wages from $4 per day to union scale of $4.50.

BIG JIM (Oatman)—Still developing ore in spite of statements of Los Angeles stock brokers. Company will take no action against recent attacks in brokers' letters, but it is expected that individuals will soon bring suit for libel

CALIFORNIA

Butte County

CHROME DEPOSIT disclosed on the Nat Lambert, near Magalia, within 4 mi. of Butte County R.R. Considerable ore already blocked out.

1915 GOLD MINING CO. (Lumpkin)—F. C. Burroughs and A. L. Thorselius, owners, completed and are running two-stamp mill on good-grade ore.

NATOMAS CO. (Oroville)—Feather River dredge reported to have started digging into old tailings pit to ascertain if tailings of Oroville district will pay to redredge.

GOLDEN FEATHER RIVER MINING CO. (Oroville)—New company to be incorporated for working gravel claims for 6,000 ft. on middle fork of Feather River. Paul Reicker, Marshall Curran and George C. Riley, located the claims.

TRIUMPH GOLD MINING AND MILLING (Lumpkin)—Company will resume operations under new management, installing compressor and drills and driving new working tunnel 750 ft. lower. F. A. Thompson, superintendent. Property, equipped with 25-ton mill and cyanide plant, has been operated for some time by lessees.

Calaveras County

HEXTER (Mokelumne Hill)—Rich gravel reported at Stockton Ridge channel. Mine equipped with machinery; gravel hauled through 3,000-ft. tunnel by electric locomotive. George Chapman, superintendent.

CALAVERAS (Melones)—Old tunnel cleaned out and retimbered 1,200 ft. Compressor and drills in operation W. J. Loring is general manager. J. A. Davis, formerly of Central Eureka, Amador County, is superintendent.

TEXAS MINING CO. (Stockton)—Permitted to sell 100,000 shares at 25c. to develop copper claims, and to issue half of its capital stock to J. R Hoskinson and six associates in payment for the claims. These shares to be issued only as other shares are sold for cash, in order to preserve equitable balance of voting power by original owners and investors.

Eldorado County

OMO RANCH DISTRICT is active, many properties being prospected or operated. C. Edner is preparing his gravel mine for winter operation. Ensley mine shaft being sunk preparatory to development. Slug Gulch getting ready for winter work. Tony Merrell is drifting on good gravel. Lynch company working its gravel mine.

BEEBE (Georgetown)—Property being prospected by Georgia Slide operators.

TAYLOR (Placerville)—Tailings may be re-cyanided by O. H. Shade, of Los Angeles. Treating 6 to 10 tons a day and a 30-day test is to be made. Dump was treated several years ago.

Glenn County

CHROME MINES have difficulty in securing miners. Construction of tramway from mine to Fruto contemplated. Roads in winter require much work to keep them in order.

Inyo County

ORE SHIPMENTS from Keeler amount to 24 to 28 cars a day. Cerro Gordo continues regular shipments; Saline Valley Salt Co., Natural Soda Products Co. and Inyo Development Co. also shipping.

DARWIN DEVELOPMENT CO. (Darwin)—Successful operation of flotation plant reported. Two more units will be added.

Nevada County

CALIFORNIA COPPER (Spenceville)—H W. Morris and Thomas Benney have purchase bond and contemplate erecting mill.

EMPIRE (Grass Valley)—Moving-picture company selected this mine as the stage for a mining-camp photoplay; 100 miners to be employed in the picture to give verisimilitude.

UNION HILL (Grass Valley)—Last payment on purchase price will soon be made Mine has produced large amount of tungsten ore within past six months, although it is a gold mine which is being brought again into the producing class under management of Erroll McBoyle.

DELHI CONSOLIDATED MINES CO. (Nevada City)—Incorporated with capitalization $1,000,000. Directors are Roy E. Tremoureux, Carroll Searls, L. P. Larue, Frank Vestal, C. R. Clinch. Will operate Delhi mine, recently bonded from St. Gothard company.

Placer County

GUGGENHEIM INTERESTS reported to be preparing for prospecting dredging ground on north fork of the American River between Auburn and Colfax.

Shasta County

GARDELLA DREDGE (Redding)—Cleanup from 10 days' operating in Clear Creek, amounted to $4,576. Bullion averaged $18.30 per oz.

Siskiyou County

WHACKER (Yreka)—Being operated by Spring Gulch Mining Co. Ore low-grade but it is believed large tonnage can be extracted economically.

KNOW-NOTHING (Etna)—North extension of Gold Run vein recently purchased by W. R. Beall, former owner of the Gold Run. Equipped with 8-stamp mill.

GOLD RUN (Etna) J. Claghoff, of New York, recent purchaser, is installing saw mill, hoist and pumping plant Rails for tramway and other machinery ordered.

Yuba County

PACIFIC NO. 5 DREDGE (Smartsville)—Launching of 9-cu.ft. dredge on Aug. 23 by Pacific Gold Dredging Co. Mr Perring was superintendent of construction. O. C. Perry, of Oroville, is manager. Dredging ground north of Hammonton, on Yuba River.

COLORADO

Clear Creek County

SUMMIT (Idaho Springs)—Being reopened for exploration at depth.

ARGO (Idaho Springs)—Flotation process at mill giving satisfactory results.

GOLD QUARTZ (Alice)—Development will be resumed and veins opened at greater depth. W. C. Bickford, manager.

BEN HARRISON (Idaho Springs)—Lessee Robert Calvert made trial shipment to Jackson mill, resulting in 50% lead concentrate.

T. P. (Idaho Springs)—Being developed by McCampbell and associates through War Eagle workings. Quito compressor and drills will be used in new crosscut.

AMERICAN SISTERS (Georgetown)—Lode claims, placers, mill sites and water rights will be sold at public auction in Georgetown Sept. 12, to satisfy judgment of $39,551 in favor of International Trust Co. of Denver

STANLEY MINES CO. (Idaho Springs)—These properties, in Spanish Bar, Coral and Trail Creek mining districts, purchased by Fisher, Cunningham, Johnson and associates. Extensive development contemplated. Total past production estimated at $3,500,000.

Park County

J. G. BLAINE (Alma)—Shoot of tungsten ore of considerable importance opened recently. Vein is quartz, 4 to 6 ft wide with a 4- to 12-in. shoot of tungsten ore assaying over 10%, some of it as high as 30%. Several other tungsten discoveries made in Alma district lately On Esmeralda, a continuation of Blaine, high-grade float found. Tungsten also found on Mt Loveland, across Buckskin Gulch.

San Juan County

EMMA (Silverton)—Mine in Ice Lake Basin being opened.

LACKAWANA (Silverton)—Leased to William Lonergan and James Fox.

NATIONAL BELL (Red Mountain)—Being developed by Davey Leasing Co.

CHAMPION (Silverton)—Shipments being made to Silver Lake mill Frank L. Ross in charge.

ADAMS (Gladstone) L. C. Carruthers, lessee, opened payable tungsten ore. Trial shipment sent to North Star mill.

KENO (Ironton)—Ross, Dougherty & Co., lessees, opened oreshoot assaying $40 a ton in upper tunnel. Working in both upper and lower tunnels.

KITTIMAC MINE & MILL CO. (Silverton)—New company to acquire under lease and bond property of Kittimac Mines Co. Joseph Jacob will be superintendent of the mine. New machine drills being installed and extensive development planned, including opening of Caliber vein. [illegible] of

American Flotation Co. is in charge of mill operations. New staff also include Isaac Camp, tramway superintendent; A. D. Malchus, assistant manager, and James M. Hyde, consulting flotation expert.

San Miguel County

DUFFY (Ophir Loop)—Being developed by Purdy, Scanlan & Lyle.

LITTLE MARY MINING CO. (Ophir)—Ten men employed on development; mill level and level above being advanced.

GERTRUDE (Telluride)—Property at head of Bear Creek Basin leased by Farrell and King. New mining equipment installed.

CARBONERO (Ophir)—Contract let to advance Shoofly crosscut 250 ft. L. H. Rouse, of Colorado Springs, owner and manager.

LEGAL TENDER (Telluride)—R. M. McLaughlin has opened rich 6-in. vein on this Mt. Wilson property, near Silver Pick mine; altitude 13,400 ft.

NELLIE (Telluride)—Being developed under lease by F. B. Van Atta and L. Munchiando. Aërial tramway will be built to 10-stamp mill on Bear Creek. Mill has been overhauled.

CARRUTHERS LEASE (Pandora)—Perino and associates have let contract for small quartz mill near Royer Creek and an aërial tramway 2,600 ft. long. Plant to be ready in October. Construction of mill under direction of Walter L. Reid; tramway to be erected by O. M. Sackett.

BLACK BEAR (Pandora)—Four levels advanced each way on the vein from inclined shaft. Vein 4 to 8 ft. wide and assays about $7 a ton. Ore treated in Smuggler-Union mills. About 65 men employed on development and about 3,000 tons per month are produced from drifting operations. Lowest level 450 ft. below the surface; collar of shaft at an altitude of 12,400 ft.

Summit County

MINNIE (Breckenridge)—Recently unwatered by Wellington company. Extensive development work will be started at once.

SILVER KING (Breckenridge)—Iron-manganese ore discovered recently. Vein is of considerable width and apexes only a few feet from surface.

COLORADO METALS SEPARATION CO. (Breckenridge)—Alterations in old Union mill completed; will now treat custom ores. Ore from the Country Boy to be treated.

Teller County

GOLD PINNACLE GOLD MINING (Cripple Creek)—Developing through Mitchell shaft. Payable ore opened.

DILLON (Victor)—New ore house will enable operators to increase output to 150 tons a day. Daniel McCarthy, superintendent.

PORTLAND (Victor)—New sampling plant is under construction at the mine and a new assay office at the mill at Colorado Springs.

ACACIA (Cripple Creek)—Fitzmorris & Quinn developing on 12th level of South Burns shaft. One-ounce gold ore opened on extension of Eagles vein.

AJAX (Victor)—Payable ore has been opened near the surface on Block 13 by Charles Hill. A 30-ft. shaft cut orebody averaging $15 to $20 a ton; extent not yet determined.

REX GOLD MINING & MILLING (Cripple Creek)—Mill on Ironclad Hill treating from 60 to 75 tons a day. Oxidized ore is being quarried from opencuts; expense of treatment reported at $1.25 per ton; considerable $4 ore opened. Thomas Kavanaugh, manager.

ISABELLA (Cripple Creek)—During July shipped 65 cars of ore, about 1,725 tons; gross value approximately $38,000; profit about $10,000. Of entire production 14 cars were on company account; nine cars of milling ore and five cars of high-grade ore were from Beuna Vista oreshoot recently developed in 15th level. Development being done by lessees through the Lee, Empire and Maloney shafts. Clark Mitchell is superintendent.

MICHIGAN

Iron

CRYSTAL FALLS MANGANIFEROUS DEPOSIT, opened two weeks ago, is not believed to be large. Diamond drill cut through 5 ft. of this ore; core averaged 35.50% manganese; ore was only 28 ft. from surface. Drill hole 100 ft. away did not strike manganese. Further drilling now being done.

SECTION 16 (Ishpeming)—First-motion hoist at the Queen mine now being installed at the Section 16. Old hoist will be discarded.

RICHMOND (Palmer)—About 250,000 tons will be shipped from this property, this year, breaking all previous records. More stripping is to be done in the spring. All machinery now operated electrically.

CLEVELAND-CLIFFS IRON CO. (Ishpeming)—Contracts awarded for additions to change houses at the Lake and Cliffs mines; not room enough for large crews now being worked. New shop will also be erected at the Cliffs.

YALE (Bessemer)—Steel headframe and shaft sets ordered for new shaft and work will be started shortly. The shaft will go down on the Jackpot property of Jones & Laughlin Ore Co. which adjoins. New lease recently signed on the Jackpot. All present mine buildings of the Yale are on the Jackpot land but shaft now in use is on the Yale.

MINNESOTA

Cuyuna Range

JOAN MINING CO. (Ironton)—Started sinking two-compartment shaft, 5 ft. 8 in. by 10 ft., in manganiferous deposit. No railroad connections yet.

Mesabi Range

BRUNT (Mountain Iron)—Two shovels working; ore taken to drying plant; when dried is stocked in pit owing to car shortage.

HAWKINS (Nashwauk)—Stripping for season finished at pit. From washing plant, 5,000 tons of concentrated ore a day being shipped.

HANNA A (Mountain Iron)—Shipping now in progress. Pit about 200 ft. deep. Four switchbacks, with steep grades, used in removing ore.

MINORCA (Virginia)—Will be reopened and operated by local men headed by John Costin, Jr. Formerly operated by Pickands-Mather Co. but lease was dropped.

SUSQUEHANNA (Hibbing)—Rogers-Brown company working on model power house. Heavy pumping equipment will be necessary later; present flow about 3,000 gal. per min. Screening plant in operation.

SLIVER (Virginia)—One shovel operating in manganiferous ore. M. A. Hanna Co. will ship this season from this mine 40,000 tons containing 3% manganese. Underground loading machine, recent invention of Captain Hoar, is in operation.

MISSOURI

Joplin District

T. C. H (Commerce, Okla.)—Started milling ore from old Eureka drifts.

SMITH (Galena, Kan.)—Contract let for drilling of M. L. Smith farm, 4 mi. southwest of Galena.

LONE ELM (Joplin)—Ten new shafts going down on this "poor man's" tract. Some good strikes made.

CRAMER (Cave Springs)—Mine closed; mill sold to Keyes and associates, who will move it to site near Commerce, Okla.

C. M. & H. (Joplin)—Installed 6-in. American pump in Glendale shaft to drain ground 30 ft. deeper than now being worked.

LOG CABIN (Galena, Kan.)—Once well-known mining tract being thoroughly redrilled for ore at deeper levels than originally worked.

FLANNERY (Sarcoxie)—Opened old Optimo ground by new shaft. Plan to solve water problem by concrete bulkhead near original shaft.

COAHUILA (Duenweg)—Slime plant at new mill started with 16 tables. Four more to be added later. Mill averaged 1,800 tons daily.

QUEEN CITY (Commerce, Okla.)—Started after month's idleness, mainly to hold force together, owners claiming no profits at present prices.

SCOTT (Duenweg)—Drill hole 400 ft. south of mill shows 9.9% blende for 42 ft.—from 231 to 271 ft. New double-compartment shaft, property's fourth, to be sunk on hole. Mill closed, ore bins full, awaiting better market.

MONTANA

Beaverhead County

BOSTON & MONTANA DEVELOPMENT (Elkhorn)—Preparing to sink shaft to connect with raise from the long tunnel. Will install hoist and compressor plant.

Broadwater County

IRON MASK (Townsend)—Will be reöpened soon; purchased by Edward Taylor, James Jobb and Albert Richards, of Helena.

BALD BUTTE (Marysville)—Tower & Templeman, of Butte, are constructing 150-ton cyanide plant to treat tailings dump estimated at 325,000 tons.

Jefferson County

INDEPENDENT (Wickes)—L. G. Knotts, owner, shipped recently carload of ore to East Helena smeltery and has another car nearly ready.

Lewis and Clark County

MONTE CRISTO (Rimini)—W. A. Clark, Jr., developing this property has stopped work and given up lease.

Madison County

CONREY PLACER MINING (Ruby)—Output during year ended Aug. 31 was greatest in company's history. More than 22,000 cu.yd. of gravel washed daily by company's four dredges. Alder gulch in which these dredges are operating is being worked for the third time. In the early '60s it was "drifted" by the first gold seekers, and in the '70s was ground-sluiced.

Missoula County

TARBOX (Saltese)—New equipment, consisting of an air compressor, power drills, etc., being installed. Shaft nearing 500-ft. level, where station will be cut and crosscut driven south to vein.

Powell County

WASHINGTON GULCH PLACER (Avon)—P. A. Danaher, of St. Paul, has purchased this 105-acre property, and will install hydraulic elevators of his own invention.

Silver Bow County

BUTTE & ZENITH CITY (Butte)—Shaft is expected to reach the 1,000-ft. level Sept. 1. On this level, 600-gal. Imperial Iron Works pump will be installed and crosscutting started to intersect the Economical vein.

BUTTE-MAIN RANGE (Butte)—Retimbering shaft from surface to 600-ft. level completed. When unwatered to 700-ft. level, crosscut will be driven to intersect orebody. Drifting on 500-ft. level opened good ore and wagon shipments will be started shortly.

ANACONDA (Butte)—Early on Aug. 26, fire starting from electric motor in shaft house of East Stewart mine damaged fans but as this shaft is upcast, was put out by fire department without damage to shaft. At the Tropic, a new 5-ton Pierce Arrow truck has been substituted for teams formerly used to haul ore to railroad.

BUTTE-DULUTH (Butte)—Development work planned by leasing company under direction of Al Frank will include cleaning of Montgomery shaft and sinking to 1,000-ft. level. Old mill will be changed to accommodate new process. Receiver Everett who will remain with new management, recently took in $6,100 from sale of machinery to Max W. Atwater.

BUTTE & BACORN (Butte)—At company's property in northern section of Butte district, great activity is being shown after shutdown of nearly 10 years. New 70-ft. gallows frame completed and buildings overhauled. Excavations for boiler, compressor and hoist made and two 125-hp. boilers are on ground. New management under name of the Greater Butte company expects to start operations by Oct. 1. Retimbering of shaft and all necessary work for opening mines on 1,000-ft. level will soon be completed.

NEVADA

Elko County

ELKO PRINCE (Midas)—The 50-ton mill is being operated steadily by Elko Prince Leasing Co. on ore from this and other properties. In Elko Prince mine, parallel vein 400 ft. distant from main vein is being drifted on north and south. From surface to within 90 ft. of where Elko Prince cut it, the ground is under lease to Paul Ehlers, one of original Elko Prince owners; three lots sent to the mill ran about $25 and he has developed about 1,000 tons of lower grade ore that will be stoped when the Elko Prince connects with his workings. Mill charges for treating custom ore are reported as follows: $5.50 for $12, ore, $6 for $20 ore, $7 for $30 ore, etc., paying for 85% of the precious metals.

Esmeralda County

SILVER PICK (Goldfield)—President Zadig states 3-ft. vein encountered in shaft at about 900 ft. Sinking suspended pending placing of larger pumps.

JUMBO EXTENSION (Goldfield)—During year ended June 30, 1916, property produced 35,541 dry tons ore, valued at $1,124,487, or $31.64 per ton, compared with an average of $61.58 for year previous. Dividend disbursements $465,100. Cash balance end of year $103,274, with additional $28,728 as value of ore in transit.

Nye County

TONOPAH ORE PRODUCTION for week ended Aug. 26 was 8,916 tons, valued at $186,568, compared with 9,257 tons for week previous. Producers were: Tonopah Belmont, 2,824 tons; Tonopah Extension, 2,200; Tonopah Mining, 1,500; Jim Butler, 1,100; West End, 875; Rescue-Eula, 204; Halifax, 155; miscellaneous, 58 tons.

MORNING GLORY (Manhattan)—Small electric hoist purchased and development will be begun. Property adjoins the White Caps.

REORGANIZED WHITE CAPS (Manhattan)—Ore in both the east and west drifts on 310-ft. level. Ore is complex and will require roasting.

EAST END DEVELOPMENT CO. (Tonopah)—Agreement to give Tonopah Belmont control for expenditure of $50,000 in development will be submitted to stockholders.

ORIZABA MINING AND DEVELOPMENT (Millers)—Silver property, about 32 mi. north of Millers, shipping several cars ore, valued at $50 per ton; control held by the Diamondfield Black Butte Reorganized Mining Co., of Goldfield.

TONOPAH EXTENSION (Tonopah)—July profit $69,209 from 8,139 dry tons, yielding $148,089 in bullion (1,680 oz. gold and 178,560 oz. silver). Victor shaft to be sunk 300 ft., electrical hoist placed on 1,540-ft. station for this purpose.

Storey County

ANDES (Virginia)—Saved 29 cars of ore from development on 350 level.

JACKET-CROWN POINT-BELCHER (Gold Hill)—Repaired surface equipment and operated cyanide plant.

ALPHA & EXCHEQUER (Virginia)—North drift on 200 level advanced to 148-ft. point, entering new ground.

CON. VIRGINIA (Virginia)—West crosscut on 2,700 level advanced to 60-ft. point through vein porphyry carrying quartz and clay stringers.

OPHIR (Virginia)—Shipped from 2,500 level 20 tons of ore to Mexican mill. North drift on 2,700 level advanced to 300-ft. point, face in dacite and quartz.

SIERRA NEVADA (Virginia)—North drift 2,400 level advanced 20 ft., face in porphyry and stringers of quartz, low assay. North drift 2,500 level reopened and repaired to the 220-ft. point.

MEXICAN (Virginia)—West crosscut 2,500 level extended to 398-ft. point, face in diorite. Mexican mill received 352 tons custom ore, averaging $21.42, and 64 tons from Mexican storage pile, averaging $9.20.

UNION CON. (Virginia)—Extracted 332 tons: 2,400 level 66 tons, average $17.99, 132 tons $24.14, 74 tons $15.90, 39 tons $20.30; 2,500 level, 21 tons, $14.26. Reopening old 2,300 shaft station and advanced southeast drift on 2,400 level to 232-ft. point. Joint Sierra Nevada east crosscut 2,600 level advanced to 88-ft. point.

UTAH

Beaver County

COPPER KING (Milford)—This property in Star district leased by A. W. Windberg.

CEDAR-TALISMAN (Milford)—Lead ore being mined from lower levels. Little zinc ore handled at present.

UTAH LEASING (Newhouse)—Company, treating dump of old Cactus mine, has just placed in commission new flotation equipment and tables. Plant handling up to 800 tons a day and making good extraction.

Juab County

TINTIC SHIPMENTS for August amounted to 741 cars by 35 shippers.

DRAGON CONSOLIDATED (Silver City)—August output was 156 cars. Much iron ore being shipped.

IRON BLOSSOM (Silver City)—Drifting being done from winze on 1,200-ft. level in north end of property; and copper ore beginning to show.

LOWER MAMMOTH (Mammoth)—Low-grade ore opened on the 1,500 level is being raised on and showing improvement. Carries silver, lead and gold.

CHIEF CONSOLIDATED (Eureka)—Company shipped 151 cars in August, largely lead-silver ore of good grade, carrying some gold. Lower grade ores are not being handled much on account of present congestion at smelteries.

Salt Lake County

UTAH-APEX (Bingham)—New Nordberg hoist and other equipment is being installed at the shaft.

MONTANA-BINGHAM (Bingham)—New compressor is being installed. May contract for driving tunnel 900 ft. further. Present length 4,042 ft.

LEHI-TINTIC (Eureka)—Compressor and machine drills to be installed; Empire and Iron Blossom tunnels to be extended 100 and 200 ft. to get under orebodies exposed in upper workings. George Nicholes, manager.

UTAH COPPER (Garfield)—July production is reported at 20,302,228 lb. as compared to 17,877,432 lb. in June; and 15,950,215 in May. Cement and forms for leaching vats for new leaching plant are on the ground. Over 40,000,000 tons of carbonate ores accumulated for leaching.

EMMA COPPER (Alta)—Second diamond drill ordered and will soon be in operation. Faulted portion of Emma limestone—in which occurred famous old Emma orebody—thought to have been cut below Bay City tunnel. Drilling is being done jointly by Emma Copper and old Emma Leasing Co.

CONGOR (Bingham)—Raising being done from Bingham Amalgamated tunnel to connect with 600-ft. incline from surface, and to determine whether veins opened apex on Congor ground. Distance from tunnel to surface about 1,800 ft. on dip of beds and veins.

MICHIGAN-UTAH (Alta)—Between Aug. 1 and Aug. 26, there were shipped 36 cars. Company hopes to maintain this rate during autumn. Triangle lease shipped two cars from City Rocks and Grizzly veins. Lessees on Big Cottonwood side are mining ore. Company doing development in Copper Prince tunnel to reach known vein.

SELLS (Alta)—At meeting of directors, held Aug. 28, arranged to give mortgage on property; principal stockholders signed notes so that company could meet obligation of $25,000, due Sept. 1, on original portion of property and $5,000 on holdings later acquired. First planned to raise money by 6c. assessment; later reduced to 2½c. a share, this being all that was legally possible. As amount from assessment is not sufficient to meet immediate demand, cash was secured by mortgage.

Utah County

PACIFIC (American Fork)—Work progressing on mill on Dutchman Flat. Expect machinery to be installed by November. C. H. Doolittle and W. E. L. Dilloway interested.

CANADA

British Columbia

TONOPAH BELMONT DEVELOPMENT CO. (Bullitt Bldg., Philadelphia, Penn.)—Developments in Surf Inlet gold mine, on Princess Royal Island, proving satisfactory; subsidiary company, Surf Inlet Power Co., is building concrete dam of the Ambursen hollow type for a 2,000-hp. power development; a 7-in. transmission line will convey power to the mine; an electric-tram line to the head of navigation is proposed. Tonopah Belmont has given up its option on the Queen gold mine, near Salmo, B. C.; also on the Bull Moose low-grade gold mine at Beatty, Nev., and on the Copper Queen group in the Santa Fe copper-mining, Mineral County, Nevada.

Ontario

PERSEVERANCE (Porcupine)—This property, north of the Davidson, to be developed.

BOSTON CREEK MINES (Boston Creek)—Has opened rich oreshoot 40 ft. long and 2 ft. wide.

WEST DOME CONSOLIDATED (Porcupine)—New high-grade vein encountered on 300-ft. level, 5 ft. wide.

MILLER LAKE-O'BRIEN (Gowganda)—A vein, 14 in. wide, carrying native silver, found on 30-ft. level.

NEWRAY (Porcupine)—Another vein carrying 5 ft. of high-grade ore with visible gold, found on the surface.

PORCUPINE CROWN (Timmins)—Winze being sunk from 700-ft. level is 40 ft. below 800-ft. level and still in rich ore.

McKINLEY-DARRAGH (Cobalt)—Has engineer examining properties in Skead Township. Company pursuing energetic exploration policy.

CONIAGAS (Cobalt)—Has option on Platt Veteran lot adjoining the Schumacher, in Porcupine district. Diamond drilling will be started immediately.

DOME (Porcupine)—Second ball mill should bring tonnage up to 1,400 tons a day. Difficult, however, to maintain tonnage and extraction. Development on Dome Extension indicates that this property will be taken over, probably involving a new mill using continuous-decantation process. Drilling on the Dome below the 700-ft. level to the 850 shows continuous ore averaging about $12; porphyry carries good gold content here. New central shaft will be completed next month. On the Dome Extension, drill No. 8 has cut 37 ft. of ore, averaging $7.40 and Drill No. 6 encountered 17 ft. averaging $12.

MEXICO

SANTA GERTRUDIS (Pachuca, Hidalgo)—In July crushed 20,282 tons; estimated profit £1,449.

CHOSEN

ORIENTAL CONSOLIDATED (Unsan)—Cable estimate, August cleanup $131,735. Treated in July 25,210 tons; bullion recoveries were: Tabowie mill, $26,243; Taracol, $21,596; Maibong, $25,630; Taracol cyanide bullion, $50,745; Maibong tube-mill bullion, $4,806; total, $128,751. Final figures for June showed 200 stamps ran 29.05 days crushing 26,511 tons yielding $138,280; net profit, $65,427.

The Market Report

Metal Markets

NEW YORK—Sept. 6

The markets were generally dull during the last week, there being practically two holidays. There were but slight changes in prices. Since Labor Day there has been a revival of interest, especially in copper and lead.

Copper, Tin, Lead and Zinc

Copper—The business of the week, which was transacted in four days, was materially less than in the previous week, which in turn was less than in the week before. In the absence of demand there were some sellers at concessions, and thre were early signs of reactionary tendency. Since the holiday, however, an improvement in sentiment has been observable, inquiries being received from numerous quarters, besides which an inquiry for 5,000 tons for Russian account developed on Sept. 6.

In the domestic market the noteworthy features were requests made by several manufacturers for deferral of their September copper to later months, owing to manufacturing difficulties. One manufacturer offered a round lot of September copper for resale and is supposed to have found a buyer in the neighborhood of 28c., New York. In general, producers have no September copper to offer and manufacturers are covered, but now and then some manufacturer finds himself in need of a little and may obtain it from some reselling manufacturer. These are, however, but sporadic cases. The major business of last week was for November-December delivery, with a little done for October delivery.

The Russian inquiry came through the British Ministry of Munitions, which is buying for the Russian government and called for bids f.o.b. New York. It is the understanding that the business is to be closed on Sept. 8. The delivery wanted is "as soon as possible."

The negotiations between the producers and the Allied Governments for a large quantity of copper wanted in the first half of 1917 appear to be all off. Without any doubt the copper is wanted, but it is believed here that a different policy in securing it may be followed; that is, instead of making one stupendous contract, the copper may be purchased in smaller blocks from time to time at the market. This would be much better from the standpoint of the producers, inasmuch as it would tend to give the market a more enduring stability. The execution of the huge contract which was contemplated would probably have resulted in some market complications later.

An interesting feature of the domestic market is the increasing extent to which domestic manufacturers, especially brass makers and sheet rollers, are adjusting their business on a toll basis; that is, copper is purchased for the account of their customers and is converted into brass and sheet on toll. The demands upon the rolling mills are so great that toll charges are high, 10c. per lb. being the common figure, while the wire drawers are getting only 1c.

Copper Sheets are unchanged at 37.5c. per lb. for hot rolled and 38.5c. for cold rolled. Copper wire is 31½@32c. per lb. for large lots at mill.

Copper Exports from Atlantic ports in August are estimated at 32,200 gross tons, or about 2,800 tons less than in July.

Copper exports from Baltimore for the week included 1,786,622 lb. copper and 550,816 lb brass to France; 599,250 lb. brass to Italy

Visible Stocks of Copper in Europe on Aug. 31 are reported as follows: Great Britain, 4,839; France, 2,675; afloat from Chile, 850; afloat from Australia, 3,150; total, 11,514 gross tons, or 25,791,360 lb. This is an increase of 492 tons over the Aug. 15 report.

Tin This market was fairly active on Thursday and Friday On Saturday no business was reported. Since the holiday the market has been dull

Tin deliveries at Atlantic ports in August were 4,325 gross tons. The stocks of tin in warehouses and landing on Aug 31 were 4,750 tons.

Visible Stocks of Tin Sept 1 are reported as follows, including tin afloat to London, 7,666; Banka and Billiton (Holland) 1,230; United States, excluding Pacific ports, 9,146; total, 18,042 gross tons, which is a decrease of 362 tons from Aug. 1, but an increase of 2,917 tons over Sept. 1 of last year.

Lead—Lead for September delivery is very scarce. Those producers who can supply it easily obtain premiums over the price of the A. S. & R. Co. The latter company fills the orders of its regular customers but has no surplus to offer. After the holiday there was an improvement in demand and a stiffening of price, 6.60c., St. Louis, being realized for a round lot on Wednesday afternoon. There were several foreign inquiries in the market, including one of 2,000 tons from the Rumanian government.

Spelter—This market was very dull. Sales of September-October metal were made at 8¼c. St. Louis.

Zinc Sheets are in steady demand and business is fair. Quotations are unchanged at $15 per 100 lb., f.o.b. Peru, Ill., less 8% discount.

Other Metals

NEW YORK—Sept. 6

Aluminum—Demand continues good. Contract deliveries are being slowly made. Outside of these there is not much stock available, and prices are rather firm at 60@62c. per lb. for No. 1 ingots, New York.

Antimony—This metal is dull and lethargic. The principal producers are asking 13½@14c., but buyers are able to get such supplies as they need at 12@12½c., which we quote as the market for the last week.

Quicksilver—The improvement continued until $80 was realized, but demand halted and the market fell back to $77 and became dull. San Francisco reports, by telegraph, $76, market unsettled.

Nickel—Demand is good both from domestic and export business. Prices are firm and unchanged at 45@50c. per lb. for ordinary forms, according to size of order. A premium of 5c. per lb. is charged for electrolytic nickel.

Minor Metals—Current quotations for **Bismuth** are $3.15@3.30 per lb., New York—**Cadmium** is quoted at $1.30@1.50 per lb.—**Cerium**, electrolytic, is sold at $8@9 per lb.—**Cobalt Metal** is quoted at $1.25 per lb.—**Magnesium** is steady, with sales at $3.50@3.75 per lb. for 99% pure—**Selenium** is from $3 up to $5 per lb., according to size of order.

Gold, Silver and Platinum

NEW YORK—SEPT. 6

Gold—More arrivals of gold from Canada are reported in New York, and some has also come in direct from England.

Gold Receipts at New York for the week were very heavy, $25,000,000 being turned into the Assay Office by importers. Part of this came from Ottawa, but most of it from Halifax, having been brought to that port presumably by a British cruiser. All of it was on London account.

Imports of gold through the port of San Francisco seven months ended July 31 were $9,451,285; exports $24,128,969; leaving $14,677,684 excess of exports.

The gold reserve of Japan which was 353,000,000 yen at the end of July, 1914, is now reported at 600,000,000 yen, of which 400,000,000 yen are held by the Bank of Japan, 170,000,000 yen being the property of the government. The amounts subject to draft are 120,000,000 yen in the United States and 280,000,000 yen in England.

Platinum—At the close of last week, $80 was asked, and this week two producers reported that price realized, while one reported inability to get it. We quote $78@80 per ounce.

Silver—The market continued steady with an improvement in prices due to British Mint purchases and small arrivals of spot silver. Bombay exchanges are low and India has not been a buyer. On the other hand while China exchange continues below parity. China has stopped sales. The London market is quoted steady with healthy undertone and closes at 32½d. bid.

Imports and exports of silver in Great Britain seven months ended July 31 in sterling ounces:

	1915	1916	Changes
Imports.....	53,995,003	52,399,403	D. 1,595,600
Exports...	40,167,994	30,150,667	D 10,017,327
Net imports	13,827,009	22,248,736	I. 8,421,727

For the corresponding period in 1914 the imports were 55,640,985 oz.; exports 65,875,762 oz.; showing 10,234,777 oz. excess of exports. The statement is remarkable in two particulars, the closeness with which the imports for each similar period approximate, and the wideness with which the exports differ from each other.

Imports of silver through the port of San Francisco seven months ended July 31 were valued at $1,823,724; exports, $4,340,788; leaving $2,517,064 excess of exports.

Mexican dollars were quoted in New York Aug. 31 at 51¾@55¾c.; Sept. 1 at 52½@55½c.; Sept. 2 at 52½@55½c.; Sept. 5 at 52⅜@55⅜c.; Sept. 6 at 52¼@55¼ cents.

SILVER AND STERLING EXCHANGE

Aug. Sept.	Sterling Exchange	Silver		Sept.	Sterling, Exchange	Silver	
		New York, Cents	London, Pence			New York, Cents	London, Pence
31	4 7575	67¼	32	4			32⅛
1	4 7575	68⅛	32$\frac{7}{16}$	5	4 7575	68	32⅜
2	4.7575	67¾	32¼	6	4 7575	68¼	32½

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine.

DAILY PRICES OF METALS IN NEW YORK

Aug. Sept.	Copper	Tin	Lead		Zinc
	Electrolytic	Spot.	N. Y.	St. L.	St. L.
31	26¾ @27¼	38⅞ @39	6 50 @6 60	6 40 @6 50	8.25 @8.37½
1	26¾ @27½	38⅞	6.50 @6 60	6.40 @6.50	8 12½ @8.37½
2	*26½ @27½	*38⅞	6 50 @6 60	6.40 @6.50	8 12½ @8.37½
4	.	...	....	....	.....
5	26½ @27½	39	6.50 @6.65	6.40 @6.50	8 12½ @8.37½
6	26½ @27½	39	6 50 @6.70	6.40 @6.60	8.12½ @8.37½

*Nominal.

The quotations herein are our appraisal of the average markets for copper, lead, spelter and tin based on wholesale contracts for the ordinary deliveries of the trade as made by producers and agencies; and represent, to the best of our judgment, the prevailing values of the metals, reduced to basis of New York, cash, except where St. Louis is basing point.

The quotations for electrolytic copper are for cakes, ingots and wirebars. Electrolytic copper is commonly sold at prices including delivery to the consumers and is subject to discounts, etc. The price quoted for copper or "regular terms" (r.t.) is the gross price including freight to the buyer's works and is subject to a discount for cash. The difference between the price delivered and the New York cash equivalent is at present about 0.25c. on domestic business. The price of electrolytic cathodes is 0.05 to 0.10c. below that of electrolytic. Quotations for lead represent wholesale transactions in the open market for good ordinary brands. Quotations for spelter are for ordinary Prime Western brands. Only St. Louis price is given, St. Louis being basing market. We quote New York price at 17c. per 100 lb. above St. Louis.

Some current freight rates on metals per 100 lb. are: St. Louis-New York 17c.; St. Louis-Chicago, 6.3c.; St. Louis-Pittsburgh, 13.1 cents.

LONDON

Aug. Sept.	Copper			Tin		Lead	Zinc
	Standard		Electrolytic				
	Spot	3 Mos.		Spot	3 Mos.	Spot	Spot
31	109	106	130	170¾	171½	31¼	52
1	110	107½	130	170¼	171	31¼	49
2							
4	109½	107	130	170¼	171¼	31	49
5	109	106½	130	170¾	171½	31	49
6	109	106½	130	171	172	30¾	48½

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2,240 lb. Copper quotations for electrolytic are subject to 3% discount. For convenience in comparison of London prices, in pounds sterling per 2,240 lb., with American prices in cents per pound the following approximate ratios are given, reckoning exchange at 4.80. £15 = 3.21c.; £20 = 4.29c.; £30 = 6.43c.; £40 = 8.57c.; £60 = 12.85c. Variations, £1 = 0.21⅜ cents.

Zinc and Lead Ore Markets

Joplin, Mo., Sept. 2—Price quotations per 2,000 lb.: Blende, high $65.70; per ton 60% zinc, premium ore, no sales, medium grades, $60@50, low $45. Calamine, per ton 40% zinc, $35@25. Average selling price, all grades of zinc, $61.52 per ton. Lead, base price $70@65; per ton 80%, metal content. High price $70 Average selling price, all grades of lead, $67.29 per ton.

Shipments of the week—Blende 6,051 tons, calamine 389 tons, lead 1,027 tons. Value, the week, $165,300. Year's value, to date, $26,219,570.

The low average base price of last month scheduled another reduction in the wage scale, and some mines closed down tonight to forestall a possible labor disturbance. Labor trouble at Henryetta, Oklahoma, is practically at an end, the Henryetta Spelter Co. now having four blocks in operation; the fifth, having been drawn, will need new retorts. These are to be installed as rapidly as possible.

The strike situation on the railroads was at such a stage that there was practically no zinc market, as buyers were taking only what ore their customers insisted on selling at a general $5 cut in price.

Platteville, Wis., Sept. 2—Quotations of the district are according to the following figures: Base price per 2,000-lb. ton for material assaying 60% zinc is $56 for premium ore down to $50 for medium grades. For material assaying 80% lead the base price per 2,000-lb. tons is $71. Shipments for the week were 2,553 tons of zinc ore, 97 tons of lead ore, and 956 tons of sulphur ore. For the year to date, the figures are, 81,575 tons of zinc ore, 2,881 tons of lead ore, and 19,313 tons of sulphur ore. Shipped during week to separating plants, 3,274 tons of zinc ore.

NEW CALEOONIA ORES

New Caledonia ore exports for the six months ended June 30 are reported by the "Bulletin du Commerce" of Noumea at 12,554 metric tons of nickel ore and 29,528 tons chrome ore. Metal exports were 1,060 tons nickel matte.

OTHER ORES

Manganese Ore from Brazil brings 60@65c. per unit for 50% ore at seaboard. Indian ore is about 60c. per unit.

Arrivals at Baltimore for the week included 1,000 tons manganese ore from India.

Pyrites—Imports of pyrites into the United States in June were 85,836 gross tons in 1915, and 101,874 in 1916; increase, 16,038 tons.

Imports of pyrites in Great Britain seven months ended July 31 were 521,348 gross tons in 1915, and 609,427 in 1916; increase, 88,079 tons.

Tungsten Ore—A fairly large business was reported at about $20, but toward the close of the week the demand appeared to have been satisfied, some sellers reporting inability to effect transactions. At the close we quote the market at $17@20 per unit.

Antimony Ore—No change.

EXPORTS AND IMPORTS

Imports of Metals, other than iron and steel, in Great Britain seven months ended July 31 in gross tons:

	1915	1916	Changes
Copper	134,394	83,449	D 50,945
Tin	26,962	21,068	D 5,894
Lead	158,643	93,844	D 64,799
Zinc	56,737	27,163	D. 29,574

Copper imports include the metallic contents of ore, matte and precipitate

Spanish Exports of Metals six months ended June 30 as reported by "Revista Minera" in metric tons:

	1915	1916	Changes	
Iron and steel	74,803	59,424	D.	15,379
Copper	8,776	7,899	D	877
Copper precip	5,983	5,836	D	147
Zinc	2,115	2,725	I	610
Lead	72,109	93,606	I	21,497
Quicksilver	709	1,152	I	452

Imports of iron and steel were 37,155 tons this year; of tinplates, 5,125 tons; of tin, 752 tons

Iron Trade Review

NEW YORK—Sept. 6

While export business is still the dominant feature in the market, a considerable number of new domestic orders is reported.

The domestic business includes some heavy contracts for bars from agricultural implement makers, who have been holding back for lower prices but have now come in. Structural steel orders are on the increase, many small building contracts having been closed. The demand for plates and shapes for shipbuilding is very heavy and promises to increase. The new vessels authorized by Congress for the Navy will require a large quantity of steel. The railroads are in the market more than for some time past, for rails, plates and bridge work

The mills for the most part are falling back on their orders and premiums for early deliveries are again talked about, especially on plates. Under these circumstances there is not likely to be any weakening in prices.

The pig-iron market is again active Some large transactions and inquiries in basic are reported, and there is also a demand for foundry iron. Prices have been rather irregular, but are gradually hardening. Contracts made not only cover fourth quarter, but run well into next year

PITTSBURGH—Sept. 5

Yesterday proved more of a holiday in iron and steel offices than many expected last week. It would have been a busy day for many men if the railroad strike had really occurred at 7 o'clock that morning, for it would have been necessary to keep a careful watch on all materials in order to determine how long works could be kept runing. As it is, the holiday was very generally observed, and with quite a feeling of relief

It is understood that some slight congestions were caused by the embargoes that were placed last week by the railroads, but on the whole the amount of tonnage tied up was not considerable. The markets were not affected, except the scrap market, which practically disappeared.

The threat that there would a railroad strike did not affect the various branches of the iron and steel market to any extent, and likewise the fact that there is no strike will not have any influence.

The tinplate mills are saying that they do not care to take any business to run over January. It is probable, however, that prices for next year may be made before very long.

Pig Iron—There has been no material change from last week's report. W. P. Snyder & Co. state the average for August at Valley furnaces at $21 for bessemer and $18 for basic pig, both unchanged from July. We quote: Bessemer, $21@21.50; basic,, $18@18.25; foundry and malleable, $18.50; forge, $18, f.o.b. Valley furnaces, 95c. higher deliver Pittsburgh.

Steel The market for unfinished steel remains practically nominal at about $45@50 per ton Inquiries are of rather light proportions. Whether the condition is due to the requirements being light or to possible buyers realizing that there is scarcely any use in inquiring it is difficult to determine. This is to be observed, however, that deliveries on regular contracts are quite satisfactory, according to all accounts. Export inquiry for unfinished steel is lighter than it was, the possible buyers having canvassed the situation so thoroughly, without finding any considerable tonnage of steel for sale for this year, that they have about given up inquiring.

FERROALLOYS

Ferrosilicon—Quotations on 50% ferrosilicon continue at $86@88 at furnace. Bessemer ferrosilicon is from $30 for 9% up to $41 for 16%, all at furnace. Supplies are rather more free than they have been.

Spiegeleisen—Quotations are unchanged at $40@45 per ton for 20% at furnace. For high grade, 25 to 30%, $55@65 per ton at furnace is asked

Ferromanganese—The market has continued quiet with only moderate demand. Contract is available at $175 per ton still. Prompt lots bring about the same, there being no special demand.

FOREIGN IRON

British Iron Ore Production in 1915 is stated as follows according to lately received figures: Mined under Coal Mines Act, 6,080,218; Metal Mines Act, 1,795,887; Quarries Act, 5,100,000; total, 12,976,105 gross tons. This compares with 14,867,582 tons in 1914, and 15,997,328 in 1913; the decrease from 1914 being 1,891,477 tons, while from 1913 it was 3,021,223 tons.

British Furances in Blast during the quarter ended June 30 were 293, being five more than during the previous quarter

Exports and Imports of Iron and Steel and manufactures thereof in Great Britain seven months ended July 31, as valued by Board of Trade returns:

	Exports	Imports	Excess, E
Iron and steel	£34,788,953	£6,824,591	£27,964,362
Hardware, etc.	6,385,635	407,707	5,977,928
Machinery	10,381,299	5,082,587	5,298,712
New ships	158,954		158,954
Total	£52,014,841	£12,314,885	£39,699,95[illegible]
Total, '15	39,347,837	11,243,074	28,104,763

The quantities of iron and steel exported were 1,825,296 gross tons in 1915, and 2,182,142 in 1916; imported, 715,327 in 1915 and 562,28[illegible] this year.

German Steel Production in May is reported by the German Iron and Steel Union at 1,112,137 metric tons, the largest since 1914 For the five months ended May 31 the total was: Converter steel, 3,171,212; openhearth, 2,751,394; direct castings, 388,826; crucible steel, 13,973, electric steel, 70,760; total, 6,129,065 metric tons. This compares with 5,010,103 tons for the corresponding period in 1915, showing an increase of 1,588,962 tons, or 27.6% this year.

Belgian Production An American correspondent who has been in Belgium and has had some opportunities to study the situation there estimates that in the Liege district the iron and steel works are now employing about 6,500 men, against 15,000 in normal times. The zinc works have 6,000, against 10,100 in 1913 In lead and other works about 1,200 are at work, or about half the normal force.

IRON ORE

Some more wild charters are reported at $1 per ton for iron ore from the head of the Lakes to Lake Erie ports. The rate fixed at the beginning of this season was 50c. Already there is talk of an advance in iron prices for next season, and it is probable that rates will be fixed at an earlier date than usual. This year's prices are $4.45 for Old Range and $4.20 for Mesabi bessemer; $3.70 for Old Range and $3.55 for Mesabi nonbessemer ore. An advance of $1 per ton is talked about..

In the cases relating to iron ore rates from Lake Erie ports, which have been pending for some time, the Interstate Commerce Commission on Sept. 5 ruled that rates on shipments and division of districts in Pennsylvania, Ohio, Kentucky and West Virginia were unreasonable and illogical. The commission ordered a revision of the charges and also ordered the railroads to establish separate charges for storing one on the docks, for dock services and for switching and other services on private tracks.

COKE

Connellsville—The coke market has been very quiet this week. It is possible that many users have laid in stocks ahead in expectation of a railroad strike. This probable accumulation would affect the market and it is not unlikely that coke may be quite plentiful with the pressure for deliveries removed Quotations are practically unchanged. Production was up to the usual mark.

United States Fuel Exports in June were as follows, in gross tons

	1915	1916	Changes	
Anthracite	352,636	515,139	I	162,503
Bituminous	1,933,410	2,065,509	I	132,099
Coke	68,628	89,835	I	21,207
Bunker coal	727,880	727,168	D	712
Total	3,082,554	3,397,651	I.	315,097

The bunker coal or coal taken by ships in foreign trade is practically all bituminous. The chief exports of coal and coke are to Canada.

Chemicals

NEW YORK—Sept. 6

The general markets are steady and rather firm, with a very good demand. Heavy chemicals are generally selling well with few or no price changes.

Arsenic—The tone of the market is slightly firmer. Demand is good and stocks are generally small. Both spot and futures are quoted $6@6.25 per 100 lb., according to size of order.

Copper Sulphate—Demand continues fair and prices are a little firmer. Quotations are $8.25@10.25 per 100 lb., according to size and terms of order

Nitrate of Soda—Reports from South America show production largely above 1915, but somewhat short of 1911 and 1913. For the fiscal year ended June 30, 1916, the total production was 57,715,611 quintals; exports, 55,285,811 quintals, of which 23,181,842 quintals went to the United States Stocks here are large but demand is fair and prices are firm at $3 per 100 lb. for both spot and futures.

Sulphuric Acid—Prices are unchanged at 1c per lb. for 60-deg. acid and 1¼c per lb. for 66-deg acid It is said that some shading has been done on large long time contracts.

Exports and Imports—Imports of sulphur into the United States in June were 3,560 gross tons in 1915, and 1,530 tons in 1916. Imports of pyrites were 85,836 tons in 1915, and 101,874 tons in 1916. Exports of sulphur were 1,657 gross tons in 1915, and 7,374 tons this year

Imports of arsenic in June were 142,225 lb in 1915, and 299,493 lb. in 1916; increase, 157,26[illegible] lb this year

Exports of copper sulphate in June were 14[illegible]268 lb. in 1915, and 2,069,243 lb. in 1916; increase, 1,924,975 lb. this year

Exports of sulphuric acid in June were [illegible]208 lb. in 1915, and 9,421,735 lb. in 1916; increase, 3,190,527 lb. this year

Imports of nitrate of soda in June were [illegible],076 gross tons in 1915, and 133,098 in 1916; increase, 10,022 tons this year.

Assessments

Company	Delinq.	Sale	Amt.
Alta Silver, Nev	Sept. 1	Sept. 25	$0.03
Beaver Gold, Utah	Aug. 19	Sept. 16	0.01
Beaver Mines, Utah	Sept. 30	Oct. 21	0.0025
Blue Star, Ida	Sept. 25	Oct. 21	0.02
Cash Boy, Nev	Sept. 1	Oct. 15	0.01
Challenge, Nev	Aug. 23	Sept 13	0.05
Coal Creek, Ida	Aug. 25	Sept 26	0.005
Con. Virginia, Nev	Sept. 29	Oct. 20	0.05
Crown Point, Utah	Sept. 16	Oct. 10	0.005
Eagle Mountain, Ida	Oct. 2	Nov. 4	0.001
Exchequer, Nev	Sept. 5	Sept. 26	0.03
Emerald, Utah	Aug. 15	Sept. 9	0.00½
Fortuna, Utah	Aug. 25	Sept 14	0.005
Friend, Ida	Aug. 26	Sept. 16	0.002
Great Bend, Nev.	Aug. 15	Sept. 20	0.01
Great Western, Nev	Sept. 26	Oct. 18	0.01
Hector, Ida.	Aug. 7	Sept. 15	0.005
Idaho-Nevada, Ida	Sept. 14	Oct. 14	0.002
Jacket-C Point-Belcher, Nev.	Aug. 14	Sept. 7	0.05
Nevada-Stewart, Ida.	Aug. 3	Sept. 2	0.003
Nevada Zinc, Nev.	Aug. 14	Sept. 2	0.01
Old Veteran, Ida	Sept. 9	Oct. 7	0.002
Ophir, Nev.	Aug. 16	Sept. 6	0.05
Paloma, Utah	Aug. 21	Sept. 9	0.01
Phedora, Ida	Aug. 29	Sept. 29	0.001
Rio Grande Grubstake, Nev.	Sept. 22	Oct. 31	0.002
Sandstorm Kendall, Nev	Aug. 22	Sept. 26	0.01
Santaquin Chief, Utah	Sept. 11	Sept. 21	0.0025
Santaquin King, Utah	Sept. 11	Sept. 21	0.0025
Sells, Utah	Sept. 21	Oct. 7	0.06
Silver Pick, Nev	Sept. 25	Oct. 30	0.01
Smuggler, Utah	Sept. 20	Oct. 18	0.005
Springfield Tunnel, Calif.	Aug. 15	.....	0.05
Syndicate, Utah	Sept. 18	Oct. 14	0.0015
Tar Baby, Utah	Aug. 3	Sept. 4	0.01
Tyler, Ida	Sept. 12	Oct. 12	0.0015
Umatilla, Nev	Sept. 18	Oct. 24	0.0025
Uvada, Nev	Oct. 9	Oct. 26	0.02
West Toledo, Utah	Sept. 12	Oct. 3	0.01
Whale, Utah	Sept. 5	Sept. 25	0.05
Wolf Mt. Copper, Utah	Aug. 2	Sept. 6	0.005
Wonderful, Ida	Aug. 30	Sept. 20	0.001

Stock Quotations

SAN FRANCISCO Sept. 5

Name of Comp.	Bid.
Alta	.05
Andes	.08
Best & Belcher	.05
Bullion	.01
Caledonia	.35
Challenge Con	.03
Confidence	.15
Cons. Imperial	.01
Con Virginia	.11
Gould & Curry	.02
Hale & Norcross	.05
Jacket-Cr. Pt	08
Mexican	.16
Occidental	.70
Ophir	24
Overman	‡ 04
Savage	.06
Seg Belcher	02
Sierra Nevada	29
Union Con	.67
Utah Con	01
Belmont	4 25
Jim Butler	.85
MacNamara	.04
Midway	17
Mont.-Tonopah	24
North Star	.19
Rescue Eula	.20
West End Con	.70
Atlanta	.09
Blue Bell	.01
Booth	.12
C O.D. Con	02
Comb. Frac	.06
D'field B.B	02
D'field Daisy	.03
Jumbo Extension	41
Round Mountain	.9
Sandstorm Kendall	05
Silver Pick	.18
Central Eureka	.07
Argo	.10
Ariz. Central	15
Big Jim	1 10
Lazy Boy	12
Oatman No. Star	‡ 10
Tom Reed	1 60
United Eastern	3 87½
United Western	08

LONDON Aug. 21

	£	s	d
Alaska-Mexican	£1	6s	3d
Alaska Tre'dwell	5	15	0
Burma Corp	3	4	0
Cam & Motor	0	11	6
Camp Bird	0	8	6
El Oro	0	9	0
Esperanza	0	11	6
Mexico Mines	3	10	0
Nechi, pfd	0	13	0
Oroville	0	16	9
Santa Gert'dis	0	13	0
Tomboy	1	2	6

SALT LAKE Sept. 1

Name of Comp.	Bid.
Alta Con	27
Black Jack	04½
Colorado Mining	15
Crown Point	03¼
Daly-Judge	8 00
Emma Cop	59
Gold Chain	18
Grand Central	55
Iron Blossom	1 50
Lower Mammoth	.05
May Day	09½
Opohongo	.01
Prince Con	1.40
Seven Troughs	02¾
Silver King Coal'n	2 87½
Silver King Con	3.45
Sioux Con	09½
Uncle Sam	03¼
Yankee	10

COLO. SPRINGS Sept. 5

Acacia	03⅞
Doctor Jack Pot	.10½
Elkton Con	.15½
El Paso	64
Findlay	03¾
Gold Sovereign	06
Golden Cycle	2 13
Granite	.73
Isabella	19⅞
Jack Pot	05½
Jerry Johnson	.04
Mary McKinney	26
Portland	1.65
Vindicator	1 90

TORONTO Sept. 4

Adanac	‡.75
Bailey	07¾
Chambers Ferland	18
Coniagas	4 55
La Rose	60
Peterson Lake	22
Right of Way	05½
Seneca Superior	25
T. & Hudson Bay	55 00
Temiskaming	60
Trethewey	‡ 21
Wettlaufer-Lor	12
Dome Exten	06
Dome Lake	43½
Foley O'Brien	55
Hollinger	6 95
Jupiter	28½
McIntyre	1 39
Newray	66
Porcu. Crown	79
Preston E. D.	‡ 03
Vipond	.40½
West Dome	.39

N. Y. EXCH. Sept. 5

Name of Comp.	Clg.
Alaska Gold M	12½
Alaska Juneau	7¼
Am.Sm.&Ref.,com	101⅞
Am. Sm. & Ref., pf.	112½
Am. Sm. Sec., pf. A	96
Am. Sm. Sec., pf. B.	84
Am. Zinc	35¼
Am. Zinc, pf	73
Anaconda	86⅞
Batopilas Min	‡1½
Bethlehem Steel	487
Bethlehem Steel, pf.	135
Butte & Superior	67⅞
Chile Cop	20
Chino	54
Colo. Fuel & Iron.	49¼
Crucible Steel	78½
Dome Mines	24¾
Federal M. & S.	16
Federal M. & S., pf.	35½
Great Nor., ore ctf.	38⅝
Greene Cananea.	48
Homestake	130
Inspiration Con.	58⅞
International Nickel	42⅞
Kennecott	50⅞
Lackawanna Steel	78¼
Miami Copper	35
Nat'l Lead, com	65
National Lead, pf	111
Nev. Consol	21¼
Ontario Min	6⅜
Quicksilver	2⅞
Quicksilver, pf	4½
Ray Con	25
Republic I&S, com	54⅞
Republic I&S, pf	113¾
Sloss-Sheffield	48
Tennessee Copper	25
Utah Copper	84½
U. S. Steel, com	98⅜
U. S. Steel, pf	118½
Va. Iron C. & C	45

N. Y. CURB Sept. 5

Beaver Con	41
Buffalo Mines	.60
Butte & N. Y	1½
Butte C. & Z	5⅛
Caledonia	.56
Can. Cop. Corpn	$1\frac{9}{16}$
Cashboy	.07
Cerro de Pasco	36
Con. Ariz. Sm.	$1\frac{7}{16}$
Con. Coppermines.	2⅛
Con. Nev.-Utah.	.25
Crystal Cop	97
First Nat. Cop.	4
Florence	.70
Goldfield Con	77
Goldfield Merger	.08
Granite	20
Hecla Min	$4\frac{15}{16}$
Howe Sound	5
Jerome Verde	$1\frac{3}{16}$
Joplin Ore & Spel	54
Kerr Lake	4¾
Magma	16¼
Majestic	⅝
McKinley-Dar-Sa	.60
Mother Lode	.37
Nevada Hills	.16
N. Y. & Hond	15¼
Nipissing Mines	7⅛
Oro	.03
Ray Hercules	3⅜
Rochester Mines	.57
St. Joseph Lead	16⅞
Standard S. L.	1⅜
Stewart	.25
Success	.34
Tonopah	5⅜
Tonopah Ex	5⅛
Tribullion	$\frac{5}{16}$
United Zinc	4½
White Knob, pf	1⅞
White Oaks	4⅛
Yukon Gold	2

BOSTON EXCH Sept. 5

Name of Comp.	Bid
Adventure	2½
Ahmeek	101
Algomah	1½
Allouez	68
Ariz. Com., ctfs.	9½
Bonanza	.25
Butte-Ballaklava	$\frac{9}{16}$
Calumet & Ariz	72¼
Calumet & Hecla	540
Centennial	18
Copper Range	61¾
Daly West	2¼
East Butte	16⅞
Franklin	7½
Granby	85½
Hancock	14
Helvetia	40
Indiana	3½
Island Cr'k, com	43
Island Cr'k, pfd	88½
Isle Royale	28
Keweenaw	5
Lake	12⅞
La Salle	4
Mason Valley	‡2¼
Mass	13
Mayflower	3⅜
Michigan	3¾
Mohawk	90½
New Arcadian	6½
New Idria	13
North Butte	21½
North Lake	1½
Ojibway	1½
Old Colony	1⅜
Old Dominion	69¼
Osceola	88½
Quincy	85
St. Mary's M. L.	74½
Santa Fe	1⅞
Shannon	8¾
Shattuck-Ariz	28¾
So. Lake	6¼
So. Utah	.20
Superior	15½
Superior & Bost	3⅞
Tamarack	37¼
Trinity	5¾
Tuolumne	.40
U. S. Smelting	72⅞
U. S. Smelt'g, pf	51
Utah Apex	$3\frac{15}{16}$
Utah Con	14¼
Utah Metal	7¾
Victoria	3¼
Winona	5
Wolverine	54½
Wyandot	1¼

BOSTON CURB Sept. 5

Bingham Mines	9¼
Boston Ely	.94
Boston & Mont	76
Butte & Lon'n Dev.	.59
Calaveras	5¾
Calumet-Corbin	.02
Chief Con	1⅞
Cortez	.34
Crown Reserve	.47
Davis-Daly	$2\frac{1}{16}$
Eagle & Blue Bell	1¾
Houghton Copper	1½
Iron Cap Cop., pf	5½
Mexican Metals	.36
Mines of America	2¼
Mojave Tungsten	3¼
Nat. Zinc & Lead	$1\frac{5}{16}$
Nevada-Douglas	1¼
New Baltic	2
New Cornelia	14¾
Ohio Copper	.07
Oneco	.80
Raven Copper	07
Rex Cons	.20
Rilla	.17
United Verde Ext	37

‡Last Quotations.

Monthly Average Prices of Metals

SILVER

Month	New York			London		
	1914	1915	1916	1914	1915	1916
January	56.572	48.855	56.775	26.553	22.731	26.960
February	57.606	48.477	56.755	26.573	22.753	26.975
March	58.067	50.241	57.935	26.788	23.708	27.597
April	58.519	50.250	64.415	26.958	23.709	30.662
May	58.175	49.915	74.269	26.704	23.570	35.477
June	56.471	49.034	65.024	25.948	23.267	31.060
July	54.678	47.519	62.940	25.219	22.597	30.000
August	54.344	47.163	66.083	25.979	22.780	31.498
September	53.290	48.680	......	24.260	23.591	......
October	50.654	49.385	......	23.199	23.925	......
November	49.082	51.714	......	22.703	25.094	......
December	49.375	54.971	......	22.900	26.373	......
Year	54.811	49.684	......	25.314	23.675	......

New York quotations cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

COPPER

Month	New York		London			
	Electrolytic		Standard		Electrolytic	
	1915	1916	1915	1916	1915	1916
Jan.	13.641	24.008	60.756	88.083	65.719	116.167
Feb.	14.394	26.440	63.494	102.667	*	133.167
Mar.	14.787	26.310	66.152	107.714	*	136.000
April	16.811	27.895	75.096	124.319	*	137.389
May	18.506	28.625	77.600	136.457	*	152.622
June	19.477	26.601	82.574	112.432	95.333	137.455
July	18.796	23.865	76.011	95.119	91.409	125.500
Aug.	16.941	26.120	68.673	110.283	82.333	126.304
Sept.	17.502	....	68.915	....	85.250	....
Oct.	17.686	....	72.601	....	88.000	....
Nov.	18.627	....	77.744	....	93.273	....
Dec.	20.133	....	80.773	....	100.43	....
Year.	17.275	......	72.532	......	......	......

TIN

Month	New York		London	
	1915	1916	1915	1916
January	34.260	41.825	156.550	175.548
February	37.415	42.717	176.925	181.107
March	48.426	50.741	180.141	193.609
April	47.884	51.230	166.225	199.736
May	38.790	49.125	162.675	196.511
June	40.288	42.231	167.636	179.466
July	37.423	38.510	167.080	168.357
August	34.389	38.565	151.440	169.870
September	33.125	..	152.625	....
October	33.080	..	151.554	....
November	39.224		167.670	....
December	38.779	.	167.000	....
Av. year	38.590	.....	163.960	....

LEAD

Month	New York		St. Louis		London	
	1915	1916	1915	1916	1915	1916
January	3.729	5.921	3.548	5.826	18.606	31.167
February	3.827	6.246	3.718	6.164	19.122	31.988
March	4.053	7.136	3.997	7.375	21.883	34.440
April	4.221	7.630	4.142	7.655	21.094	34.368
May	4.274	7.463	4.182	7.332	20.347	32.967
June	6.932	6.936	5.836	6.749	25.170	31.011
July	5.659	6.352	5.531	6.185	24.611	28.137
August	4.656	6.244	4.520	6.088	21.946	29.734
September	4.610	......	4.490	......	23.151	......
October	4.600	......	4.499	......	23.994	......
November	5.155	......	5.078	......	26.278	......
December	5.355	......	5.266	......	28.807	......
Year	4.673	......	4.567	......	22.917	......

SPELTER

Month	New York		St. Louis		London	
	1915	1916	1915	1916	1915	1916
Jan.	6.386	16.915	6.211	16.745	30.844	89.810
Feb.	8.436	18.420	8.255	18.260	39.819	97.762
Mar.	8.541	16.846	8.360	16.676	44.141	95.048
April	10.012	16.695	9.837	16.525	49.888	99.056
May	14.781	14.276	14.610	14.106	68.100	94.217
June	21.208	11.752	21.038	11.582	100.614	68.591
July	19.026	8.925	18.856	8.755	97.250	50.750
Aug.	12.781	8.730	12.611	8.560	67.786	51.587
Sept	13.440	......	13.270	......	67.841	......
Oct.	12.800	......	12.596	......	66.536	......
Nov.	15.962	......	15.792	......	88.409	......
Dec.	15.391	......	15.221	......	89.400	......
Year	13.230	......	13.054	......	67.553	......

New York and St. Louis quotations, cents per pound. London, pounds sterling per long ton. * Not reported.

PIG IRON IN PITTSBURGH

Month	Bessemer‡		Basic‡		No. 2 Foundry	
	1915	1916	1915	1916	1915	1916
January	$14.59	$21.60	$13.45	$18.78	$13.90	$19.70
February	14.55	21.16	13.45	18.93	13.90	19.51
March	14.55	21.81	13.45	19.20	13.95	19.45
April	14.55	21.65	13.45	18.95	13.95	19.45
May	14.61	21.78	13.60	19.11	13.83	19.58
June	14.70	21.95	13.67	18.95	13.77	19.34
July	14.94	21.95	13.91	18.95	13.68	19.20
August	16.01	21.95	15.31	18.95	14.75	19.25
September	16.86	......	15.95	......	15.70	......
October	16.95	......	15.96	......	15.80	......
November	17.57	......	16.47	......	17.20	......
December	19.97	......	18.44	......	18.95	......
Year	$15.82	......	$14.76	......	$14.95	......

‡As reported by W. P. Snyder & Co.

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Nashwauk Iron-Washing Plants

By L. A. Rossman*

SYNOPSIS—Since the success of the Trout Lake concentrator, with a capacity of 40,000 tons of iron ore per day, has been demonstrated, a number of concentrators similar in design but of smaller capacity have been erected. At Nashwauk the four concentrators are operated by the M. A. Hanna, the Cleveland-Cliffs, the Wisconsin Steel and Butler Bros. companies. The process in general use is practically the same as that originally installed at the Trout Lake. Recently La Rue has installed Wetherbee concentrators to replace turbos and concentrating tables.

On the western part of the Mesabi Range there are great deposits of iron ore which contain a large amount of sand since the natural process of leaching or concentrating has not removed the silica from the ore. There are many millions of tons of this ore that can be easily and cheaply mined by the openpit method, but which have value only after it has been treated to remove much of the sand. To evolve a process that would remove this silica has taken years of experimentation. It was 12 or 15 years ago that a carload of ore from the Arcturus mine, near Marble, was sent to Georgia to be washed, and the results of this preliminary experiment being satisfactory, an experimental plant was built in 1905 by the Oliver Iron Mining Co., at Coleraine, in the Canisteo district. This was built under the supervision of John C. Greenway, now general superintendent of the Calumet & Arizona Copper Co. The experimental plant proving successful, a larger one was constructed in 1909 and this, the Trout Lake concentrator, has a capacity of close to 40,000 tons of crude ore a day.

At Nashwauk much of the ore is high in silica, and as a result, all the mining companies now operating have their own concentrating plants. The four operating companies at Nashwauk are: The M. A. Hanna Co., operating La Rue; the Cleveland-Cliffs interests, the Crosby; the Wisconsin Steel Co., the Hawkins; and Butler Bros., the Harrison. Practically all the ore is removed by the openpit method and nearly all of the production of these various mines is washed or concentrated. Three of the washing plants—those at the Harrison, Hawkins and Crosby mines—are similar in the general process employed and, with the exception of certain details of practice, the general method used at the Trout Lake concentrator is followed. La Rue mine follows a somewhat different process, which is discussed at length later in this article.

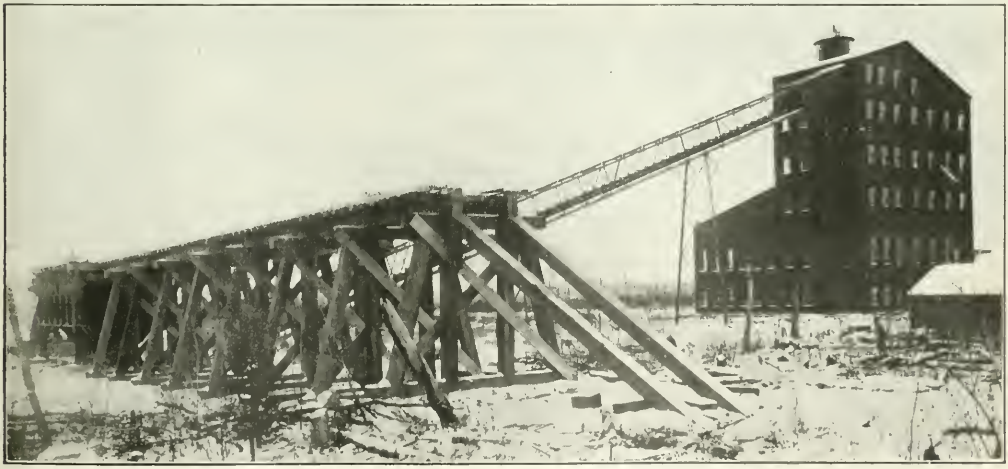

FIG. 1. CROSBY IRON-CONCENTRATION PLANT AT NASHWAUK

The washing plants at Nashwauk are of interest because they are attempting the concentration of ore on a smaller scale than that at Coleraine. The Crosby is called a half-unit plant, while the Hawkins and Harrison concentrators are called one-unit plants and have a capacity of about one-fifth that of the Trout Lake mill.

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*Grand Rapids, Minn.

A description of the Crosby plant will make clear the characteristics of the Hawkins and the Harrison. The ore is taken from the mine and dumped from a 20-ft. trestle into two bins, shown in Fig. 1, from which it is fed to a conveyor belt by two Stevens-Adamson apron feeders. This conveyor belt is 30 in. wide, 219 ft. long, slopes 20° and discharges into the mill at a height of 69 ft. above ground. The ore discharges, into the trommel from the conveyor, which has perforations 2 in. in diameter. The oversize discharges to the shipping bins, and the undersize passes into a log washer, shown in Fig. 2, which is 25 ft. long, 6 ft. wide and 3 ft. deep, and is of the Greenway-Hutch type. At the bottom of the log washer the ore meets a strong current of water under pressure, which prevents the materials from lying at the bottom. The paddles break up the ore, and the heavy flow of water carries part of the lighter material over the lower end of the machine, while the heavier ore particles are forced by the action of the paddles toward the upper end and discharge to the shipping bin.

The overflow from the lower end of the log washer is conducted into what are called "turbos." A turbo is constructed similar to a log washer, but is somewhat smaller in its dimensions. The one at the Crosby plant is 18 ft. long. The overflow from the turbos is fed to a series of Overstrom concentrating tables of Allis-Chalmers make, shown in Fig. 3. The tables make an iron product that flows to the shipping bins, while the lighter and sandy material is discharged to waste.

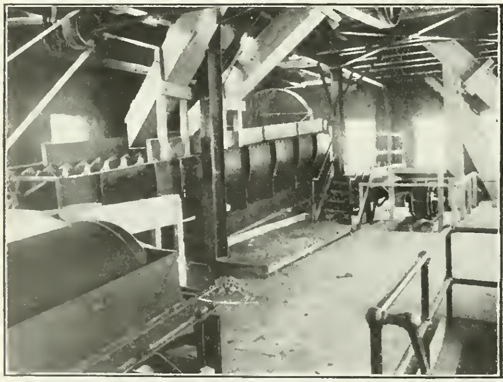

FIG. 2. LOG WASHER AND CHIP SCREEN

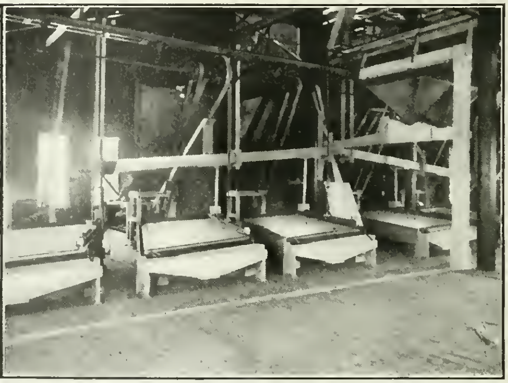

FIG. 3. OVERSTROM CONCENTRATING TABLES

Machinery Equipment of a Mill Unit

Such is the process in general. There are several variations of this in the three plants operating with this type of equipment. There is, for instance, a difference in size of the various plants. The Harrison and Hawkins plants, of one-unit capacity, comprise one trommel, two 25-ft. log washers, four turbos and a varying number of tables. A half-unit plant comprises only a trommel, one log washer, two turbos and a smaller number of tables. The Crosby plant is so constructed that additional machinery can be installed to make it of one-unit capacity, just as the Butler plant, which was built last year, was changed from one-half to one unit during the past winter.

At all the plants at Nashwauk the ore is conveyed by belts to the top of the building, while at the Coleraine plant it is dumped directly from the cars into the top of the structure. A difference in the iron-ore formation, of course, calls for variation in the equipment. At the Crosby plant, for instance, a picking belt is used, which is not found at the Harrison plant. This is 20 ft. in length and 30 in. wide. The rock and useless material is picked from the belt, and the ore to be crushed is sent to a 7x10-in. Blake crusher of Allis-Chalmers make.

A chip trommel with ¼-in. perforations is another feature of the Crosby plant, shown in Fig. 2, receiving the discharge from the log washer.

At the Butler plant the chunks of ore too large to pass through the grizzlies onto the apron feed to the inclined belt conveyor, were formerly crushed in a large gyratory crusher, but this was removed in the early part of the present season.

The number of concentrating tables is another feature at the Crosby plant. There are five single-deck Overstrom tables for the one-half unit. At the Hawkins plant, 18 double-deck Overstrom tables for use in the one unit were installed last season, and at the Harrison plant the present equipment includes 12 double-deck tables for the unit. The number of tables is of course regulated by the degree of concentration desired.

All the plants are of steel construction. The Crosby plant, which is typical in size of the others, is a steel structure with dimensions of 62x67 ft. and has an extreme height of 81 ft. The machinery is all of Allis-Chalmers manufacture.

The capacity of a one-unit washing plant is about 5,000 tons of concentrates per 24-hr. day. This is now the approximate production at the Hawkins plant, and it may be considered the standard for a mill of this size.

Wetherbee Concentrators at La Rue Mill

At La Rue plant of the M. A. Hanna interests the ore is washed by a method different from those used in the three other plants. La Rue plant has been so far largely an experimental one. The process involves the use of a log-washer and Wetherbee concentrators. The ore is dumped from the cars into bins and is fed onto a 24-in. belt conveyor with the apron feeder. Upon discharge at the top of the mill the ore is screened through a trommel of 5-ft. diameter with 1-in. perforations. Its undersize discharges to a log washer, whose overflow passes to a 6-ft. Wetherbee concentrator, whose overflow in turn passes to a 3-ft. Wetherbee. The feature of the process is the use of this type of machine in place of turbos and concentrating tables.

The Wetherbee concentrator is designed to simplify he iron concentration process and do the work now done by turbos and tables. The machine, as shown in Fig. 4, onsists of a cylindrical drum carried on a vertical shaft vithin an outer casing. The shaft is driven from above. The drum compartment receives the ore to be washed ınd discharges it by centrifugal force through openings nto the annular space between the drum and casing.

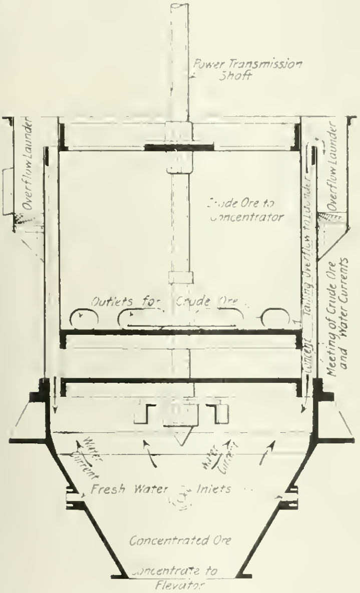

FIG. 4. WETHERBEE CONCENTRATOR

he casing has an overflow launder at the top and is bolted the bottom to a water-tight compartment connected ith the boot of an elevator. The required water enters the base of the machine, rises through the annular space tween the revolving drum and the casing, and disarges into the overflow launder at the top of the casing.

Centrifugal Force Reduces Water Consumption

The work of the machine is based on the following prinple: If, during a second of time, a particle of ore ttles 4 in., while a particle of quartz settles only 2 in., is evident that in order to separate these two particles means of an upward current of water, a current of newhere between 2 and 4 in. per second would be reired, or say 3 in. per second. Assuming that these same o particles are placed in the Wetherbee concentrator and revolving drum given such a velocity that the quartz rticle remains in suspension, traveling in a given horiıtal plane, the heavier ore particle in the same length time will settle, say 1 in. It is then evident that the slightest upward flow of water will wash out the particle of quartz and still allow the particle of ore to settle, and that the same results are secured by the use of this machine with an upward flow of, say, only $\frac{1}{16}$ in. per sec. as could be secured by upward current alone with a flow of 3 in. per sec., or in other words, with the use of $^1/_{16}$ of the amount of water. The fact that the whirling current can be controlled independently of the velocity of the upward rising current allows an exact and independent control over the material that goes into the overflow or into the concentrates, by changing either the speed of the drum or the amount of water used.

La Rue is the only concentrating plant of this type on the Mesabi Range, and its results with Wetherbee concentrators will be watched with interest.

The washing of iron ore means more than most people probably realize. It has only been through the employment of the methods described that the development on the western Mesabi has been permitted. The evolution of the concentrating process has allowed the development of iron-ore deposits that have brought millions to the owners, to the operators and to the public. Today every mine west of Keewatin has all or part of its ore treated in some such manner. Probably during this season no less than 40,000 tons of concentrate per day is being shipped, and there is no doubt that if other properties are opened up and become shippers, other plants will be constructed. How they will differ from those of Nashwauk will of course be a matter of speculation. One might say that there has been little or no difference, except in details developed in the concentrating process since the Trout Lake concentrator was built. The Wetherbee process is the only variation that involves anything entirely new.

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Radium Production in Bohemia

In the mining of uranium ore in Bohemia, 25,720 lb. of uraninite prepared for smelting, having an average value of $471.50 per 100 lb., was produced in 1915, according to the United States Commerce Report. Of the different uranium compounds, there was produced in the Government mine in Joachimsthal 2,325 lb. of an average value of $252.50 per 100 lb.

The Government factory for radium compounds produced compounds containing 1.751 grams (27.07 grains) of radium elements having a total value of $209,361.50. The radium production in 1915 represented an increase of 0.879 gram (13.57 grains) as compared with the production in 1914, the value of which shows an increase of $100.000.

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German Substitutes for Copper

War substitutes for the 6% by weight of copper, which on the average goes into the manufacture of a German locomotive, are reported, according to *Iron Age*, Aug. 10, 1916, to be in part as follows: The fireboxes and stays are now made of cast iron. All the smoke and steam tubes and the oiling cocks and thin pipes are of weldless drawn steel. For the rod bracings, axles, greasboxes and the bracing parts, the difficulty is believed to have been overcome by using cast iron and a special alloy called flange metal, which is a mixture of tin, lead and antimony. It is regarded as possibly dangerous to use this metal unless the pins and axle journals are previously bushed with white metal. Cast iron is used for piston boxes, side-valve rods, frames and lubricators, lubricator covers and step bearings. Bronze covered with vulcanized rubber, which was the standard metal for the various handwheels, is being replaced by cast-iron wheels covered with ordinary string or jute fabric. German engineers are now experimenting with a new rolling process for preparing the flange metal referred to, having an equivalent of bronze, which will dispense with antimony.

American Institute of Mining Engineers in Arizona

The meeting of the American Institute of Mining Engineers, which convenes in Arizona on Monday, Sept. 18, promises to be a noteworthy one in the annals of the Institute. Geographically the selection of Arizona as a meeting place is particularly fortunate, since it is in the center of a highly modernized mining and metallurgical district that has abundant examples of the most recently developed methods both of mining and of metallurgy. Particularly will engineers be enabled to see and study the best applications of recent methods of fine-grinding of ores and also some of the best applications of the flotation process.

The leading metal-producing companies of all sections of the country will be represented by members of their staff, who will make the trip primarily for the purpose of acquiring valuable information. The country's record production of metals during the last year has greatly stimulated the interest in those general mining topics that will be discussed at the Institute's sessions. The great advance in copper production will promote interest in the huge porphyry copper mines of Arizona.

It is said that more than twenty corporations will be represented by Institute members, who may participate in the technical discussions. Among these are the Anaconda Copper Mining Co., the largest copper-producing corporation of this country; the American Smelting and Refining Co., the largest lead-producing company; the Ray Consolidated Copper Co., the Treadwell and Alaska-Juneau mines, the Miami Copper Co., and the New Jersey Zinc Co.

Many of the most prominent engineers of the profession will be present, among whom may be mentioned: Dr. L. D. Ricketts, president of the American Institute of Mining Engineers; B. B. Thayer, of the Anaconda Copper Mining Co.; William L. Saunders, Sidney J. Jennings, George D. Barron and Philip N. Moore, of St. Louis. A special train has been provided for the party from New York and vicinity and will become the traveling headquarters, moving from point to point in Arizona each day during the week of the convention.

A great many interesting papers have been prepared for discussion at the meeting. A total of about seventy are to be considered, most of which bear largely upon new methods of production and the mining outlook in various parts of the world. Some of the interesting papers that may be mentioned are: "Automatic Operation of Mine Hoists as Exemplified by the New Electric Hoists for the Inspiration Copper Co.," by H. Kenyon Burch and M. A. Whiting; "The Water Problem at the Old Dominion Mine," by P. G. Beckett; "Power Plant of the Burro Mountain Copper Co.," by Charles Legrand; "Geology of the Warren Mining District," by Y. Bonillas, J. B. Tenney and Leon Feuchere; "Flotation Concentration at Anaconda, Mont.," by Frederick Laist and Albert E. Wiggin; "History of the Flotation Process at Inspiration," by Rudolf Gahl; "The Advent of Flotation in the Clifton-Morenci District, Arizona," by David Cole; "Comparative Test of the Marathon, Chilian and Hardinge Mills," by F. G. Blickensderfer; "The Inspiration Plant, Concentrator and Other Surface Equipment," by H. Kenyon Burch. The first technical session, to be held on Sept. 19, will take up the subjects of "smelting" and "leaching."

All these papers are of exceptional interest to the mining profession at this time, and they are all good papers, splendidly written and highly informative. The visitors at the meeting are exceptionally fortunate in the program that has been offered to them, and to those who are so unlucky as not to be able to attend, the papers as printed by the Institute will constitute a record of great value and of extreme interest.

Antimony Deposits in Alaska

The considerable demand for antimony during the last year has stimulated the development of certain Alaskan deposits of ore of that metal, from which ore to the value of about $74,000 was mined and shipped during 1915. Stibnite, the sulphide of antimony, has been noted at 67 localities in Alaska, but only a few of these have produced and marketed ore. In 1915 the production of antimony ores was begun at four mines in the Fairbanks and at two in the Nome district. All the operations were small and most of them consisted of digging out the rich ore near the surface by opencuts and of breaking and hand-sorting it.

These deposits form the subject of a report recently published by the United States Geological Survey, Bulletin 649, a volume of nearly 70 pages, entitled "Antimony Deposits of Alaska," by A. H. Brooks.

According to this report the Alaskan antimony deposits may be divided into three principal groups—siliceous gold-bearing stibnite lodes, stibnite-cinnabar lodes, and stibnite-galena lodes. Each of the first two of these groups is further divided, according to structure, into fissure veins, shear vein deposits and stockworks. A free copy of this report may be obtained from the Director, Geological Survey, Washington, D. C.

Powers of Miners' Unions

By A. L. H. Street*

In denying the right of the Western Federation of Miners to compel a local miners' union to perform a contract to transfer its property to plaintiff the United States District Court for the district of Montana lately decided that a union organized under the laws of that state for the purpose of furthering the interests of its members was without authority under its charter to surrender its powers to the Federation, subordinating itself to the control of that association and agreeing to forfeit its property to the Federation in the event of secession or expulsion therefrom. (Moyer vs. Butte Miners' Union, 232 Federal Reporter, 788.)

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*Attorney at law, 829 Security Building, Minneapolis, Minn

Stoping Methods at Miami*

SYNOPSIS—The mining of an orebody of 2,300,000 tons estimated content, of which 95% was won, is described. Body developed by levels and sublevels. Shrinkage stoping was used, leaving 50-ft. pillars for support. Final stage consists in removing the pillars. Stoping starts at the lowest level and proceeds upward while pillar mining starts at the top sublevel and proceeds downward. Distribution of weight during operations is discussed.

The relatively hard character of the ground in the western section of the property of the Miami Copper Co., Miami, Ariz., made it advisable to use a wide shrinkage-stope and pillar system of mining. The system as finally evolved was applied to the mining of 2,300,000 tons of ore by the use of stopes and pillars each 50 ft. in width. Development, mining and extraction of this orebody has been continuously in progress since 1910, and the final stages of extraction are now reached. A complete survey of all phases of this system can therefore be made. Modification in working methods was obviously necessary, and the system to be described is believed to be typical of the best features.

Development by Levels, Sublevels and Drifts

The preliminary work had three main objects: The opening of a haulage level, the construction of a drawing-off level, and the driving of sublevels for use in stoping. In addition to these, some extra sublevel drifting was necessary to determine exactly the boundaries of the orebody, the general outline having been determined by churn drilling. This development was based on the requirements of stopes 50 ft. wide, with pillars 50 ft. wide between each stope. The length of these units varied from 200 to 500 ft.

The tramming, or haulage, level was 50 ft. below the floor of the stopes and parallel to the longer axis. These lines were also beneath the middle of the stopes and pillars. Each line therefore served one stope and one pillar, this arrangement making it possible to load along an entire stope without switching or uncoupling. This advantage is apparent principally during the process of stoping when rapid drawing of excess broken ore is desirable. Furthermore, the arrangement of the drawing-off level chutes at 25-ft. intervals, as shown by Figs. 1 and 2, makes this arrangement of the haulage level necessary for a minimum of development. The drawing chutes were all on one side of the drift, each chute terminating in the drawing-off level 25 ft. above the tramming level. With each chute having a capacity of 15 tons, a block of seven, therefore, held a little more than the normal trainload of 100 tons. All chutes were of standard design, of the flat-gate or guillotine pattern with hand-operated levers. Rocks greater than 10 in. in size were seldom delivered from them, and chute blasting was practically eliminated on this level. With cars of 3½ tons capacity, the loading rate was from 3 to 5 tons per minute.

In the timbering of the haulage level, 10x10-in. timber was used almost entirely, sets being spaced at 6-ft. 3-in. centers. The standard set which is in use at present requires a 9-ft. post and 8-ft. cap, the posts being hitched in the ground 7½ in. below the ball of rail. All drift-set posts are set at a batter of 1½ in. per ft.

A distinctive feature of this system was the drawing-off level, 25 ft. above the tramming level. This was used for handling all stope and pillar ore from raises which perforated the stope floors, and delivering this ore through grizzlies to the tramming chutes. The primary drawing raises, as shown in Fig. 3, branch from each side of the drift and deliver directly into the chutes. The secondary, or intermediate, raises used extensively in the pillars were midway between these chutes, and delivered to them by means of inclined slides.

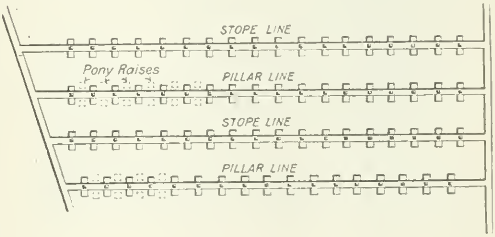

FIG. 1. PLAN OF DRAWING-OFF LEVEL

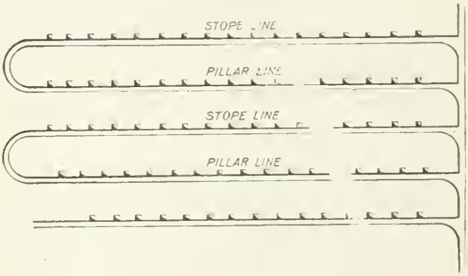

FIG. 2. PLAN OF TRAMMING LEVEL—SAME AREA AS FIG 1

The drawing-level drifts were driven parallel to the haulage drifts, with a fringe drift at each end to provide entry and ventilation. Stope drawing lines were directly under the center of the stopes, so that the raises were symmetrical. Pillar drawing lines were generally 5 ft. south of the long pillar axis for convenience in putting up vertical development raises through the pillars. This arrangement was later modified, so that symmetrical raises were also possible in the pillar lines.

The pocket chutes into which the ore was drawn from the stope raises were all cribbed, 5 ft. square in the clear, 6x8-in. and 8x8-in. cribbing being used. Experience showed that the 8x8-in. size was the most economical over a long period. The life of this cribbing was variable on account of the quality of the ore, a representative group of chutes showing a cribbing life of 12,430 tons each.

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*Paper to be read at Arizona meeting of A. I. M. E., September, 1916, by David B. Scott, mine efficiency engineer at Miami Copper Co.

To eliminate boulders in the tramming chutes, grizzlies were placed over the collar of these chutes on the drawing level. The grizzly opening was 18 in. square. It was found to be highly desirable to have these grizzlies placed several inches above the collar of the raise to permit easy working when ore hangs up on the grizzly. It was also found to be best practice to have the opening in the grizzly not less than 18 in. square directly below the lip of the chute, as this is the point where "hanging up" on the grizzly starts. The design of the drawing raises in the stopes from the drawing-off level to the stope floor differed slightly from those in the pillars.

From the floor of the drawing level, inclined raises on each side of the drift were run up to the edges of the stope, and then funneled. Vertical center raises through the roof of the drift were originally employed, but their effectiveness is rather doubtful, and they are both difficult and awkward to draw. This arrangement gave sets of two raises in one plane along every 25 ft. of stope. Funneling of these raises to a top diameter of 20 ft. gave a practically continuous perforation of the floor of the stope. The raises were in general 6x6 ft. at the bottom. The back or hanging wall, constituting part of the roof pillar between the drawing level and the stope floor, had a tendency to collapse under weight, but this proved rather an advantage in providing a larger opening for the drawing of the stope ore. Timbering inside of these drawing raises for support of this brow was therefore unnecessary.

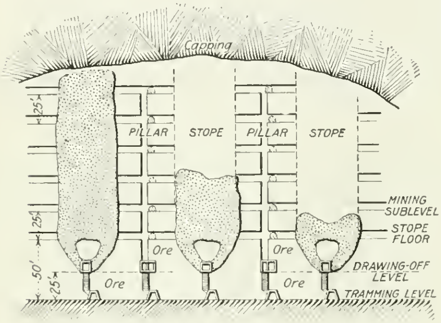

FIG. 3. CROSS-SECTION THROUGH STOPE PILLARS

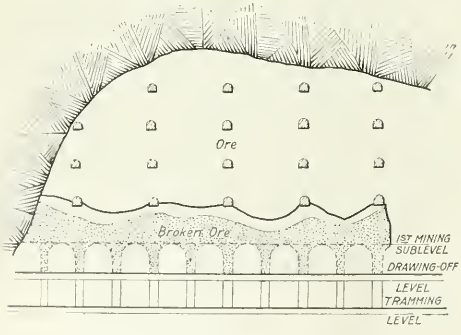

FIG. 4. SECTIONS OF STOPE DURING MINING

Later practice provided raises in the pillars of the same general type as those found in the stope, but their planes were not in a continuous line with the planes of the stope couples, but midway between them, as shown in Fig. 5. The earlier type of arrangement, with stope and pillar raises all in the same plane, was also extensively used and is shown in plan in Fig. 5, 1 and 2. This arrangement is probably not as effective in drawing, however, as the other.

An additional arrangement, and one largely used in the drawing of 500,000 tons of pillar ore, made use of intermediate raises. These were located 12½ ft. from the regular raises. To provide outlet for the ore, these were put up from "pony sets" in the roof of the drift, and delivered to slides which ran down into the regular 25-ft. pocket chutes. These intermediate raises provided double the ordinary number of openings into the floor of the pillar.

The timbering requirements of this level have shown that the drifts can be supported with 10x10 timbers spaced at 5-ft. centers, using 8-ft. posts and 7-ft. caps. This type of timbering remains nearly intact in some of the drawing lines after two years of service. (The chute timber details of the type which gave satisfaction, under conditions of heavy weight and wear of drawing, are shown in Fig. 11.) This set is especially effective in keeping weight from the cribbing in the pocket chutes to the tramming level. Experience has shown that on this level a minimum amount of 2-in. lagging on drift sets should be used, and this should not be placed closer than 2 or 3 in. apart. "Pony-set" timbering for the intermediate chutes required the use of 12x12-in. posts in the sets. An inside height of 8 ft. in these sets was found to be more desirable both for drawing and for repair than a 6-ft. height.

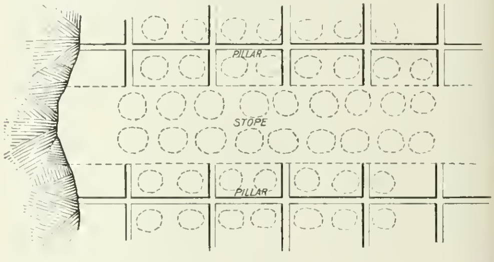

FIG. 5. PLAN OF SHRINKAGE STOPE

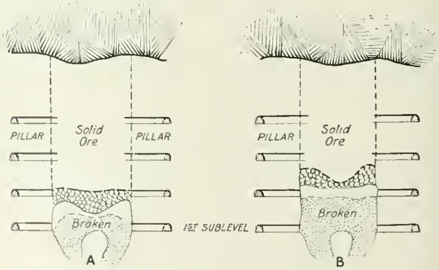

FIG. 6. CROSS-SECTIONS THROUGH STOPE

The provision of means of entry and ventilation for the stopes governed the type of sublevel, or mining-level development. The distance between levels was fixed at 25 ft., and this distance proved to be convenient especially in the later mining of the pillars. Obviously the arrangement of drifts and crosscuts underwent some revision in opening up new ground, and as the nature of the ground became understood, the following type of development seemed to be the best for the mining of wide stopes and pillars:

Along the axis of the pillars, drifts were run to the ore-limits. Crosscuts at 50-ft. intervals were driven each way across the pillars to the stope boundaries. Raises for handling development ore were provided at 50-ft. intervals along the drifts. Although in earlier development crosscuts were driven entirely across the stopes, connecting all of the pillar lines, they came to be regarded as unnecessary in the breaking of the stopes. If we assume therefore that no development is required in the stopes themselves, the combined tonnage of stope and pillar ore served by this development is 67 tons per foot of drift and crosscut, and 400 tons per foot of raise. Considerable secondary crosscutting and raising in addition to this, however, was necessary during the later pillar mining.

MINING IN SHRINKAGE STOPES

The first operation was the funneling of the drawing raises. This was done at first by cutting out a chamber above the raise and drilling 8 and 10 ft. down-holes with water Leyner machines, all around the circumference of the raise. This proved unsatisfactory for the reasons that the holes did not break well, and that it was difficult to drill deep down-holes of nearly vertical pitch with this type of machine. The method used almost entirely was that of setting up in the raise and drilling up-holes with the same machine, in a ring around the raise. This successfully funneled the raise to a diameter of 15 to 20 ft. Continuation of this funneling produced a stope floor perforated with openings which practically touched on the rims across and along the whole stope. Setting up on the broken ore, the ground was squared along the sides of the stope and any stubs between funnels blasted out. The floor of the stope was thus opened out with a back 50 ft. wide and a length of 200 to 500 ft.

Using the entries on the first mining sublevel, drilling was started along each side of the stope. Steel as long as could be swung in the space was used, and holes from 10 to 15 ft. in depth were drilled upward and outward toward the center of the stope. The results of these preliminary rounds, as shown in Fig. 6, were twofold: About half of the distance to the next sublevel entries was broken along the wall of the stope, and a long belly or rib was left in the center of the stope. The principle of caving was therefore made use of to some extent in the breaking of this central rib, which was drilled in the succeeding round. After the first cut, the back was maintained on a flat incline until connection was made with the pillar crosscuts on the level above. Originally some use was made of crosscuts across the stope on the level immediately above the stoping operations, in order to drill down-holes into the back and thus assist the caving of the central portion of the stope. This was not satisfactory, principally because of the difficulty in getting deep holes and in getting a wide enough reach across the back. The results did not justify the extra development expense entailed.

After each drilling shift the excess of broken ore was drawn so as to allow from 6 to 8 ft. of open space between the back and the broken ore. Large blocks of caved ore were "bulldozed" in the stope, when possible, to prevent later plugging of the drawing raises. When connection was made with each successive entry crosscut on the level above, the back and sides were squared up and the stoping continued upward in the same manner. The stopes were carried to a maximum height of 125 ft., it being necessary in most cases to break right through to the capping. In a typical stope of hard ore, the expansion in volume due to breaking, required the drawing of 39% of the ore in the stope, the latter being full to the back at completion.

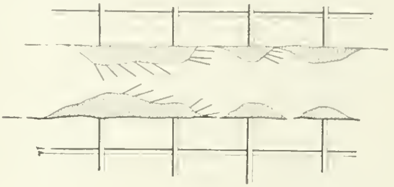

FIG. 7. PLAN OF STOPE, SHOWING DRILLING

Drilling was done with steel from 10 to 16 ft. in length. The maximum footage of holes drilled per shift was 110 ft., and the average from 60 to 80 ft. according to the number of set-ups required.

PILLAR MINING STARTED AT TOP SUBLEVEL

The process of breaking the pillars was practically the reverse of stope breaking. Mining was started at the edge of the ore on the top sublevel and carried downward level by level; in each case the 25-ft. roof pillar was broken through to the broken ore above. This retreating method was desirable for two reasons—it provided a safe exit from working places and it insured an even settling of the capping. As soon as the process was started, even in the hardest ground, speed of working was essential because the pillar took weight as soon as the capping became dislodged. The mining was done successively on three or four levels at a time at different points of attack, the work on each level being 100 ft. nearer completion than the work on the one below it, as shown in Fig. 8.

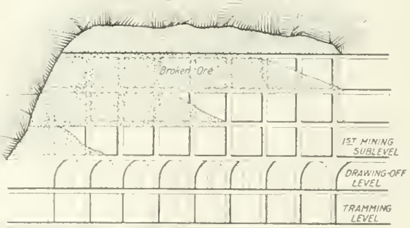

FIG. 8. LONGITUDINAL SECTION THROUGH PILLARS

Preliminary crosscutting halfway between the original crosscuts was generally required to give better drilling faces, especially in the harder pillars. After this crosscutting had been well advanced on the top level, drilling was started at the end of the pillar and across its whole width. Following the first rounds, sufficient broken ore was mucked to give entry on the sloping ore, and machines were set up on the broken ore and long holes drilled in the back. On the top level the ore was not broken nearer than 10 ft. of the capping. Drilling followed strict procedure in retreating from the edges of the pillar toward the central drift, and in the retreat along the central drift as the sides were broken. The roof was carried at a slope of about 45°. All holes were drilled in the same direction—pointing away from the line of retreat to eliminate the chance of drilling into missed holes on the next cut. The original development raises at 50-ft. intervals were used for mucking excess ore, and generally an intermediate series of raises was put up, making the raise interval 25 ft. The final development to tonnage ratio for the completed breaking of stopes and pillars was therefore reduced by this pillar work to 45 tons per foot of drift development, and 200 tons per foot of raise development.

The first round of holes drilled from the level floor broke to about 12 ft. above the sublevel, and the second round on which long steel could be used increased this height above the sublevel to 20 ft. It was common practice to drill through to the broken ore above, but the remaining arch, 5 ft. or so thick, usually caved when the back was arched the whole 50 ft. of pillar width. At the start of this work the experiment was tried of drilling down holes in the floor of the sublevel to a vertical depth of 5 ft., to assist this subsequent caving through from the level below. It was necessary to case the collars of these holes with 3-in. pipe to prevent fitchering. The breaking of these holes was unsatisfactory, so this practice of drilling floor holes was discarded.

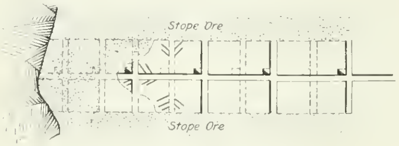

FIG. 9. PLAN OF PILLAR

A very important detail of pillar work was the covering-over of raises as the work retreated past them. Failure to do this properly would defeat the whole system of careful breaking in, allowing the capping to pipe down through the raises. Protection against this running of capping was secured by means of stulls placed in each raise 5 ft. or so below the level on which breaking was being done, these stulls being hitched in the ground and lagged over. When the same raise was reached in the mining retreat on the level below, the process would be repeated and the stull covering above would then be blasted out, allowing the broken ore to fall to the newer and lower raise covering.

Mining on the last, or sill, floor of the pillars was subject to modifications imposed by the "pony-set" raises, which split the distance between the regular 25-ft. raises on each side of the pillar. These raises were funneled in retreat from the end of the pillar, along with the regular raises. This funneling was not carried more than 25 ft. ahead of the pillar breaking, because it virtually undercut the entire width of the pillar. Machine set-ups across the raises for the purpose of drilling the back were made on 10x10-in. stringers which extended across the funnel. This was done to insure against a sudden settling of broken ore in the raise, as occurred occasionally, with consequent danger to the machinemen.

Distribution of Weight During Stope Drawing

Systematic drawing of the broken ore was started when about 70% of all stope and pillar mining had been completed. No drawing was permitted within 100 ft. of any mining operations. Drawing of one stope next to a pillar which was in process of being broken was tried as an experiment, and it caused crushing and swaying of the pillar even in the hardest ground.

The question of weight on the drawing-off level during the drawing period is one of the interesting features of this system. At the outset there was considerable weight in certain definite portions of the drawing-off level, and no weight whatever in other sections. This variation in different sections was due undoubtedly to a combination of the following factors: First, the height of capping above the ore in the northern section averaged 340 ft. with a thickness of broken ore of 125 ft. below it. This gave a total height of ground of 465 ft. in a mobile condition. The southern drawing section had an average capping thickness of 250 ft. and a volume of broken ore a litle over 100 ft. thick, with a total thickness of movable ground of 350 ft. The crushing in the northern section was such as to require complete retimbering in some of the stope lines. In the southern section, the weight was almost negligible; only about 20% of the lineal footage of drawing drifts in this section became heavy enough to require repair for operation. Second, in a small section where complete breaking of the pillars from top to bottom was impossible, there were some blocks of unbroken pillar above the drawing level. The sections of drawing-off drifts below these unbroken areas were always heavy, probably on account of unequal

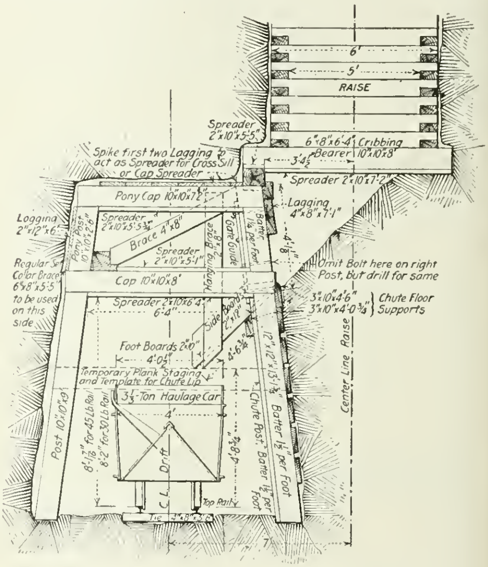

FIG 10. SECTION THROUGH DRIFT AND RAISE

distribution of weight or the concentration of the weight on a few points. Third, when drawing had become developed on a large scale over a considerable area, the weight did not show any increase, but on the other hand it showed a decided tendency to slack off. Upon the completion of drawing in these sections there was little evidence of weight and the drifts remained open. It is likely that the broken mass of capping and ore reached a state of equilibrium, and that the weight became very widely and evenly distributed. It is interesting to note that in one large section where all conditions during mining were satisfactory and the pillar breaking most complete, about 70% of the timber put in three years ago on the drawing-off level still stands.

It is apparent that weight was thrown almost entirely on the drawing drifts and not on the pillars between these drifts, as evidenced by the presence of untimbered crosscuts through these pillars. That the drawing-off level took all the weight so that the tramming level was left intact is shown by the present condition of the latter. Sections of the tramming level beneath badly crushed drawing-level drifts do not even require lagging in the roof, and 8x8-in. drift-set timbers that have been in place nearly five years show no weight. This constitutes one of the most pronounced advantages of the drawing-off level.

The repair cost on the drawing-off level did not exceed 10c. per ton of ore drawn on any one stope or pillar line and went considerably below this cost on the tonnage served by the entire drawing-off level. Repair work was greatly facilitated by the presence of chutes every 25 ft. along the drifts.

Drawing Operations to Prevent Packing

Control of drawing was essential to procure an even lowering of the capping, and to permit a retreat from the western to the eastern limits of the drawing section. This required the pulling down of the capping on a more or less inclined plane which dipped possibly 15° to the western or completed portion. The drawing of a series of chutes in a plane at right angles to the direction of retreat, or across the stopes and pillars, instead of along one whole stope, was the most satisfactory method in getting the ore to run readily.

When drawing was started, there were some difficulties in getting the ore to run steadily. The nature of the ore and the length of time that elapsed between stoping and drawing, caused the chutes in some areas to pack very tightly. Some idea of the compact nature of broken ore under pressure can be gained from the fact that occasional crosscuts were driven from pillars into shrinkage stope ore, and that no timbering was required for some of these drifts in broken ore. A method that resulted satisfactorily in starting these chutes was the use of small "pony-set" raises put up in the back of the drawing-off level drift midway between the drawing raises. This involved running an inclined raise for 15 ft. on each side of the drift up to the broken stope ore. When a hole was drilled through into broken ground, the raise was funneled immediately, and blasting of this funneling round loosened the stope ore and usually the hung-up ore in the adjacent drawing raises. A series of these "pony-set" raises sufficed to make the ore run readily in the regular raises. This method had the disadvantage that the "pony-sets" took weight and were expensive. The second method, which involved no extra raises and which proved the more satisfactory, employed a system of breaking the arch of hung-up ore. Entry to the back of packed ore was made through the raises, and heavy stulling was done against the hung-up ore. Small drifts were then started in the foot wall of the raise and run parallel with the long axis of the stope and at a height of about 15 ft. above the drawing level. These drifts were driven in solid pillar ground and connected up a series of hung-up raises. Starting at the end of the drift, the ground was drilled vertically and horizontally across the stope. When these holes were blasted the legs between the regular raises were knocked out and an arch of broken ore left. Arches 40 ft. across and 30 to 50 ft. wide were not uncommon in this work and these arches invariably collapsed, bringing down the stope ore. In this work the hung-up ore would not cave, even if the next raise 25 ft. away was running regularly, so that there was little danger in this work underneath the broken ore, and no accident ever occurred.

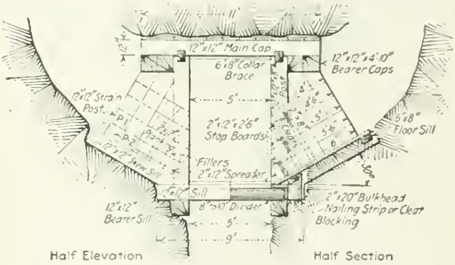

FIG. 11. DRAWING-OFF LEVEL CHUTE SET

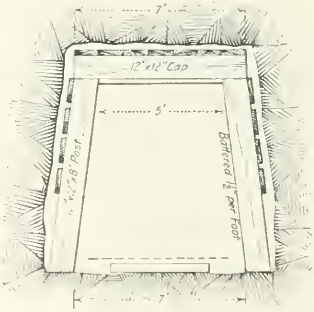

FIG. 12. DRIFT SET FOR DRAWING-OFF LEVEL

Choking of chutes was caused occasionally by packing of ore in the bottom of the inclines. It was also necessary to blast out part of the brow of the raise over the chute to prevent plugging with boulders. It was desirable to eliminate blasting by chutemen, and a separate squad of blasters, who handled all of the explosives required in chute drawing, was part of the organization.

Over a period of one year with a drawn tonnage of slightly over 400,000 tons, the average rate of drawing per shift was 118 tons per man. The monthly rate ran from 94 to 112 tons per man. These figures were based upon all labor directly employed in the drawing, including chute checkers. Under very favorable conditions the tonnage per man has exceeded 200 tons for several shifts. The largest individual output ever reached on one shift was 440 tons by one chuteman. The cost of drawing this ore into the tramming chutes amounted to 3.7c. per ton over a year's period, for direct expense of labor and explosives. Where special methods were required in the case of hung-up ore, the cost for short periods went as high as 15c. per ton.

Figures on recovery of ore which involve a computed tonnage on one hand and a known tonnage on the other, must be approached with some caution, yet the results of drawing, on a total output of 1,700,000 tons in one section of the work may be of interest. This area showed an estimated recovery of approximately 95% of the original tonnage. Individual data were kept on each stope and pillar, and although the drawing from these is undoubtedly interchanged, the figures favored the stopes over the pillars by about 10%.

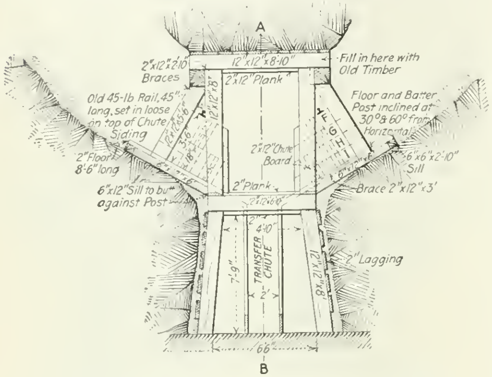

FIG. 13. ELEVATIONS OF PILLAR PONY-SET

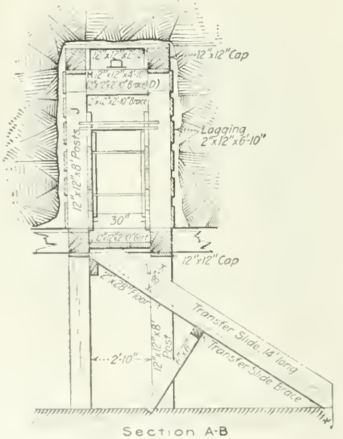

FIG. 14. SECTION ON A-B OF FIG. 13

The harder ore was drawn more easily and with greater tonnage than the softer areas, because of the greater amount of packing under pressure in the latter case. In any case the compactness of broken ore is an important factor, as it increases the tendency of the drawing chutes to ravel vertically toward the capping without drawing laterally. The broken ore even under moderate pressure tended to stand nearly vertically around the rim of a drawing chute. The angle of repose, if it can be so called in this condition, will be found to be between 80 and 90° in this class of ore. In a small number of chutes where the ore was greatly packed, the ore drawn corresponded in volume to a cylinder with a diameter of 14 ft. and a height equal to the height of ore to the capping.

It is apparent from this that a large number of drawing raises per unit of area rather than a large area in the funnel mouth of the raise itself is desirable for recovering the largest percentage of the ore.

SECONDARY RECOVERY OF ORE

It became obvious at the conclusion of drawing that a certain amount of clean broken ore remained in the stopes and pillars. This remainder probably stood in the shape of a wedge directly over the drawing drifts and also along the boundaries of the old stopes and pillars. To recover the ore above the drawing drifts, the backs of the latter were shot down through to the floor of the stope. This work was done in retreat, and the ore mucked and drawn on the incline into the tramming chutes. This work cost from 15 to 25c. per ton, and the output per man averaged 40 tons. Results obtained from these operations confirmed the view that the clean ore stood in a series of wedges or cones, which had an apparent base of 20 ft. and a height of 50 ft.

To recover the ore standing where the old stopes and pillars joined, a series of intermediate drifts midway between the original drawing lines was driven. These drifts were at the same elevation as the drawing-off level. Dumping chutes and supply raises were provided from crosscuts on the tramming level at 200-ft. intervals. The drifts were supported with 12x12-in. timbers set at a distance of 4 ft. 2 in. center to center, and chutes were placed in each set staggered along the drift. The back was broken on top of the lagging, and a small shrinkage stope about 20 ft. wide carried up until loose ground was encountered, or until caving occurred. The ore drawn from the chutes was trammed in 1½-ton cars to the main tramming raises, the maximum tram being 100 ft. This work, which is now in operation, marks the completing stage of mining hard ore by the wide stope and pillar system.

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Duty to Safeguard Shafts

By A. L. H. STREET*

A mine operator may be found to have been negligent in failing to secure removal of ice from around the top of a shaft, creating liability for injury to an employee caused by the ice falling on him while he was descending the shaft in the performance of his duties, when the only reason given for the nonremoval is that the work would have delayed other operations. But in reaching this conclusion, Springfield, Mo., Court of Appeals holds that the mine owner could not be held liable unless the dangerous condition was actually known or had existed so long before the accident that knowledge thereof fairly could be presumed. (Shimmin vs. C. & S. Mining Co., 187 Southwestern Reporter, 76.)

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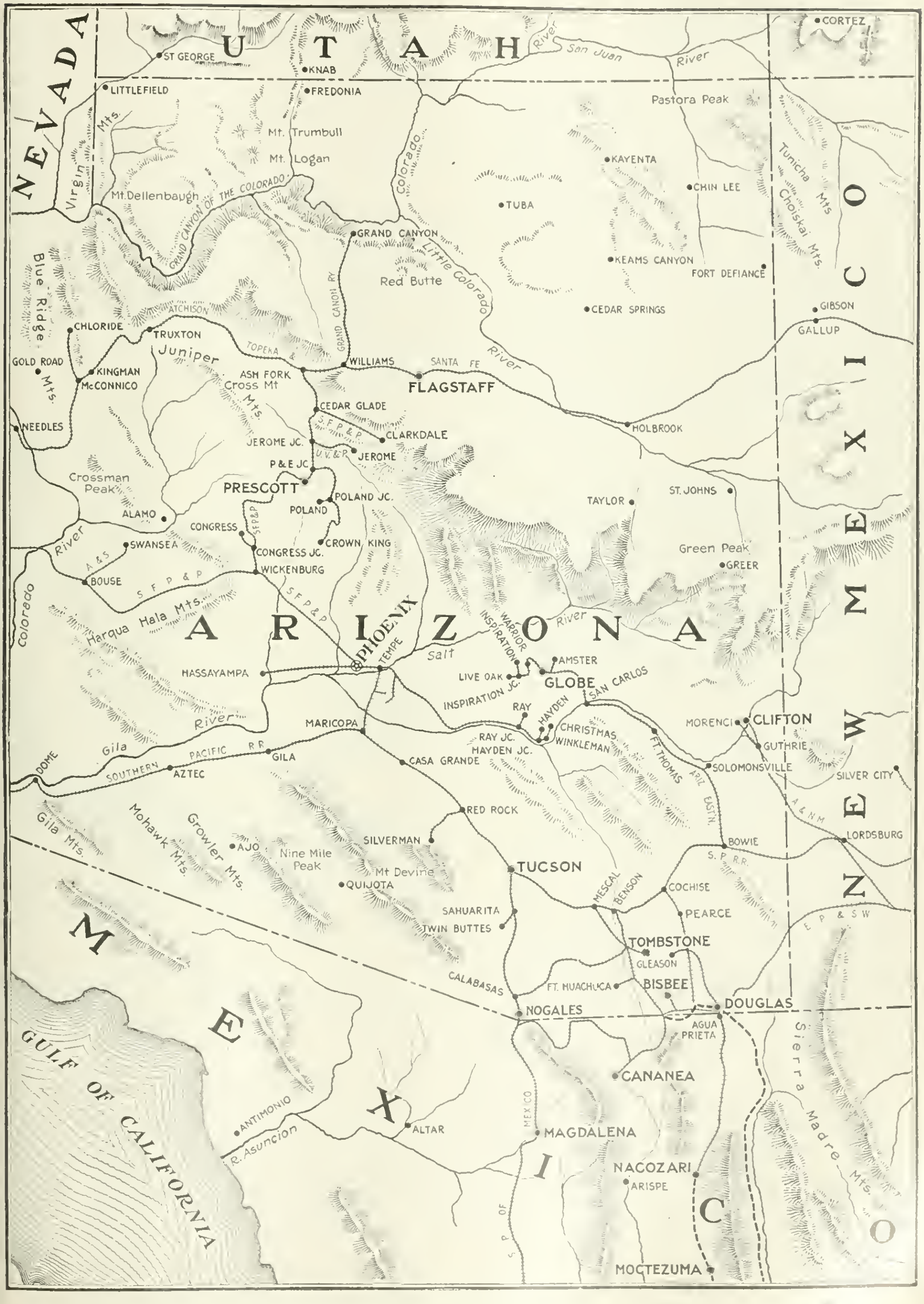
*Attorney at law, 829 Security Building, Minneapolis, Minn.



THE MINING CAMPS OF ARIZONA, SCENE OF THIS YEAR'S ANNUAL MEETING OF THE A. I. M. E.

American Smelting and Refining Co.

The semiannual report of the American Smelting and Refining Co. for the period ended June 30, 1916, gives a review of the operations of the company during that time. The profits make an abnormal comparison with the earnings of the same period in 1915. At that time the prices of all metals were depressed and the production of ores was correspondingly decreased, but during the first half of this year prices have been stimulated beyond any previous record, and this has resulted in a large increase of production. Operations, on the other hand, have been carried out at much higher cost than ever before. Wages have advanced, and the 8-hr. day has been introduced at all points. The cost of materials has gone up 50% and in some instances more than 100%. Partly on this account the profits per ton of ore smelted or bullion refined have been seriously reduced, and this is also due to the fact that the toll received from the mines and smelteries has been fixed in long-time contracts, made when present costs were not considered possible.

Taking these considerations into account, it will be seen that increased profits are due partly to a very large and abnormal increase in business, but to a greater extent to the production of company mines and to new lines of business in which the company has interested itself and which are hoped to become increasingly profitable. A few years ago the business of the company was almost entirely the smelting of lead and silver ores and the refining of the resulting bullion. This portion of the business has been far less profitable per ton of material handled than during the same period of last year. The company calls attention to the entire lack of earnings from the properties in Old Mexico.

The net income for the six months' period applicable to the payment of dividends amounted to $11,145,694, an increase over the same period of last year of $6,125,712. The last two quarterly dividends on the common stock were declared at the regular rate of 4% yearly and 2% yearly extra. After the payment of regular dividends on the preferred stock and at the rate of 6% on the common stock, there was carried to the credit of surplus, $6,642,960.

During the first half of the year the company purchased new properties and largely extended the capacities of old works at an expense of $3,623,786. It is expected that at least an equal amount will be laid out during the remainder of the year for similar purposes. Of the amount expended, there was charged to depreciation and ore depletion $1,019,189, and to the reserve created out of the earnings of 1915 for enlargement and extension, $1,999,590. The remainder, amounting to $604,706, was added to the property account. The very large increase in the production of all character of ores has required an equal increase in smelting and refining capacities. The proof of the successful accomplishment of this increase is shown by the fact that although the daily product of the company, both in amount and value, is much greater than at the beginning of the year, the total value of ores and furnace products on hand has decreased more than three-quarters of a million dollars.

The net earnings of operating properties amounted to $11,767,384, and other income reached $1,461,675, making a total gross income of $13,229,059. Total charges against this income amounted to $2,083,365, leaving a net income for the six months of $11,145,694. The profit and loss surplus at the beginning of the year amounted to $19,560,438, making a total profit and loss, gross surplus, of $30,706,132. Dividends amounting to $4,502,734 were paid, leaving a total profit and loss surplus of $26,203,398.

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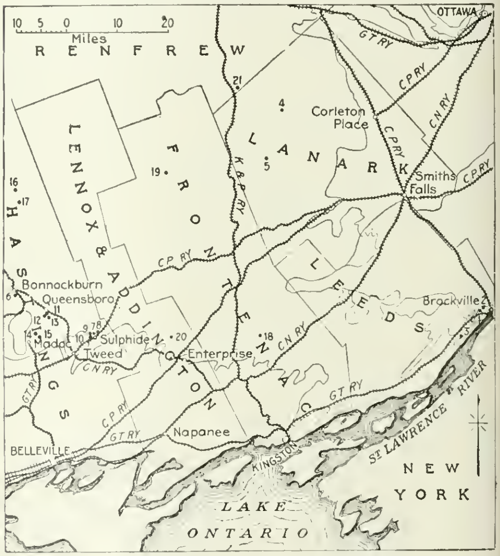
Ontario Iron-Pyrites Deposits*

The fact that the iron-pyrites resources of Ontario are contained within a considerable extent of territory will be shown in the following article; their value is sufficiently indicated by the exports of the last 15 years, totaling 538,755 tons worth $1,438,122. The war has had a stimulating effect on the demand of the United States for Ontario pyrite, and during the coming years this will doubtless result in a steady increase of production.

Reference to the accompanying map will show that the majority of the pyrites mines and prospects are concentrated within two main productive areas—the first a narrow belt extending about 8 miles southwest of Brockville, the second a broad area some 20 miles square extending from the town of Sulphide on the east to Madoc on the west.



OUTLINE MAP OF ONTARIO PYRITE DEPOSITS

The earliest mining for pyrites in Ontario was done within this first area on the Billings property, near Brockville, in 1868. This property is marked 1 on the map. Here the main openpit was sunk 250 ft. deep, gouging out the richer oreshoots and doing no timbering. While operation ceased in 1880, the men who worked in the old pits said they were not completely exhausted.

The other openings, 2 and 3 on the map, are prospects. At No. 2, the Sloan prospect, there is a width of 3 ft. of solid pyrites on the foot wall. Eighty tons of ore assaying 40% sulphur has been shipped from here to Buffalo and Capleton.

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*Abstract from "Iron Pyrites Deposits in Southeastern Ontario, Canada," a paper to be presented before the Arizona meeting of the A. I. M. E. by P. E. Hopkins, assistant geologist, Bureau of Mines, Toronto, Ont.

Steady output of the pyrite mines of the province began in 1898 with the opening of the Bannockburn mine, marked 6 on the map, and mines of Hastings County have been continuous producers ever since. Today the two main working mines are that of the Canadian Sulphur Ore Co. and the Hungerford of the Nichols Chemical Co., marked on the map Nos. 12 and 7 respectively.

At the Bannockburn mine, opened as an iron mine in 1898, the pyrites was encountered in two lenses at a depth of 8 to 15 ft. below a gossan of limonite. The south lens was mined for a length of 160 ft. and to a width of from 8 to 15 ft. and to a depth of 275 ft. During six years of operation about 580 tons of pyrite per month was shipped to the General Chemical Co. at Buffalo. The quality of ore did not decline with depth, but owing to the hazards of openpit mining operations were abandoned in 1906.

HUNGERFORD MINE OF NICHOLS CHEMICAL CO.

The Hungerford mine, No. 7 on the map, though opened as a gold mine 40 years ago, was not operated continuously as a pyrite property till August, 1905, when the Nichols Chemical Co. established its title to it. In 1907 this company erected an acid works at Sulphide for the treatment of its own ores and also of other ores bought from the mines of the neighborhood.

The pyrite occurs in three parallel deposits dipping 60° to the south. The north deposit, upon which most of the work has been done, varies in width from 6 to 22 ft. It has been exploited to a length of 620 ft. and to a depth of 575 ft., and the ore still continues. The length as indicated on the surface is about 500 ft. There are now two shafts on the property, and about 3,500 ft. of drifting has been done on the orebodies on the six levels.

The ore is coarsely granular and makes a large percentage of fines. The main impurity is calcite, although there is also some quartz present. A small quantity of pyrrhotite occasionally occurs, mainly in the north lode next the foot wall. The average percentage of run of mine ore is about 35%, the fines being much higher.

The acid works have been successfully operated since their completion in July, 1907, and machinery has been installed at various times to increase the capacity and to make new acids. At present sulphuric, hydrochloric, nitric and mixed acids are made by the contact process and shipped in the company's tank cars to various parts of Ontario and Quebec. Electric power supplied by the Seymour Power and Electric Co. is used throughout the mine and acid works.

CANADIAN SULPHUR ORE CO.'S MINE

The Canadian Sulphur Ore Co.'s pyrites mine, No. 12, was discovered in 1906 by Stephen Wellington while prospecting for iron. Under the gossan, merchantable iron pyrites was discovered, from which a carload of iron pyrites was shipped in 1908. Later the Canadian Pyrites Syndicate bought the property, installed a small plant and shipped a few hundred tons of pyrite. In the spring of 1910 the property was handed over to the present company, which began shipping ore three months later and has continued to the present. The mine is equipped to produce 100 tons of iron pyrites per day, yielding 40% of sulphur. Since Dec. 11, 1912, it has been run by electricity supplied by the Seymour Power Co. A branch line 2½ mi. in length from the Bay of Quinte Ry. near Queensboro to the mine was completed in 1913. The ore is shipped to the Nichols Chemical Co.'s acid plant at Sulphide, 11 mi. southeast, and to the chemical companies at Hamilton and Detroit.

The pyrite is mined by underground and openpit methods. The development work consists of three shafts and two opencuts, with some diamond-drill borings. The work in late years has been confined to shaft No. 3 and the two openpits. The vertical shaft No. 3 is 250 ft. deep with about 800 ft. of drifting on the 60-, 120- and 200-ft. levels. The pyrite deposits are marked by gossan outcrops from 2 to 30 ft. in depth. Beneath are the pyrite deposits, which occur as lenses in contact with rusty schist to the south and white quartzite to the north (both Grenville in age) near an irregular post-Hastings intrusion of gray felsite. The strike of the deposits is slightly north of east, while the dip is almost vertical, inclining slightly to the south. Lenses vary in width up to 25 ft., but horses of country rock are frequently inclosed in the pyrites.

The ore is high-grade, requiring very little cobbing if any. Ores have been shipped running 40 to 48% sulphur. The deposits are free from impurities such as arsenic, zinc, lead, copper and calcium. The pyrite burns satisfactorily and is in good demand by sulphuric-acid makers.

A promising prospect is the Hungerford Western Extension, No. 9 on the map. This was fairly well prospected in 1906 by means of surface trenches at regular intervals along the strike of the fahlband. The western lens had been exploited by surface trenches to a length of 500 ft., exhibiting, near the line between the lots, a width varying from 16 to 18 ft. of ore, which will grade from 42 to 44% sulphur. The only impurity consists of small included lenses of calcite. The eastern lenses are presumably continuations of the Hungerford mine orebodies. A gossan 40 ft. wide occurs on the south end of the property, but not enough work has been done to determine the extent of the deposit.

Among a number of other promising prospects may be mentioned the Ontario Sulphur Mines, Ltd., No. 9; the Queensboro, No. 11; and the Canada, No. 8.

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Shattuck Arizona Copper Co.

The production of the Shattuck Arizona Copper Co. for August amounted to 1,699,575 lb. of copper, 253,143 lb. of lead, 30,512 oz. of silver and 508.71 oz. of gold. For eight months of 1916 the total production was 11,976,584 lb. of copper, 2,101,080 lb. of lead, 213,112 oz. of silver and 3,408.52 oz. of gold.

⁂

Arizona Copper Co. reports for the half-year ended Mar. 31, 1916, that the copper production was 2,957 tons, all produced in February and March. Of this 964 tons was disposed of as bessemer, and 1,993 tons was refined electrolytically. Net working profit was £158,613, from which must be deducted £29,418 for general expenses and £70,906 for interest and sinking fund, and to which must be added £7,980 from holdings in other companies, leaving a net balance for dividends of £66,268.

No. 4 Concentrator of Clifton was started the middle of April, but the flotation plant is not yet complete nor is all of the reconstruction finished. The oil-flotation plant at No. 6 concentrator in Morenci has likewise started operating, but is not yet complete.

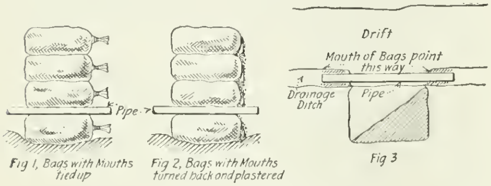
Details of Practical Mining

Underground Dams and Bulkheads

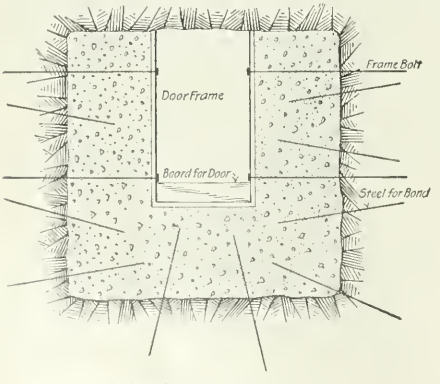
By Albert E. Hall* and George McFeely

In some mines the amount of water is practically negligible, while in others its removal is a serious problem. Most mining men are familiar with the various forms of pumps and drainage systems in use, but possibly the use of underground dams is new to some.

One of the cheapest and most easily constructed dams is that made of clay, which is highly efficient within its limits. There are many ways in which a clay dam can be constructed. A good one can be made from cement bags filled with clay. In this method of construction, the bags can be filled on the surface, and can be easily taken to the point desired in the mine. This is often advisable in restricted workings. At the point where the dam is to be constructed, all loose material must be removed. Clay is then rubbed in well on the rock surface, and the first row of bags is laid on this foundation. The bags are laid with their mouths on the water side of the dam, and the spaces between them are filled in with clay and the usual drain pipe is put in place. On this another layer of bags is laid and the spaces again filled with clay. This is continued until a wall is finally built. When it has been [illegible] high enough, the mouths of the bags are opened and plastered back against the face of the dam. If one wall of bags is not sufficient to withstand the pressure, another can be placed behind it or the wall curved to present a convex surface to the pressure. Since the bags are of small dimensions, the flexibility of this method is great.


Drift
Mouth of Bags point this way
Drainage Ditch
Pipe
Pipe
Fig 1, Bags with Mouths tied up
Fig 2, Bags with Mouths turned back and plastered
Fig 3

A DAM AND BULKHEAD OF BAGS



A CONCRETE BULKHEAD

Water may be carried past a raise by the use of this same method. This is done by laying a pipe over the raise and using bags filled with clay to fill in around its ends. Place the bags as shown in Fig. 3, and open the mouths and plaster them back after all are in place. If the opening is too small for bags, the clay can be put in without them in any amounts advisable.

If it is impossible to construct a sump of sufficient capacity, the lower levels may be used to hold the water if a suitable bulkhead has been constructed. These bulkheads are made of cement or concrete. A low place near the shaft is prepared, and then holes are drilled into the walls, roof and floor of the opening and reinforcing rods placed in them to act as a bond between the walls and the concrete. A doorway is left in the bulkhead, which is usually held in place by long bolts running into the walls. A batten door, calked with clay and fastened to the frame with iron straps, completes this bulkhead.

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*Superintendent, Sable [illegible] Copper Co., Massey, Ont.

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Method of Tunnel Ventilating

In the Wilson Avenue water tunnel, Chicago, which is 45,000 ft. in length, great care was exercised in the design and installation of the ventilating system, says H. W. Clausen in the *Journal* of the Western Society of Engineers for May, 1916, and a quantity of air much in excess of any heretofore used in similar work was provided. The standard equipment consisted of one General Electric centrifugal air compressor of a capacity of 5,000 cu.ft. of air per min. for each drift, at a pressure of 1.5 lb., where the length of the drift did not exceed 6,000 ft. Where the drifts were longer, two compressors were used in series, giving a capacity of 5,000 cu.ft. at 3 lb. pressure. These compressors were driven by 50-hp. motors operating at 3,600 r.p.m. and directly connected to the centrifugal impeller. Gage boards, upon which were mounted indicating and recording instruments, were provided so that an absolute check was maintained upon their operation. These compressors were supplied by William A. Pope at a price of $1,398 each.

Steel asphalt-coated pipe 18 in. in diameter delivered air to the face. This pipe was made of 14-gage steel in 20-ft. lengths, with ends flanged back at right angles to the axis of the pipe and provided with loose malleable-iron flanges. A soft-rubber gasket was inserted between two lengths, and the joint was then tightened up. The unusual point of this pipe was its light weight—two men easily lifting a 20-ft. length—and its strength. The pressure on a 20-ft. length when fans are exhausting is about 20 tons. The end of the pipe was maintained about 100 ft. from the bench.

The pipe was suspended along the side of the tunnel over the drainage ditch. The system was operated equally well to blow in or exhaust air from the tunnel. After a blast the system was reversed and the powder smoke removed from the tunnel. This reversal was accomplished by a bypass with the necessary valves, the compressor always blowing in one direction.

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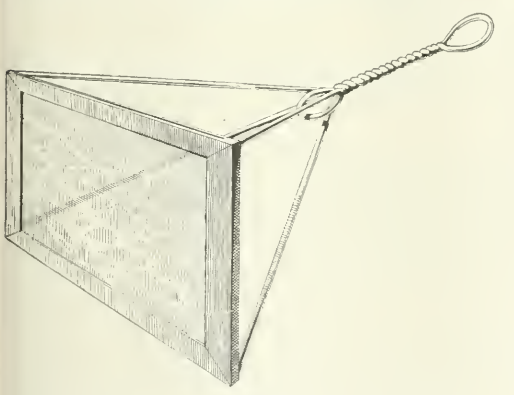
A New Bob-Line Reflector

A short time ago there was published a description and sketch of a reflector for facilitating transit sights in mines. This is merely an extension or amplification of the old practice of tearing a leaf from a notebook and pouring oil on it to increase its transparency. This practice was however often hard on the notebook, says *Coal Age*, Sept. 9, 1916.

The objection to the device described is that the tracing cloth must be given a circular cut, and while the exact method of fastening is not shown, whatever mode is used it will take time. And when the sights are to be given from "cartwheels" or other points in the roof not marked by a spad from which the plumb bob line may be hung, three hands are required: One for the device, one for the bob line, and one for the lamp. As the ordinary run of mine-survey help is provided with but two, its operation would be difficult.

The accompanying illustration shows a device that can easily be made in the blacksmith or carpenter shop.



REFLECTOR FOR USE IN UNDERGROUND SURVEYING

A tin frame is made to hold a half sheet of ordinary letter head or extension sheet paper, the upper edge of the frame being left open for its insertion. Four wire standards are soldered or riveted to the frame. These are carried back to a common point, and twisted into a handle, a loop being left at the common point for hooking in the carbide lamp. This loop should be far enough from the frame to prevent burning the paper.

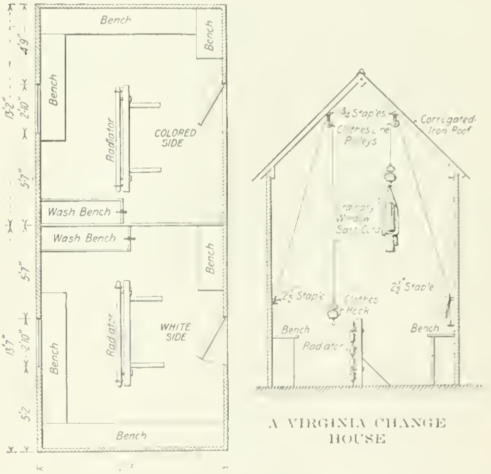
This arrangement throws the full rays of the lamp against the paper. Letter paper is cheaper than tracing cloth and serves the purpose well. The frame or handle may be turned so as to have the long side vertical, but this is not necessary, for when it is held horizontal a sufficiently lengthy view of the bob line can be secured. The advantages of this device are in its simplicity and the care of making it.

A Cheap Change or Dry House

By Roy S. Bonsib*

Although the Rich Patch Mines are among the oldest in Virginia, it has only been within the past few months that the health of the miners has received much attention. One of the largest mines in this group, No. 11, is about $1\frac{3}{4}$ mi. up the mountain from the camp, and as this mine is rather wet, the men coming from work in water-soaked clothes on cold, windy days were often laid up a week at a time with severe colds and kindred ailments. In order to eliminate or reduce the source of trouble, a shanty formerly occupied by the compressor engineer, near the mouth of the tunnel, was converted into a dryhouse, a ground plan and elevation of which are shown in the illustration.

The benches and washstands were built of boards taken from a neighboring unused shanty, the only expense being the cost of labor to get them, which was about $2. The house is heated by two home-made radiators made up of six 6-ft. lengths of $1\frac{1}{4}$-in. pipe taken from a scrap pile, connected by return bends. Steam tapped directly from the boiler was carried by 1-in. pipe 120 ft. through a wooden trough buried about 18 in. underground. A 1-in. water line was run alongside of the steam line in the wooden trough to warm the wash water slightly.



A VIRGINIA CHANGE HOUSE

In calculating the size of radiators required for the dryhouse, the following rules were observed: Kent says that as a general rule, "one square foot of surface will heat 70 cu.ft. of air in outer or front rooms." Since the requirements were not only to heat the building, but also to provide clothes-drying facilities, it was assumed that 20 cu.ft. of air would be heated per square foot of radiating surface. Having some old $1\frac{1}{4}$-in. pipe on hand, it was found in a catalog of pipe and pipe fittings that such pipe required 2.3 lin.ft. to give one square foot of radiating surface, giving a final result of six 6-ft. lengths for each radiator.

Clothes are suspended from the ceiling over the radiators by means of a hook arrangement, [illegible] sash cord. Slotted openings were placed in each end of the building and the upper part of the partition between the two rooms was removed, to increase the air circulation and hasten the clothes-drying.

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*Mining engineer, Low Moor, Va.

COST OF RADIATORS AND PIPE FITTING

Labor getting and cutting 1¼-in. pipe	$2 63
Cutting trench and fitting pipe	3 00
Twelve 1¼-in. return bends....	1 77
Four 1¼- to 1-in. reducers.	20
Three 1-in. valves....	5 52
Six 1-in. ells . . .	30
Six 1-in. tees	30
Four 1-in. unions	40
220 ft. 1-in. iron pipe	10 85
Total cost	$24 97

COST OF FIXTURES AND INSTALLATION

13.5 lb. sash cord.	$4 05
3 doz. clothes-line pulleys.	1.95
1 gross 1¾-in. wrought staples...	.40
3 doz. 2½-in. wrought staples	.15
2¼ doz. 2½-in. wrought hooks	52
2 padlocks .	.50
8.5 lb. nails...	30
Labor of installation	7 79
Total cost. ...	$15.66
Cost of radiator and pipe fitting	24 97
Cost of fixtures and installation .	15.66
Total combined cost......	$40 63

This dryhouse easily accommodates thirty men and has not only made a decided improvement in the health and comfort of the miners, but the ore production has been increased by the increased regularity and quality of labor.

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Double-End Skip Dump

In some of the deep mining regions where inclined shafts are commonly employed, such as those in Michigan, and where mining, stope filling and shaft sinking go on simultaneously, it becomes advantageous to use a double-ended skip dump such as that described as follows:

The skip dump is placed in the inclined shaft *A* above the mouth of the waste chute *B*, as shown in Fig. 1. In the usual course of mine operations it becomes desirable to dump sand or mill tailings into the chute *B* on the down trip of the skip, then lower it into the shaft to the point where sinking is proceeding, load with muck and hoist to the chute *B* again, then lower the skip beneath the ore chute *C*, load and hoist to the surface bins. It is obvious that in the course of such operations it becomes advantageous to use a double-ended skip dump that will dump whether the travel is up or down, if desired, or allow the ready passage of a load of ore without dumping.

The dump mechanism is supported above the waste chute *B* by the track runners *D*, supporting the skip track *E*. A number of timber uprights *F* extending to the shaft hanging wall support the dumping mechanism. The latter consists of two sets of parallel guide rails *G* and *H* attached to the timber uprights. Their inclined extensions are close to the skip track, but give ample clearance for the skip wheels *I*.

Arranged to align with the inclined ends of the guide rail *G* are the bent rail sections *J*, one on each end, which are pivoted at *K* to allow them to swing down and rest upon the skip track, the ends *L* being flatted for this purpose on the under sides, which rest upon the rails, and curved upon the upper sides, which receive the impact of the skip wheels. The rail sections are supported at the pivot *K* by brackets bolted to the timber uprights and are normally held in the position shown by dotted lines in Fig. 1 by the counterpoises *M*. These two counterpoises *M* are simultaneously overcome by a system of levers hand operated by a single operator who stands on the platform *N* and throws the lever *O*.

The action of this lever is best understood by reference to Fig. 2. Movement of the lever *O* overcomes the counterpoise *P* and through the connecting-rods shown attached to the rocker lever *Q* throws the latter either forward or back. One arm of the rocker lever *Q* is attached to the nearest switch counterpoise by the link *R*, and the other arm to the corresponding switch counterpoise at the other end by the link *S*. It is thus seen that the throwing of the lever *O* to the right lifts the switches from the rails and allows the skip to pass through without dumping.

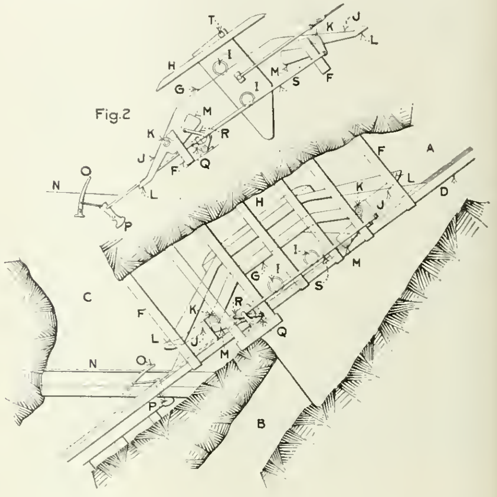

Fig.1

FIGS. 1 AND 2. DOUBLE-ENDED SKIP DUMP, FIG. 2 SHOWING SKIP IN DUMPING POSITION

If the switches are down in the position shown by Fig. 2, the skip is dumped as follows: The rear skip wheels are of considerably wider tread than those of the front wheels and, as the skip descends, these wider wheels engage the curved switches *J*, thus raising them vertically over the front skip wheels and dumping the skip as shown in Fig. 2. Complete rotation and overturning of the skip are prevented by the rollers *T* projecting from the skip, which engage the upper guide rail *H* as the skip dumps.

This mechanism is the invention of Charles L. Lawton, of Hancock, Mich., granted patent No. 1,151,955 on Aug. 31, 1915.

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How to Prevent Misfires, one of three questions asked by the mine-safety department of the California Industrial Accident Commission, was answered by a number of members of the Safety Bear Club, which now has an enrollment of 4,600. The best answer was decided to be the following: "To prevent misfires, take care of your powder, caps and fuse by keeping them in a dry place. The most trouble comes from making the primer wrong, avoid bringing a sharp bend in the fuse. When putting on cap be sure that the fuse has been freshly cut. For wet holes some kind of compound should be used to keep water out of the cap; if you have no regular compound, use roofing paint or common white laundry soap; never oil or grease. Wet holes should be shot soon after they are loaded."

Details of Milling and Smelting

Allen Automatic Classifier

By J. W. Crowdus*

The mill manager's search for an efficient classifier has led him through various extended investigations in recent years, first of the cone type of classifier, then of the screw or rake type. Each type has in turn enjoyed its period of rising popularity as new improvements were made, but the end is not yet, and there still seems to be a great deal of room for improvement. In his review of metallurgical progress for 1910, Alfred James states that "probably a really continuous and automatic cone, which does not clog or require continuous adjustment, would readily win the day."

As early as 1904 there was in operation at one of the well-known Arizona copper properties the forerunner of such a machine, which, though crude and cumbersome in design and action, was based on the proper principle. Used as a concentrate dewaterer and fed with all the concentrates produced in the mill, ranging from the bull-jig product to the vanner slimes, its spigot discharge contained only 22% water. It did this work without care or attention and saved the cost of four laborers over the previous method of handling. A repeat order resulted to the inventor, but the latter, wishing to furnish an improved machine, delayed filling the order till recently.

Improved Classifier of Automatic Action

The improved machine finally installed was of the design shown in section in Fig. 1, and by photo in Fig. 2. It is an automatic, free-settling, basin-type cone classifier. Briefly stated, the machine consists of a peripheral overflow cone fitted with a central open-apex truncated cone containing a float which is connected to a ball valve at the spigot.

The action of the classifier is as follows: The mill stream enters the feed spout shown at *A*, Fig. 1 and after passing through the truncated cone *B*, the mill-stream water and the solid particles carried by it flow upward and outward over the lip into the overflow launder. The solid particles too large or too heavy to be carried by the upflow into the launder settle in the large cone, accumulating until reaching the outlet of *B* when they obstruct the flow of the mill-stream water from *B* into the large cone, thereby causing the water to rise in *B* and with it the float *C* which, through the lever *D*, the link *E* and the valve arm *F*, removes the ball *G* from the spigot. Then the settled solids in the cone flow out through *G* in quantity proportionate to the area available for their passage, which varies proportionately to the quantity of solid particles settling in the cone and obstructing the mill stream flow from *B*. The settled solids in the large cone cannot lower beneath the point necessary to permit a free flow of the mill-stream water from *B* into it, and the normal shape of the basin formed by their surface is continuously maintained, insuring uniform classification. When solid particles cease settling in the cone, the discharge through the spigot stops as soon as the obstructing particles are removed from the outlet of *B*, the water in it lowering and with it the float *C*, thereby closing the valve at the spigot, the valve remaining closed and the cone full of classified particles until the mill-stream flow from *B* into the cone is again obstructed by solid particles settling from the mill stream.

The classification takes place in the basin formed by the surface of the settled solid particles in the large cone, the shape of the basin being automatically maintained under all conditions of feed within the capacity of the cone. Should the mill stream feed more settling solid particles than can be discharged through the spigot, the basin automatically contracts, as shown at *A*, Fig. 3, until the velocity of the water flow has adjusted the abnormal feed condition. Under normal operating conditions the float controls the quantity discharged through the spigot. An increase in the quantity of settling sand or a decrease in the volume of water in the pulp stream feed has indentically the same effect—that is, the classifying basin contracts to the point where the velocity of

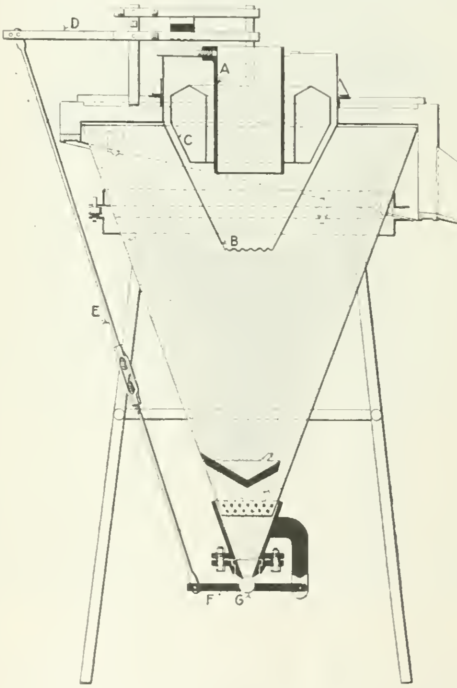

FIG. 1. SECTIONAL DRAWING, ALLEN AUTOMATIC CLASSIFIER

the water takes care of the altered condition. The degree of dilution of the spigot discharge remains practically the same under all conditions of feed.

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*Engineer, 209 Mills Building, El Paso, Tex.

If this classifier is compared with the familiar gooseneck discharge, or uncontrolled spigot-discharge cones, or pyramids using hydraulic classifying water, some of its advantages are apparent as follows: It is strictly automatic, adapting itself to all conditions of feed without attendance; the solid particles settling in the cone control their discharge through the spigot; when solid particles cease settling in the cone, their discharge through the spigot ceases; the spigot discharge has the same relative proportion of water to solids under all conditions of feed; when the spigot discharge is to be concentrated or reground, the degree of dilution is under perfect control since no hydraulic water is used and there is no dilution of the pulp stream; requiring no power, it can be placed anywhere in the mill without regard to lineshafting; it has fewer working parts, and its upkeep is small compared with other types of classifiers; in case of shutdown or starting up, its action is automatic and requires no supervision.

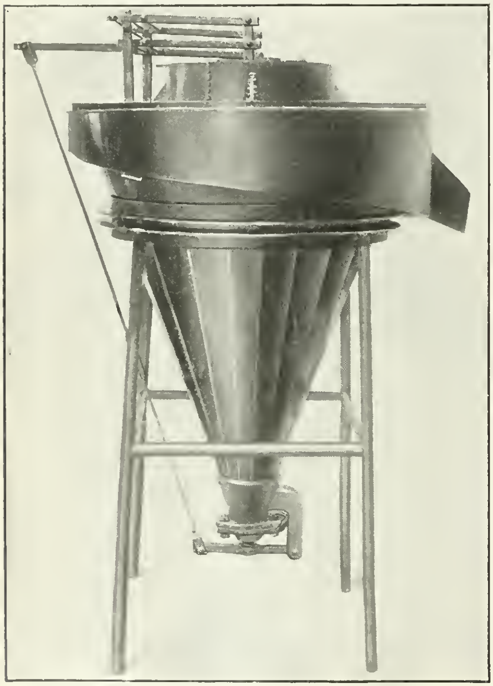

FIG. 2. ALLEN AUTOMATIC CLASSIFIER

Old Dominion Test of Automatic Classifier

As an example of the work done by this new classifier under ordinary mill conditions, the results of a six-day test made by the Old Dominion Copper Mining and Smelting Co., Globe, Ariz., are given. The feed to the cone was the overflow from hydraulic classifiers, the diluted spigot discharge of the automatic cone being fed direct to concentrators of the vanner type. Samples were taken every hour. In the table is given the screen analysis and the percentage of the total copper contained in each mesh of the feed into the cone, the spigot discharge from the cone, the concentrates produced by the vanners and the concentrator tailings.

TEST OF THE AUTOMATIC CLASSIFIER

	Allen Cone Feed		Allen Cone Spigot Discharge		Vanner Concentrates		Vanner Tailings	
Mesh	% Mesh Wt.	% of Copper Contents	% Mesh Wt.	% of Copper Contents	% Mesh Wt.	% of Copper Contents	% Mesh Wt.	% of Copper Contents
Plus 35	0.34		1.12	0.40	0.00	0.00	1.1	1.37
Plus 48	0.85	0.36	2.19	0.70	0.72	0.39	3.12	3.23
Plus 65	2.60	0.48	7.92	1.57	0.62	0.33	9.42	6.12
Plus 100	12.56	2.29	28.25	5.93	2.76	1.24	39.15	25.40
Plus 150	18.28	7.22	30.36	17.83	17.25	14.78	33.12	36.30
Plus 200	11.74	9.66	13.80	18.83	18.83	18.58	8.50	14.04
Minus 200	53.63	97.99	16.36	49.51	59.82	64.68	5.58	13.54

Referring to the screen analysis of the work done by the cone, the average cyanide mill engineer possibly will not be impressed, but when attention is called to the reason for the high percentage of —200 mesh in the spigot discharge, the creditable work of the cone is apparent. As shown by the table, 59.82% of the total vanner concentrates was constituted by material of —200 mesh which contained 64.68% of the copper produced by the vanners. This very fine cupriferous material is constituted by sulphide particles which, by reason of their greater specific gravity, settled to the spigot of the cone along with the coarser gangue particles. The vanner tailings contained 5.58% of —200-mesh material. This may be assumed to be gangue and represents about 4¼% of the total amount of —200-mesh gangue particles fed into the cone. The vanners saved 81.7% of the copper in the feed, a high percentage of such fine material, due to the excellent classification and the control of the degree of dilution. The spigot discharge from the cone was composed of 71.2% solids and 28.8% water, a low percentage of water when more than 80% of the solids are —100-mesh particles. After completion of the tests, the Old Dominion company ordered five more machines. This classifier is the invention of Charles Allen, and is manufactured by the Allen Cone Co., El Paso, Texas.

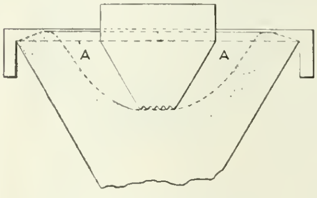

FIG. 3. CONTRACTION OF SETTLING BASIN

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A Dry Ore Concentrator

An ore concentrator recently patented by L. D. Chavalier and H. C. Reche consists of an oscillating-deck table upon which the crushed ore is fed. This table is provided with air passages that conduct an upward flow of air to the under surface of the table. The resultant effect of the oscillating table surface and the upward flow of air current is the classification of the ore in accordance with its specific gravity. This is assisted by horizontal air currents which keep the partly separated mass stirred up.

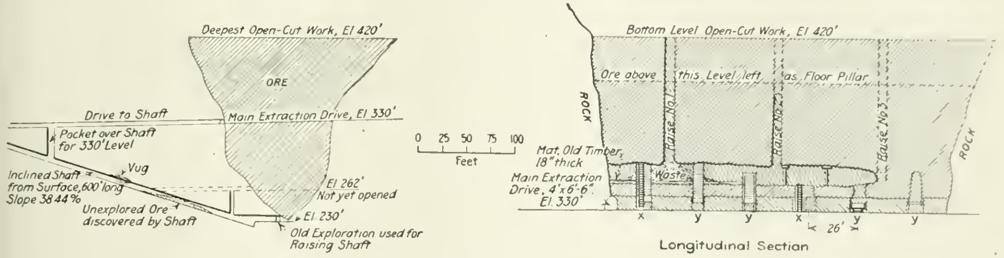
The apparatus is particularly designed for use in localities where the scarcity of water makes the usual forms of wet concentration inapplicable. This machine was granted U. S. Pat. No. 1,194,477, on Aug. 15, 1916.

Underground Mining in Cuba

By L. B. Reifsneider*

SYNOPSIS—The development and mining by underground methods of a body of iron ore is described. This is accomplished without interfering with the surface mining in progress over the area. The stopes are filled with waste drawn in through raises into the openpit, while the ore is removed through an incline whose portal is outside of the surface mining area.

The main orebody of hard red magnetite of the Vinent mines of the Daiquiri group at Daiquiri, Cuba, is underlaid in part by a separate body of black magnetite. The main body is being worked by opencut methods, and as it was desired to work out the underlying black magnetite at the same time as the main orebody, the problem of mining the deep ore without disturbing or caving the floor of the opencut work presented itself. The explorations developed the deep ore as running nearly due north and south for a length of approximately 450 ft., with a varying width of from 100 to 160 ft. and an approximate depth of 150 ft. below the lowest opencut level on that side of the mine. The deep ore is generally soft and friable and is cut at irregular intervals by dikes of rock that vary from a few inches to 20 ft. or more in width. There are also bars of very hard ore, which usually run parallel with the length of the ore. The original explorations that discovered the deep ore were put in on what is known as the 330 level, datum being taken from a point in the valley below the opencut workings.


Deepest Open-Cut Work, El 420'
ORE
Drive to Shaft
Main Extraction Drive, El 330'
Pocket over Shaft for 330' Level
Vug
Inclined Shaft from Surface, 600' long Slope 38.44%
Unexplored Ore discovered by Shaft
El 262' Not yet opened
El 230'
Old Exploration used for Raising Shaft
0 25 50 75 100
Feet
Bottom Level Open-Cut Work, El 420'
Ore above this Level left as Floor Pillar
ROCK
Raise No. 1
Raise No. 2
Raise No. 3
ROCK
Mat, Old Timber, 18" thick
Waste
Main Extraction Drive, 4'x6'-6", El. 330'
x
y
y
x
y
y
26'

Cross Section

Longitudinal Section

METHOD OF UNDERGROUND MINING IN CUBA

Access to Workings Through Inclined Shaft

After careful study it was decided to use a cut-and-fill system for stoping the ore, starting on the 330 level. As there was no location on the surface suitable for sinking a shaft without interfering with the opencut operations and the grade and location of the primary exploratory tunnel were not suitable for establishing haulage, it was finally decided to sink an incline shaft, or slope, from the sidehill beyond the limits of the surface ore, locating the collar of the shaft on the surface so as to permit handling the production over one of the main haulage levels and also be able to tap the ore, which in the meantime had been developed 100 ft. deeper, at a minimum expense. While the shaft was being sunk, development work could be carried on through the old exploratory tunnel and part of the ore on the 330 level prepared for mining.

The slope has a total length of 536 ft. from collar to change of grade at the bottom. The grade is 38.41%, and it taps the deepest ore on the 230 level. So far most of the development work has been done on the 330 level. A tunnel, known as the 330 main extraction drive, 5x7 ft. in the clear, has been driven close to the contact on the east side of the orebody. This drive has been kept as close to the orebody as possible to avoid making the stoping drives in rock. The drives for the stopes are turned off at 36-ft. centers. The stopes are carried 24 ft. wide, and a 12-ft. pillar is left standing. These intervals frequently vary, for the dikes of rock mentioned are left standing as pillars wherever possible. This tends to make the stope widths irregular.

These preliminary drives crosscut the orebody from east to west. They are carried 4½x6 ft. in the clear, and usually do not require timbering. After the west wall has been reached, the drive is divided into 24- to 30-ft. sections and raises are driven at these points to a height of 8 ft. above the roof of the drive, or about 15 ft. above the rail. Every third raise is driven large to permit the installation of a chute and ladderway, usually about 4x8 ft. The intermediate raises are cut only 4x4 ft. for chutes alone.

Stoping is then started from the double-size raises, leaving a stope floor about 6 ft. in thickness above the roof of the preliminary drive. As the stopes open out, the carloading chutes and the ladderways are cribbed and the ladders installed, and as the stoping progresses, the other raises are broken into and the loading chutes installed in them. Experience has shown that by putting the chutes at 25- or 30ft. centers the ore can all be shoveled and no wheeling is required, considerably increasing the production. The first cut in the stope is carried the full width, 24 ft., and 9 ft. in height. If heavy back is encountered, as frequently happens, the ore being threaded with horizontal cleavages, props or bulkheads of old timber are placed as needed.

As soon as the stoping has advanced sufficiently, raises to surface are started, so that by the time the first cut is finished, preparations for running in waste for filling the worked-out ground may be well under way. As this ore underlies the surface working, the raises are therefore put up primarily so as to require as little rehandling of the waste for stowing it in the stopes as possible, about three raises being carried to surface for a stope 150 ft. long. The waste that is used in filling is waste that is hand-loaded in mining the surface ore, and instead of being hauled to the waste banks is dumped into the stopes. Before fill is run into any stope, the cribs and manways are built up to the back and a mat of old timber is laid on the stope floor, so that when mining up from the lower level, this old timber mat can be caught up and supported until all the ore is worked out, just as would be done in a caving or top-slicing system.

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*Mining engineer, 32 South 34th St., Camden, N. J.

A 23- to 25-ft. floor pillar is left to support the floor of the surface workings, the stoping being carried up the 405-ft. level. The floor will later be recovered by surface methods. After the stopes on each side of a pillar have been worked out, the pillar is attacked. A preliminary drive is put in as in a stope and the manways and cribs started. In place of putting up a raise to the surface to draw in the fill, however, the fill is drawn from the worked-out stopes on each side and this fill is replaced by continually dumping waste into the stopes as it is drawn to fill the pillar. Care must also be taken not to take the slices in the pillar too high, or trouble will be encountered from having the waste from the sides run in and mix with the broken ore. There is also a tendency for the ore in the pillars to separate on the natural cleavages, but this in a way is beneficial, as less explosives are required to break the ore to loading size, although frequently considerable ingenuity has to be exercised in order not to lose detached pieces, which have a tendency to be covered by the waste.

On the last cut in a stope the cribs and manways are carried up to support the floor pillar, and as mining progresses in working out the ground from the 230 level up, connections will be made with these cribs for drawing fill from the surface for filling as mining proceeds. Water to the extent of 20,000 to 30,000 gal. per day is pumped from the 230 level, the larger amount being the average during the rainy season. Two small duplex pumps having 2½-in. suction and 2-in. discharge handle the water. These are operated by compressed air at 80 lb. pressure. Only one pump is in use, the other being held in reserve. The water is pumped to the 330 level and from there is piped out through the old exploratory drive.

MINING BY CONTRACT

All mining and driving is done by contract. In the stopes the miners are paid 30 to 35c. per ton for the ore delivered in the ore chutes, from which they pay for dynamite, caps, fuse and carbide. No deductions are made for tools, air or spare machine parts. They work a 10-hr. shift and average $2.35 per day. Trammers work on a premium system based on a rate of $1.50 for 10 hr. and as a rule make $1.95 per day. The cost of ore delivered at the slope, exclusive of timbering and overhead charges, is 11.3c. per ton. Explosive costs vary. In the first stoping cut, where the ore is blasted off the solid wall, about 1.4 tons of ore is broken per pound of dynamite used. After the ore has been undercut, the proportion rises to 2.7 tons per lb. Flat holes are used entirely in stoping, as it has been found that 100% more timber is needed if stoper drills are used. The tendency of the upper holes to leave a bad back is proverbial, but it is particularly aggravated in this formation by the many horizontal cleavage planes in the ore. The preliminary drives for the stopes are paid for on an average of $4 per lin.ft. of drive, the miners doing their own tramming and delivering the material either in the pocket on the slope if ore, or tramming it outside if waste.

HARD SEAMS OCCASIONALLY ENCOUNTERED

The raises for filling are always carried up 5x7 ft. in the clear until near the surface, where their size is reduced. The reduction in dimension prevents jamming of rock in the raise when large rocks are dumped with the other waste, as frequently occurs. The raises cost $5 per ft. Occasionally one of them strikes one of the particularly hard seams of ore, and then the price may rise to as high as $8 per ft. In one of the raises recently driven, one of the hard seams was encountered. Eighteen holes were needed to break a 6-ft. cut in a 5x7-ft. area. To blast the center and cut holes 60% semi-gelatin dynamite was used and occasionally the holes were reloaded three times before they bottomed satisfactorily. After the cut holes break out, no difficulty is experienced in breaking out the balance of the round with 40% powder. The men working in raises place their own stages and ladders and pay for their dynamite, fuse, caps and carbide, the same as the miners in the stopes. They do no mucking. Their average earnings on contract are $2.38 per day.

The machines used in stoping are Ingersoll-Rand 2B drills in soft ground, 3¼-in. drills in hard ground and MC32 stopers for raising. The 3¼-in. drill is being replaced by the C116 Butterfly-valve machine, which has been found to be as effective as the 3¼-in drill with less air consumption. When it was decided to sink the incline shaft, or slope, the explorations on the 230 level had advanced sufficiently to allow the shaft work to be attacked from the bottom. Two gangs of 3 men each, two machine men and one chuck-tender were therefore started, working a 10-hr. shift at the top and bottom. The ground at the top was soft and had to be carried in timber, steel drift sets consisting of a 9-in. I-beam cap with 6-ft. clearance and 5-in. H-section posts, 8 ft. high, giving 7 ft. clearance over the skiprail, were used. The gang sinking did their own mucking and timbering. The ground, while requiring timbering, was firm and allowed us to carry the face from 10 to 12 ft. ahead of the timber. Two 2B machines on a vertical drift bar were used for drilling, 8 holes usually being required to break a 7-ft. cut. Practically the same kind of ground was carried clear from the collar to within a few feet of the 330 level. The timber sets were placed on 5- or 6-ft. centers.

At the bottom, or 230 level, conditions were different. The first 35 ft. of the raise was driven in a hard porphyritic diorite. Two 3¼-in. drills were mounted on one column, and when necessary, an extra machine was rigged in on another column in order to drill over the face. Eighteen to 22 holes were required to break a 5-ft. cut. The material, besides being very hard, was badly fissured, and it was with difficulty that a hole could be drilled to its required depth. From 70 to 80 well-tempered bits were required for the round, and very often more were used. The fissured material broke well, however, and as the bottom holes were shot last, the muck was thrown far enough down the slope so that very little work was required to clear the face for the next set-up. At 35 ft. from the change of grade, the back of an unexpected orebody was encountered. For 55 ft. the ore was encountered in the floor, at times rising to 5 or 6 ft. in height in the face. The value of the ore made selective blasting necessary and considerably delayed the work. The ore was mucked out before the rock was blasted. All the material from the lower part of the slope was trammed to the old exploratory shaft and there rehandled with a bucket to the 330 level and from there trammed to surface. As there were enough tramcars on hand, no delay was experienced in the actual raising, but an additional expense of two trammers and a hoistman was incurred.

The shaft was carried full section for 90 ft. from the bottom, when a vug was encountered. This also marked the end of the ore. The ground in the vicinity of the vug was very insecure, and it was decided to reduce the area to 5x7 ft. until the bad ground was passed and enlarge it to the required area afterward. After passing the vug, the same material that had been encountered at the bottom was again met and continued until the two headings were connected.

Slope Driven from Three Points

While the sinking and raising had been going on, a drive to the slope had been started on the 330 level and reached the vicinity of the slope before either of the headings had reached that elevation. It was decided to start sinking and raising from the latter working, and 8 ft. was sunk and 16 ft. raised from there. When the three headings were finally connected, there was a deviation from the engineer's points of 3/4 in. in elevation and 1/2 in. in line. Considering the conditions, this was a good connection.

The cost of the slope, including everything but engineering, superintendence and compressed air was as follows:

COST DATA OF INCLINE SHAFT

	Per Ft.
Labor (contractors, hoistmen, timbermen and trammers)	$8.386
Light and explosives	1.338
Timber, including steel sets	1.954
Supplies (steel, drill repairs, etc.)	1.463
Total	$13.141

After the slope was finished, a raise was put up under the 330 level, to be used for a pocket. Several sets of steel timber were placed under the raise, an arc door was fitted and a pocket of 125-tons capacity was made. The work of cutting the pocket, installing the steel and placing the timbers for the grizzly at the top of the pocket, including cutting the hitches, cost $214.30.

About the time this work was finished, the depression in the iron-ore demand compelled the curtailment of production and the work was temporarily abandoned. All the labor employed was Spanish with Spanish foremen.

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Miami Copper Co.

The report of the Miami Copper Co. for the first half of 1916 shows a total production of copper of 26,931,915 lb.—4,097,333 lb. in January, 4,141,286 lb. in February, 4,459,783 lb. in March, 4,330,882 lb. in April, 4,978,243 lb. in May and 4,924,388 lb. in June. The smelter production of 5% gives a net production of 25,585,314 lb. of merchantable copper. The average assay of the ore was 2,086% copper, and the concentrator extraction was 74.41% of the copper. The saving of copper was 31.38 lb. per ton of ore, or net after smelter losses of 29.81 lb.

Improvements at the concentrator will include the replacement of the three chilean mills in Section 5 by two large Hardinge mills using steel balls, with the object of bringing the capacity of the section up to 1,000 tons per day.

Gross income was $5,810,357; total costs, $2,310,617; leaving profit of $3,499,740. Dividends Nos. 14 and 15, amounting to $2,054,564, were paid, leaving a net surplus of $1,445,176 for the half-year.

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Lead-Zinc Mining in Virginia

By F. B. Speed, Jr.*

The results of the recent development work at the Holladay mine of the Virginia Lead and Zinc Corporation in Spotsylvania County, Virginia, are directing attention toward this district as an important producer of lead and zinc ores. This region, which has for many years been the largest producer of pyrite in the United States, has also been worked intermittently for iron, copper and gold for two centuries, but it is only within the last few years that the presence of lead and zinc sulphides in workable quantities has been known. The overlooking of the lead and zinc deposits for so many years, while perhaps unfortunate from an economic point of view, is not unnatural when the history of the district is known.

Early in the Eighteenth Century the limonite gossan ores were used for the manufacture of pig iron in charcoal furnaces which were erected near the ore deposits. Since the bodies of iron pyrite would yield in their gossan outcrops larger quantities of iron ore than bodies of sulphides other than pyrite, the leaner gossans were neglected by the iron miners. In mining the richer gossans the pyrite bodies below were discovered, and their development was started many years ago. Recently, however, the prospecting of some of the leaner gossans has disclosed the presence of workable lead and zinc bodies, which are now being actively developed. At present there are two producing lead and zinc mines in the district—the Allah Cooper, in Louisa County, about 5 mi. northeast of Mineral, Va.; and the Holladay, in Spotsylvania County, about 10 mi. farther to the northeast.

The belt in which the sulphide bodies occur is well defined, striking in a northeast-southwest direction and having an average width of 4 to 5 mi. The rocks of the belt are schists of probably Lower Cambrian age, which are principally of the quartz sericite type, although chloritic and hornblendic types are not uncommon, and in places there are calcareous varieties. The structural lines extend parallel to the general strike of the belt, and the dip of both the bedding and foliation is mainly to the southeast, although reverse dips occur.

The larger orebodies occur in the less siliceous portions of the schist series and occupy fissured positions. Replacement of the wall rock by sulphides on the hanging-wall side chiefly is characteristic of the deposits, the foot wall being usually well defined, and the hanging wall less so. In places this replacement has been very extensive, certain of the orebodies showing a thickness of 60 ft. or more. The presence in association with the sulphides [illegible] minerals as hornblende, garnet, pyrrhotite and zinc spinel classifies these occurrences as high-temperature deposits.

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*Charlottesville, Va.

Development of the Holladay lead and zinc property, which was undertaken by the Virginia Lead and Zinc Corporation in December, 1915, has disclosed a large body of rich ore. The property is being developed through two shafts 1,300 ft. apart, and in all about 800 ft. of drifting on the orebody has been done. As a result of this work the dump shows about 6,000 tons of ore, while the ore brought in sight is conservatively estimated at 50,000 tons, and the probable reserves many times this amount.

At the present time the ore is being sold for the manufacture of paint, and shipments are being made at the rate of 30 tons per day, which is about half the present output of the mine. An idea of the quality of the ore may be obtained from the fact that that sold during the past month was settled for on the basis of 22% combined lead and zinc. The construction of a standard-gage railroad 10 mi. long to connect with the Chesapeake & Ohio Ry. near Mineral, Va., has been started, and a 100-ton concentrating mill is being planned, the construction of which will probably be under way at an early date.

As previously pointed out, the district is highly fissured and mineralized and offers a most promising field for further prospecting, which has already been begun. Intelligent work along these lines will no doubt lead to the further development of this district, which may be considered as having much promise of becoming an important producer of lead and zinc.

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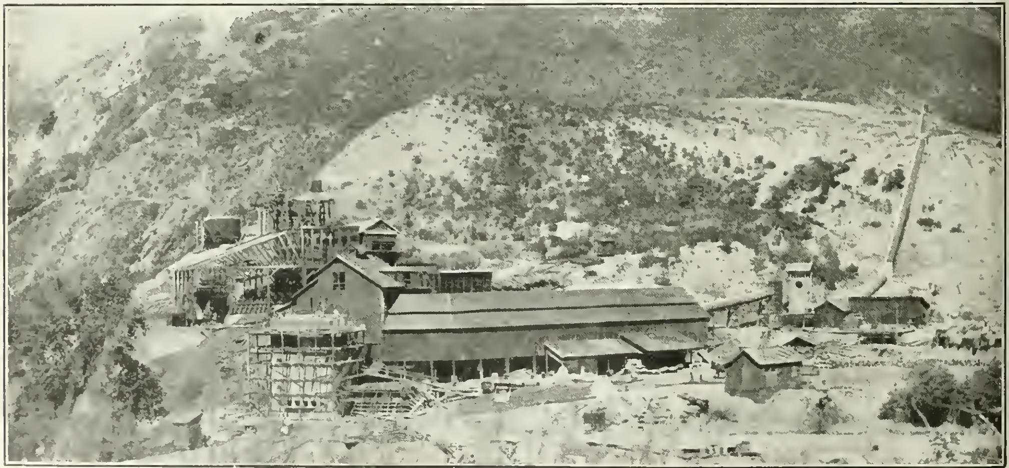
Iron Ore Movement on a great scale from Ashtabula Harbor on Lake Erie to Pittsburgh is reported by the Pittsburgh & Lake Erie R.R. On June 10 the railroad unloaded from vessels and loaded into cars for furnaces 1,609 carloads of ore, besides putting [illegible]25 carloads on the docks. Of the 1,609 carloads, 1,385 were for blast furnaces in the Pittsburgh district. These cars were unloaded by noon June 12, and were returned empty that night for reloading at the harbor at Ashtabula. On one day recently the Pittsburgh & Lake Erie moved a solid train of 99 cars, with a gross tonnage of 7,586, of which about 4,800 tons was ore, all consigned to the blast furnaces of the Jones & Laughlin Steel Co. at Aliquippa.

Oceanic Quicksilver Mill

EDITORIAL CORRESPONDENCE

The new construction work at the Oceanic quicksilver mine at Cambria, San Luis Obispo County, Calif., includes a receiving bin, 150 tons capacity, at the mine; aërial tramway, capacity 300 tons in 10 hr.; concentrating plant, 200 tons capacity in 24 hr.; and a new 50-ton Scott furnace, with condensers. This was rush construction, having in view a greatly augmented treating capacity during a period of high quicksilver prices. The entire concentrating plant was in commission in 2½ months. All the materials of construction had to be shipped by water to San Simeon, the port of San Luis Obispo County, and from there had to be hauled by motor trucks over a 16-mi. road inland to the mine.

The ore is received at the concentrator in a coarse-ore bin of 200 tons capacity. After being crushed and before being lifted to the main storage bin of 800 tons capacity, the crushed ore is passed through screens having 2-in. square openings which separate the coarse ore from the minus 2-in. material. The minus 2-in. goes to the two 50-ton Scott furnaces, and the 2-in. oversize is fed to two 5x4-ft. ball mills, the product of both mills being pumped to the sizing screen, making 10-, 20- and 35-mesh products. The oversize from the sizing screen is returned to one of the ball mills, the different screen sizes being treated on Overstrom sand tables. The 35-mesh product is passed over a 60-mesh duplex Callow screen, and the undersize of this Callow screen passes over a 100-mesh duplex Callow screen. The undersize of the 60-mesh and the oversize and undersize of the 100-mesh Callow screens pass through 5-ft., 6-ft. and 8-ft. Callow settling-out tanks respectively, and the thickened pulp from these tanks is treated on Deister slime tables. The overflow water from the settling-out tanks is returned to the sand pumps that handle the pulp from the ball mills.


CONCENTRATING MILL UNDER CONSTRUCTION AT OCEANIC QUICKSILVER MINE

The quicksilver occurs as cinnabar in sandstone and mudrock, and the ore requires fairly fine grinding to secure a commercial extraction. The extraction varies somewhat with the quicksilver content of the ore, being higher with a better-grade ore. The concentration ratio is about 20:1. The concentrates are at present sun-dried and treated in the Scott furnace.

At the furnace plant a 50-ton Scott furnace was added to the one already in use, together with a two-compartment brick condenser and two large wooden condensers. The wooden condensers are built with tongue-and-groove floors and tongue-and-groove redwood sides and roof; they are 16 ft. wide, 10 ft. long and 23 ft. high and give ample cooling and condensing space.

The new tramway furnishes the ore for both condenser and furnace. It is 2,600 ft. long and is equipped with a 1⅛-in. carrying rope on the loaded side, a ⅞-in. rope on the empty side, a ⅝-in. traction rope and 10-cu.ft. buckets.

The machinery, including the ball mills and crushers, was built by the Joshua Hendy Iron Works, San Francisco. The American Steel Wire Co. furnished the tramway-rope equipment. The Deister Concentrating Co. furnished the Overstrom and Deister tables. The machinery is driven by a 165-hp. gas engine made by the Bessemer Gas Engine Co. Herbert Haas, of San Francisco, was construction engineer.

It is anticipated that the Oceanic quicksilver mine will be one of the larger producers in the state, with a monthly output of 400 flasks. The company is sinking a new two-compartment shaft to a depth of 400 ft. The hoisting compartment is 4 ft. 6 in. by 5 ft., the manway 4x5 ft. The collar of the shaft is situated on the main extraction adit level. Arrangements are being made for electrifying the entire plant. It has not yet been decided whether the electric current will be generated at the mine or purchased from the San Joaquin Light and Power Co.

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Japanese Mines Output in 1915

The production of Japanese mines in 1915, according to a leading Japanese paper the *Chugai Shogio,* was valued at 175,950,000 yen, a gain of about 13.5% over the production of 1914. This figure does not include the production of the Government Iron Works, known to be greatly increased, through coöperation with the Russian government in supplying was munitions. As shown by the accompanying table, the majority of the items produced enjoyed substantial gains both in quantity and value of the product. The greatest individual gain was made by refined antimony, whose quantity was increased 116% over 1914, totaling 8,320 metric tons, whose value was 747% greater than that of 1914. Metallic zinc scored similar gains in jumping the quantity 274% and the value 841.8% over those of 1914. Other items making large gains in quantity were those of tin, 253%; wrought iron, 69%; pyrite, 41.7%; chromite, 41.3%; manganese, 51.5%; scheelite, 90.9%.

MINERAL PRODUCTION OF JAPAN, 1915

(Official statistics according to "Chugai Shogio")

	Amount	Percentage Increase Over 1914 Amount	Value
Gold, kg.	8,213	16.2	15.0
Alluvial gold, kg.	80		
Silver, kg.	159,261	5.5	1.5
Copper, m.tons	75,415	7.0	37.5
Lead, m.tons	4,764	4.4	18.0
Bismuth, kg.	1,074		
Bismuth ore, m.tons	21		
Tin, m.tons	341	253.3	254.2
Antimony, refined, m. tons	8,320	116.0	747.0
Antimony, crude, m.tons	27		
Mercury, kg.	38		
Zinc, metal, m.tons	21,131	274.0	841.8
Zinc, ore, m.tons	6,121	56.9*	27.8
Pig iron, m.tons	64,897	12.2*	8.9*
Wrought iron, m.tons	1,168	69.0	67.0
Steel (except government works), m.tons	16,741	8.9	34.0
Pyrite, m.tons	67,536	41.7*	36.8*
Chromite, m.tons	2,979	41.3	109.7
Manganese, m.tons	25,870	51.5	96.8
Scheelite, m.tons	352	90.9	154.4
Wulfenite, m.tons	11		
Wulfenite, crude, m.tons	10		
Arsenic, kg.	14,885		
Phosphate, m.tons	57,723	50.9	18.0
Graphite, m.tons	666	16.0	32.5
Coal, m.tons	20,490,702	8.1*	19.0*
Oil, liter	170,390,580	39.8	4.6
Asphalt, m.tons	1,975	1.5*	1.5*
Sulphur, m.tons	61,405	2.6	5.0*
Sulphur, ore, m.tons	17,174		

* Decrease

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Tungsten in the Assay for Lead

The recent great interest in tungsten and its recognition in districts where its minerals had not been known to occur lend a new interest to a paper by Herbert Lavers ("Proc. Aust. Inst. M. E.," N. S. No. 10, 1913) in which is discussed the influence of tungsten on the ammonium-molybdate assay for lead. In a certain sample negative results were obtained for lead, but after removal of the tungsten a figure of 9.8% Pb was obtained.

The interference seems to be due to the following cause: When the lead sulphate obtained by ordinary methods is dissolved in ammonium acetate, lead acetate is obtained. The titration reaction is then as follows:

$$Pb\ (C_2H_3O_2)_2 + (NH_4)_2\ MoO_4 = PbMoO_4 + 2NH_4C_2H_3O_2$$

When the ore contains tungsten, this is converted into trioxide by action of the acids, and during solution with ammonium acetate it combines with lead thus:

$$Pb\ (C_2H_3O_2)_2 + (NH_4)_2\ WO_4 = PbWO_4 + 2NH_4C_2H_3O_2$$

So that if sufficient tungsten be present in the ore to combine with all the lead present, the addition of the standard solution gives negative results.

It is therefore necessary to remove the tungsten before proceeding with the lead assay, and this is done in the following way:

The ore is digested in 10 c.c. HCl, 10 c.c. HNO_3 added and evaporated to small bulk. This is taken up with water, boiled, allowed to settle and filtered. By this means the tungsten is converted into tungstic acid and removed with the silica. To the filtrate is added H_2SO_4 taken to white fumes and the assay proceeded with in the usual manner.

The reaction between lead acetate and tungstic acid suggests a rapid volumetric method for the estimation of tungsten. The tungstic acid obtained on the filter paper with the silica is dissolved in ammonium hydroxide, neutralized with acetic acid and an excess of standard solution of lead acetate added. This combines with the tungsten as already shown. The excess is then titrated with ammonium molybdate and the difference calculated to $PbWO_4$. Tungstic acid has no effect on the zinc assay. The method is simple and satisfactory.

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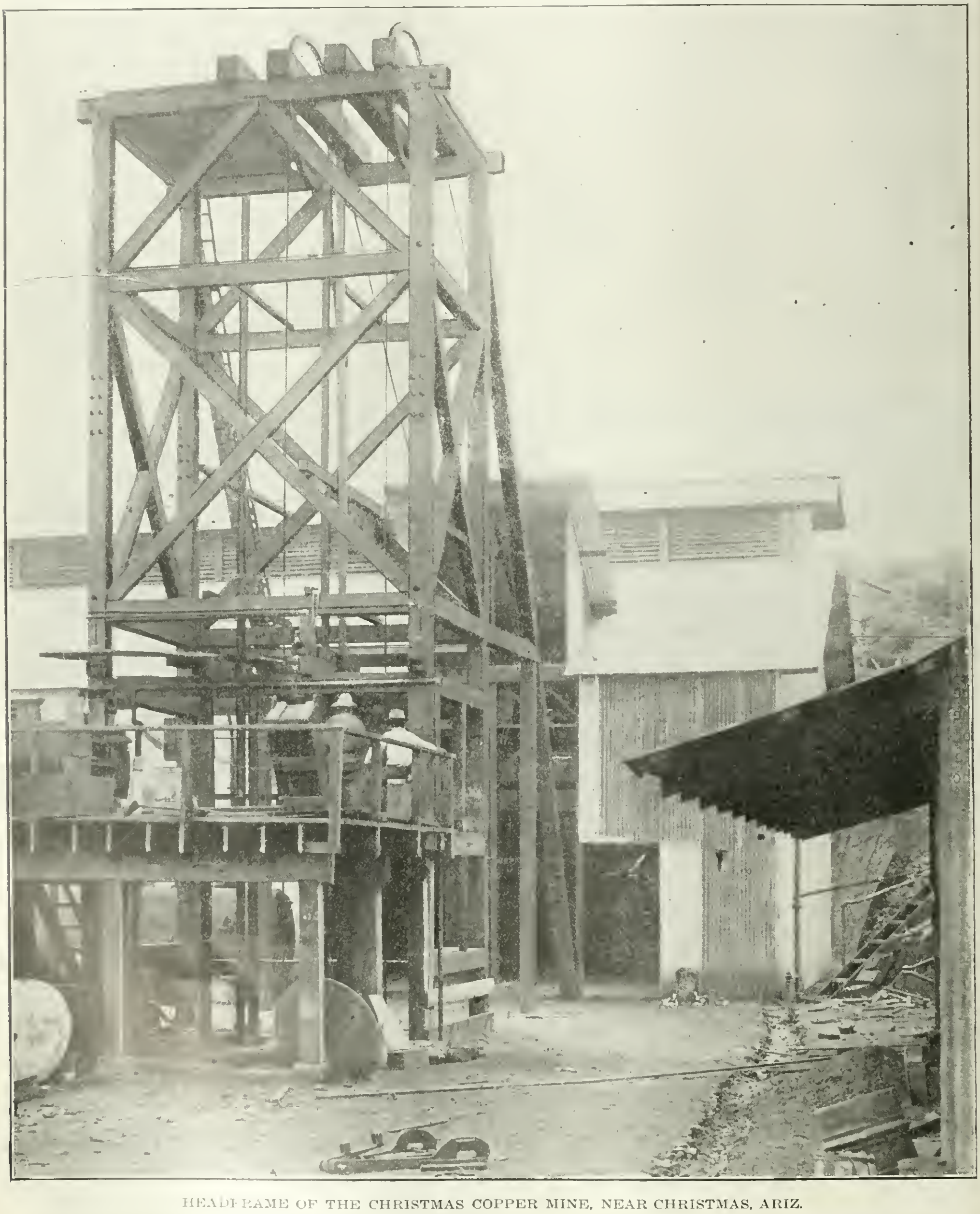
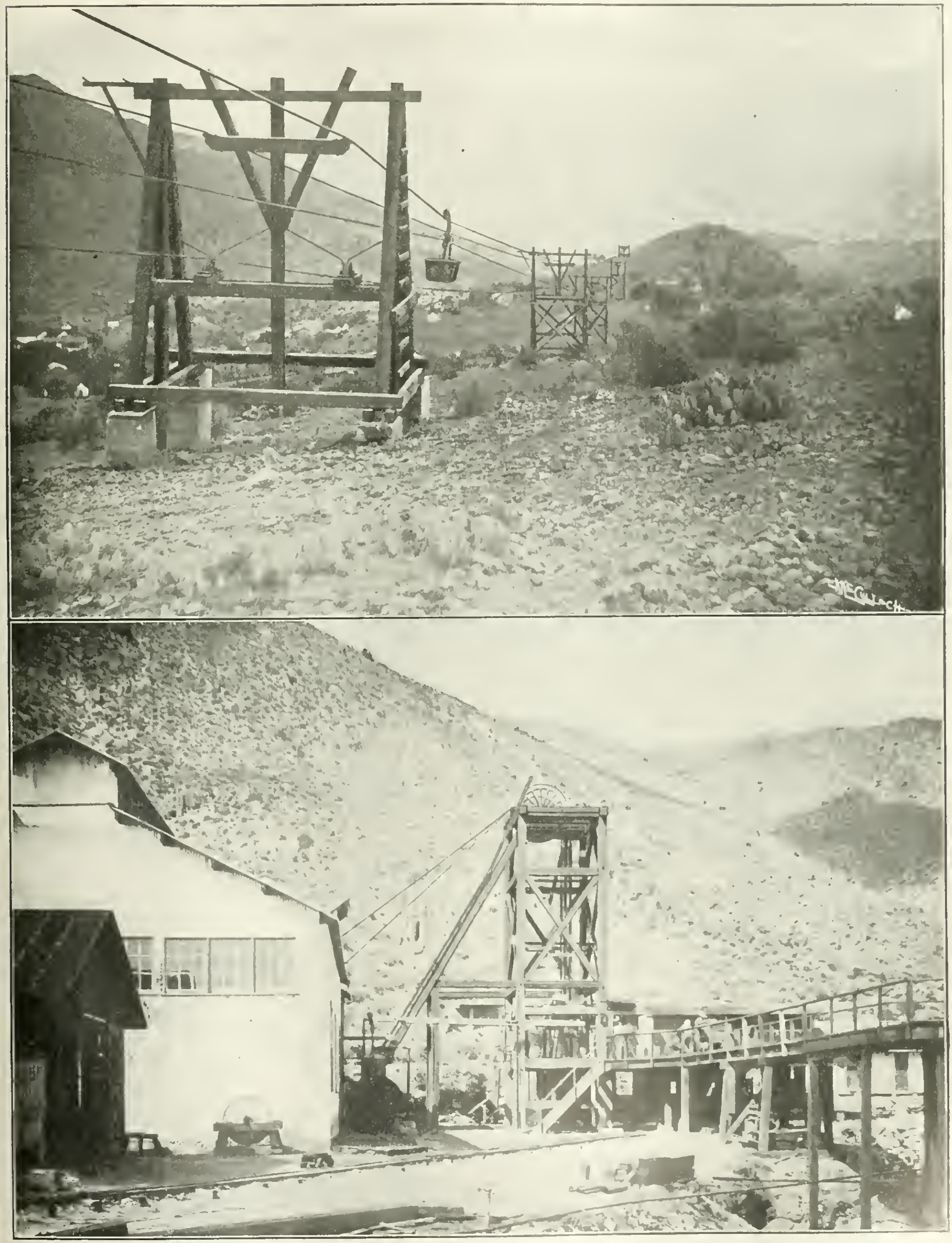
Wolframite in Argentina, says a recent Argentine official report, is found almost exclusively in veins of quartz with mica. The regions which present such veins or where they may be expected to be found belong to the geological group of the Pampean hills. The most important of all the mines of wolframite in the Argentine Republic is situated on the east side of the Sierra of San Luis, west of the village of Dolores, near the Concarán station of the Pacific Ry. This mine belongs to a company which for more than 10 years has been exploiting the wolframite, including small quantities of scheelite.'

Photographs from the Field



HEADFRAME OF THE CHRISTMAS COPPER MINE, NEAR CHRISTMAS, ARIZ.

This property was acquired by the American Smelting and Refining Co. about two years ago. It was formerly owned by the Saddle Mountain Mining Co., in which New Haven people were interested; later by the Gila Copper Sulphide Co.



CHRISTMAS TRAMWAY AND SIDE VIEW OF THE MINE HEADFRAME

A 7,000-ft. Bleichert aërial tramway connects the Christmas mine with the siding near the terminus of the Phœnix & Arizona Eastern R.R. The ore is shipped to the American Smelting and Refining Co.'s plant at Hayden, Ariz., about 20 mi. distant. The properties are in the southern part of Gila County

Correspondence and Discussion

The Economics of Housing

The question of housing company employees is of more or less importance to most industrial plants, but is of prime importance to mine plants, which are usually located in uninhabited regions where practically the entire force has to be housed in company quarters.

After completing the housing facilities for 5,000 to 6,000 employees in a previously unpopulated region, it seems that the entire problem was one of economics purely and simply. The correct understanding of the factors entering into the question and their proper weight were the prime considerations. The construction of club building, welfare building, etc., was not based on philanthropy so much as on business economics. For the better understanding of the subject, a few deductions might prove interesting.

In an unpopulated region where men work on shifts there are very few sources of interest outside of the work itself. Unmarried men living in bachelor quarters soon become restless and many leave for a more interesting existence. In one instance housing facilities in bunkhouses for 4,000 men, four in a room, cost $21 per man. The only outside interest was a welfare building that cost $4 per man. This made the total housing cost for bachelors $25 per man.

The same types of buildings in the form of apartments and single houses with the necessary attributes of a town cost an average of $725 for the house and $250 for the attributes, making a total of $975 against $25, or $950 more per man required as an initial investment. Now consider the income received on the investment. Rent for the bunkhouse is charged at the rate of 50c. per week or $26 per year, so that (allowing 2% for repairs) the income per man is $25.48, while the total initial cost is $25. This is equivalent to amortizing the houses in one year besides the necessary repairs. In the case of the married men the total value of the property is taken as the principal and 8% is charged on this, divided into twelve monthly payments; 2% is set aside for repairs. This gives an interest rate of 6% on the company's investment; but the ultimate redemption of the capital is problematic.

Summing these facts up, unmarried men can be housed at an initial cost of $25 per man with capital redemption within a year. Married men are housed at a cost of $975 with interest at 6% and redemption of capital uncertain. These conditions obtaining, a canvass is made of the labor requirements in all the departments of the enterprise. A study of conditions in similar places shows that a certain proportion of the operators must be steady, reliable, sober, skilled and satisfied. It is generally conceded that married men comfortably housed are preferable to bachelors with their occasional lapses from the narrow path. The elder members of the staff are entitled to good living quarters, while the younger members must be housed in a hotel or boarding house. Semiskilled labor is satisfied for a year or so in bunkhouses, but usually becomes dissatisfied and changes if housed under these conditions much longer. If their places are easily filled by an abundance of labor and the operations are not hindered to too great an extent by the breaking in of new hands, this is not a great loss.

It is usually the policy of a company to keep a more or less constant ratio between the married and unmarried men and provide accommodations to suit. The unskilled labor encountered during the construction period is most economically housed in bunkhouses. The better men can be picked for operators at the end of construction and their quarters provided if they are married. The rule prohibiting unmarried men from having houses is a good one, as an unmarried man with a house causes all the expense of a married man without any of his assumed stability. It is well to remember that public buildings, such as railroad stations, churches, schools, etc., are entirely nonrevenue producing, while semipublic buildings are good revenue payers. A Y. M. C. A. building, clubhouse or bowling alley will pay for itself in a remarkably short time. In this connection I would recommend, from an economic standpoint, an increase in the latter type of building for spare time rather than the first. A Y. M. C. A. building can be run by a broad-minded man with equal benefit to that of a church and to greater advantage.

In the construction of a new plant from 5 to 15% of the cost of the plant should be allowed for housing facilities and the distribution of this amount should be based on the requirements and limitations indicated.

New York, Aug. 1, 1916. F. W. Fredericks.

Blast-Furnace Tapping by Electricity

One of your correspondents, J. C. Welch, in the *Journal* of May 27, 1916, gives a copy of a clipping from the *Greenwood Times*, B. C., which has some historical value in connection with the ferreting out of the origin and first use of the electric arc in the opening of blast-furnace tuyeres and tap holes. It seems, however, that the first source of such information has been neglected. I refer to the *Transactions* of the American Institute of Mining Engineers. In Vol. 31 (1901), page 626, there appears a paper by F. L. Grammer, on "The Electrical Burner for Blast Furnaces." A copy of this paper is given herewith, and no comments should be necessary. The Transactions, even of 15 years ago, form an authoritative record of things metallurgical, and in an instance of this kind cannot be neglected as a first source.

Rancagua, Chile, July 24, 1916. Veritas.

Mr. Grammer's paper says:

In these days, when anthracite is less extensively used as a blast-furnace fuel than it was a generation ago, and managers endeavor to maintain regular and known ore mixtures, the "freezing" of tuyeres, cinder notch or iron notch is infrequent and consequently the oil-burner or "kerosene blowpipe" is seldom employed and furnace foremen have, to a considerable degree, forgotten their former cunning and persistency in the use of the drill and sledge. Still, in starting new or abandoned plants with untrained labor and in running some of our large 100-ft. furnaces, slips, resulting in very cold furnaces, may occur even under experienced managers.

During my superintendence of the Cleveland, Ohio, blast furnaces, such a misfortune, owing to a dearth of trustworthy foremen, was experienced and our electrician, Thomas Martin, proposed to open the tuyeres and cinder notch by means of the heat of the electric arc. We have heard that the surface cracks or marks developed in rolling heavy plates have been closed by electric welding, as by a soldering iron, and also that an electric burner has been employed at some German blast furnaces, but the experiment was quite novel to us, and I think it constituted one of the first, if not the very first, successful application of this device for the purpose named, in the United States.[1]

In the construction of the circuit we attached one wire to a pipe, feeding a cooling block of the furnace wall, some distance from the point where the burner was applied. The current from this wire passed either through the crucible or through the circumferential shell. The other wire, after running through a resistance coil immersed in a barrel of water, was attached to clamps holding the carbon, the latter being inserted in an iron pipe provided with a wooden handle and applied at the desired point by the goggled operator.

Our first experiments were not very successful. We used 1.5-in. carbons, 1.5 ft. long, not being able at the moment to obtain larger ones. Subsequently, we had carbons made 4 and 6 ft. long, and with these we burned a hole through 18 in. of cold iron in 5 minutes. A current of from 400 to 500 amp. did the work, but 1,000 amp (at 80 volts) gave better results. Our two dynamos were General Electric, with 110 kw. capacity and 220 volts. We reduced the voltage by means of a resistance coil of german silver wire.

The results were so satisfactory that permanent wires were strung up to the furnaces,[2] and "hard holes" at tapping time, requiring slackening of wind, are now an evil of the past.

Water-blocks sometimes leak and flood a side of a furnace, closing several tuyeres and causing one-sided working. But by putting blanks on the penstocks temporarily out of use, the blast can be kept on the furnace while the closed tuyeres are burned open. Several furnaces on the Lake fronts used it successfully, after hearing how it had assisted us.

The electric current employed is not dangerous to the workman, and the apparatus, unlike the oil-blowpipe, is always ready for service. It can be applied instantly to a black, cold surface, without the need of any blast pressure —a boon which will be appreciated at single stacks, where the freezing of the tuyeres may have made it difficult to get the necessary pressure, by affecting the gas supply to the boiler house.

The saving in oil, worn-out men, drills and time commends this simple and effective burner as the best. We may say of this apparatus what used to be said of a dress coat or a pistol—that "it is not needed often, but when it is needed, it is needed awfully." Plants not equipped electrically can use the power of a neighboring municipality or other works, employing a rotary transformer to obtain the desired current. Both the holder of the burner and the curious spectators should wear the darkest glasses, such as are worn by heaters—or twelve hours of great suffering will be the penalty.

A Bryn Mawr graduate, in describing the bessemer converter, which she had just seen for the first time, remarked that she was much impressed with the "intense molecular activity" there displayed. This pedantic but accurate description applies with still greater force to the electric-arc burner, as those who are so foolishly enthusiastic as to watch it with unshielded eyes will be forced to confess.

Origin of Sudbury Nickel-Copper Deposits

In the *Journal* of May 6, 1916, Cyril W. Knight offers a very interesting contribution on the "Origin of Sudbury Nickel-Copper Deposits." Though his discussion is brief, yet as new evidence bearing on the origin of the Sudbury ore deposits, it probably should rank as the most important contribution offered since Doctor Barlow's and Doctor Coleman's monographs were published several years ago.

Doctor Coleman's later discussion, in the *Journal* of July 8, adds nothing to his views as expressed in his monograph and in subsequent discussions in the *Journal*. The feeling is hardly avoidable, however, that in his latest discussion he fails to allow to Knight's contribution the weight that it deserves.

Whatever value may be attached to Knight's observation or to any that may in future be made, the importance of Doctor Coleman's work will remain untouched. His monograph, containing his generalizations as to the norite laccolith and as to the general positions of the nickeliferous orebodies, will remain a classic. His maps will still be found in the outfit of every prospector in the district. The hard, faithful, accurate and honest work done by Doctor Coleman and his assistants will still be as highly appreciated as before by those best in position to value the accuracy of the work they accomplished. But a scientific theory is merely a theory and serves its best purpose when it acts as a stimulus and guide for further research. It becomes merely a mental stepping stone should later ascertained facts not prove to be in harmony with it.

I am acquainted with a number of technical men who have held Doctor Coleman's geological work in very high esteem, but who have never been convinced of the probable correctness of the theory of magmatic segregation as accounting for the origin of Creighton, Whistle, Levack and other orebodies in this district. If Knight's observation of numerous apophyses branching into the norite from the parent granite mass, in Graham, Creighton and Snyder Townships, is correct (and this is a matter that any geologist can easily disprove if Knight is incorrect), then it will be difficult to believe that the present Creighton orebody was formed by the settling of sulphides under the action of gravity before the norite mass solidified. Doctor Coleman's suggestion that the later (in place of earlier) intrusion of the granite has little or no bearing on the manner in which the Creighton orebody was formed, I feel, can only convince those who are differently constituted mentally from myself.

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[1] The principle was very clearly stated in 1891 by Prof. J. W. Langley, ("Trans.," XX., 252, who said that in the course of experiments upon fusion in an electric-arc furnace, it happened on several occasions that the arc from the end of a carbon rod struck squarely in the center of a lump of steel about as large as a hen's egg, and that "in a very few seconds that arc would bore a hole through that piece of steel, the corners of the steel being still so cold that, when seen through the dark spectacles that one had to wear, they appeared to be black." I am informed that a similar device has been used by safe robbers.

[2] The low potential requires a heavy copper wire.

That the nickeliferous deposits bear some relation in origin to the norite is undeniable. The point of doubt is that they were formed by segregation by gravity from the molten norite magma. If Knight's observation is correct and if Doctor Coleman's theory of the origin of the Creighton deposit is also correct, then we must believe that an intrusion of granite roughly two miles wide and thirteen miles long was forced into the outer crust of the earth mainly along the base of the norite mass and that the Creighton orebody, already forming part of this base, was not seriously disturbed by this great intrusion. To me this is incredible. Being so constituted, I have only a choice between accepting the fact based on observation or the theory based on opinion.

Possibly, to minds differently constituted, the intrusion of granite under the enormous Creighton orebody, without seriously disturbing the latter, is easily conceivable. If so, no amount of discussion will clear the difference away.

To me there are some other serious difficulties in the way of accepting the magmatic-segregation theory as accounting for some of the larger Sudbury deposits, that I have not seen adequately met. But since I feel the keen interest that arises from more than twelve years' experience in the exploration and mining of these nickel ores, I would very much like to see further discussion and expression of opinion as to the bearing of Knight's observation on their origin. C. V. CORLESS.

Coniston, Ont., Aug. 29, 1916.

Revision of the Mining Laws

I am pleased to give a few facts that I deem essential in the revision of the mining laws of the United States. I have been a close observer of mining law and its operations ever since the early days of the Comstock Mines at Virginia, Nev.

I have been a pioneer of many mining countries, such as Idaho and the Black Hills in 1878, where I resided for over 20 years; I also spent 5 years in Alaska and old Mexico. I was graduated in metallurgy under Prof. H. C. Hoffman, who now holds a chair in the Massachusetts Institute of Technology, Boston, and I believe my experience in all these years gives me the advantage of having an opinion of my own in studying the mining laws of our own country.

The revision of the mining laws no doubt would greatly lessen the misunderstanding that now prevails. After reading the first paragraph of your article I would say, briefly, that the present law has served the miner pretty well, but in my opinion some corrections should be made and the corrections should be such as to give the prospector an advantage for his hardship in prospecting the undeveloped mineral resources of the public domain. I am glad to note that under the liberal rulings of Secretary Lane this has been accomplished in a measure. I believe that a claim staked as at present would be sufficient, but mineral-bearing rock should be discovered. Such discovery might embrace any mineral-bearing rock, whether it is talc, slate, Potsdam sandstone, quartzite or schist, which have all been known to carry gold in paying quantity in the Black Hills. To use Judge Moody's idea in deciding what constitutes a discovery, any mineral-bearing ore or vein embedded on the side of a mountain or in the formation, though it be broken up, as long as its course is downward, he considered rock in place and a valid location.

Question No. 2 I would answer, no; No. 3 I would answer, no. To No. 4, I advise location as at present. As to No. 5, locations should be made according to the trend of the vein as traceable through the ground. To No. 6, I would say that if one person be the discoverer of a mining claim, a group of, say, five claims would be sufficient; to No. 7, five claims for one group; to No. 8, yes.

As to No. 9, recording of deed of claim should be, as now, in the office of the register of deeds in the county in which the claim is located, but the law should be so framed that one person only could get a record of that particular piece of ground. Should the locator of such ground fail to comply with the United States mining law and another desired to obtain title to the ground, owing to defects in the location, an adverse decision should be brought to quiet the title. In that way it would be settled at once who is the real owner of the property.

In answer to Nos. 11 and 12, if not convenient to do the annual assessment work, the locator should have the right to pay the money in the Land Office in lieu of doing $100 worth of work; to No. 13, yes, the work should be done, if desired, on one claim, so long as it is beneficial to the whole group. To No. 14 I would say, no; to No. 15, a shaft 10 ft. deep in blasting rock should be considered an assessment for a quartz claim, or if a drift is run in a tunnel, an equal amount of work would be sufficient.

To No. 16 I would answer, yes, a record of the assessment should be made with the register of deeds of the county; to No. 17, yes, with some corrections. I have just received notice of a patent having been granted for the Copper Queen mine in Inyo County, California. I was a year and a half in getting this patent. I have no complaint to make, since my attorney omitted some items that he should have mentioned. The department at Washington, D. C., returned a letter for additional evidence. This was absolutely right, but as my home is in Denver, I procured a mining lawyer here, and he formulated the points that I was asked to correct, and I found that I was compelled to go to Inyo County, California (to the Land Office), where these claims were located, to make the additional affidavits. This was expensive, and think I should have had the right to go before any United States Commissioner to make these affidavits, and then send them to the Land Office in California, and so eliminate the red tape.

As to No. 18, the abolishing of extralateral rights should be adopted. This would greatly lessen the chances of lawsuits. As regards No. 19, record should be made as now, within 90 days from date of location. In reply to No. 20, the locator should not be compelled to patent the ground so located unless he desires to do so, and he should have full possession of the ground so long as he performs the annual assessment work. To No. 21, I would reply negatively. JAMES JACOBY.

Denver, Colo., Sept. 4, 1916.

Editorials

Copper-Refining Capacity

It is well known that the production of crude copper has increased in 1916 to a larger extent than has that of refined copper. The lag in the latter has been due to inability to increase quickly the refining capacity, which throughout the year has been taxed to the utmost. The supply of copper has in fact been checked in the refineries. We have recently made a survey of this situation.

On Jan. 1, 1916, the electrolytic refiners of the United States reported an aggregate capacity at the rate of 1,877,000,000 lb. of copper per annum, or about 156,000,000 lb. per month. Adding 20,000,000 lb. per month for the copper that is refined otherwise than electrolytically and for what is marketed as pig, we had a total capacity for the production of about 176,000,000 lb. of refined copper per month.

However, the operators of refineries are seldom able to maintain the full rated capacity for a long period. The actual production during the first half of 1916 is estimated at about 1,000,000,000 lb., or about 167,000,000 lb. per month, and that estimate is probably not far out of the way.

On Sept. 1, 1916, the refiners reported an aggregate capacity of 2,173,000,000 lb. per annum. The increase was due chiefly to the new Anaconda refinery at Great Falls, intended to replace the old one, which had been begun in 1915. At three other refineries there had been increases of capacity relatively small.

On Sept. 1, 1916, there was construction going on at four refineries, which was figured as adding about 220,000,000 lb. per annum to the capacity of the United States. This was coming along but slowly, owing to the inability to obtain prompt delivery of material and machinery. It is estimated that part of it will be ready for use in January, 1917, and part of it in February. However, at present there is no certainty respecting estimates of time.

Anyway, it is clear that no relief from the tightness in the position of refined copper is to be expected until the early part of 1917. In the meanwhile many mines producing increased quantities of copper must face the contingency of being unable to sell all of it immediately out of sheer inability to get it smelted and refined. The situation in copper is now similar to the situation in zinc in 1915, but copper-refining capacity cannot be augmented so easily and so rapidly as was the case with zinc.

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The Institute Meeting

The coming meeting of the American Institute of Mining Engineers is going to be one of the most interesting that has been held in years. The visit to the great mining camps of Arizona ought to be of great benefit to every engineer, whether he is more particularly interested in mining or metallurgy. The mining methods followed at the great copper mines are varied and interesting, and many of them are novel and of recent adoption. The visits to the works of the Chino Copper Co., the Copper Queen, the Calumet & Arizona, the Old Dominion, Miami, Inspiration and Ray will constitute a wealth of uptodate mining and metallurgical experience that can probably be found in no other district of equal area in the world.

Of particular interest is the application of flotation, and many of these companies have adopted the process on a large scale and are using it successfully. The variety of methods and appliances used by the large concentrators is such as to form a liberal education for the engineer who is interested enough to make a close study of the subject. New methods of crushing and grinding are also in use at many of these mills, and the newest forms of grinding machinery are in operation. Modern and efficient methods of ore and pulp handling are installed, and ore transportation has also been so closely studied as to produce highly efficient methods. The Arizona meeting is to conclude with a visit to the Grand Cañon of Arizona on Sept. 24, where the members of the party will undoubtedly acquire some highly interesting data of a different sort. Altogether, no one who makes this trip ought to leave Arizona without having received a great amount of valuable knowledge and a strong stimulus toward future progress.

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The Position of the Zinc Smelters

For some time back the price for common spelter has been seesawing between 8 and 9c. When the price has fallen to about 8c., sellers have withdrawn. When it has risen to about 9c., buyers have disappeared. At no time, however, has there been large volume of buying, and it is probable that stocks have been continuing to increase, as they began to in the first half of the year.

In previous comments upon the situation in spelter, we have drawn attention to the increased cost of smelting, owing to higher costs for labor and material and less efficiency, and we have conjectured that a market price of 7c. or so is only equivalent to about 5c. before the war. The recent behavior of the market rather bears this out. Smelters withdraw around 8c. for the reason that at that price there is not much in it for them.

Of course, at such a figure those smelters who are operating old Belgian plants in the Kansas coal field, that were abandoned around 1901 and were repaired during the war boom, find themselves in real difficulties. Similarly do those who took over old plants in the gas fields, where the supply of gas had already become short. A cost of 10 or 12c. per 1,000 cu.ft. for gas was not a matter for concern in 1915, but it is fatal now.

Therefore we now get reports of coal smelters going out of business and some of the gas smelters preparing to. This will naturally tend to bring demand and supply into equilibrium and establish the spelter market upon a fairly stable basis, which apparently is going to be in the neighborhood of 8c. per lb. with present conditions, with a tendency, however, to work gradually lower. For one thing the production of the electrolytic works, which in some important cases has been figured—and probably correctly—as being capable of meeting the severest competition, will continue to increase. For another thing, as the ephemeral smelteries go cold, the supply of smelters will become more ample and operators, once more able to pick and choose, hire and fire, will improve the efficiency of their plants and be better able to compete at lower prices.

It is scarcely to be expected, however, that we shall see the old levels for spelter until the great readjustment in conditions for labor and material comes about, although it is likely that both miners and smelters, but especially the latter, will experience hard times before then. No one of experience in the zinc business doubts that ultimately we shall see not only 5c., but probably as low as 4c., for spelter. Some of the important new enterprises in this industry that are now in the construction stage have been projected on the basis of 4c. for spelter; that is, if they could not live at such a depth, they were deemed risky.

Facilitating Flotation

Flotation is making such advances and its application is increasing so rapidly that much study is being given to the obtaining of supplies of the ingredients necessary in its practice. It is fortunate that the requirements are few and simple, with the exception of the oil. When flotation was first applied, there was no difficulty in getting the kind of oil desired in the required quantity at a reasonable price, but since the requirements have enlarged so tremendously, the problem of securing oils has become one of vital importance. It has been found in general that petroleum or some of its byproducts will function satisfactorily so far as the oiling of the ore particles is concerned, but when it comes to the frothing agent, petroleum is seldom satisfactory. The requirement is usually for some vegetable product, such as pine oil, and the other well-known varieties that have been used in flotation practice. Some conferences between metallurgists and botanists have brought out the fact that many of the common varieties of vegetation are capable of producing oils or gums, and that it is possible to take advantage of the abundance of some particular kind of vegetation and make it produce an oil that can be used as a frothing agent.

In Australia the *eucalyptus amygdalina* supplies the frothing agent right in the territory where it is to be used. The Australians were fortunate in this, however, since the eucalyptus oil was produced before flotation was thought about. It is well known, however, that in the vegetable kingdom there are many plants whose essential oils and gums may satisfactorily replace one another. An instance of the sort is the *guayule* plant, formerly so abundant in Mexico, that was found to yield a substitute for rubber. Efforts are now being made to accomplish the same thing in flotation. The forms of vegetation most common in the localities where flotation is being principally practiced are being tested to determine their possibilities as oil producers, and it has been announced that the ubiquitous sage brush of our western country is at last about to provide a valid reason for its existence. It is said that the oil produced from sage brush will satisfactorily supply the frothing agent required by the great number of flotation plants in the West.

Antimony Supplies and Prices

The strong demand for antimony and the high prices paid for it resulted this year in a very large increase in the imports of the metal, which are the chief supply of the market. The domestic production is almost negligible, and though that has been stimulated to some extent, most of the metal smelted and refined at our works is from foreign ore. For the fiscal year ended June 30 last, the total imports into this country, including antimony contents of ore, were 32,617,318 lb., this quantity comparing with 16,090,963 lb. in 1914-15 and 13,163,629 in 1913-14. The imports of 1916 were thus more than double those of the preceding year. There were some reëxports, amounting in 1916 to 3,831,330 lb., so that the net imports for the year were 28,785,988 lb. These compare with 13,972,082 lb. net imports in 1915, an extraordinary gain.

As exports from England and France are under an embargo, the increased supply came mainly from the East, China and Japan both contributing, though China furnished much the larger share. In fact, the great demand here has built up the mining and smelting industry in that country to an extraordinary degree. The English and French brands, which formerly controlled the market here, have practically disappeared, and the current quotations are of Chinese and Japanese metal.

Not all the large net imports are retained in this country. A considerable quantity is used in the manufacture of munitions and is exported in that form. Just what the proportion is cannot be determined, since such exports are not recorded as those of antimony, but appear under other heads.

The imports of recent months have been so large that they have exceeded the demand, and prices have fallen from a high level of 45c. per lb. down to 12@12½c.; but they are still considerably above the 6 or 7c. which prevailed before the war.

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There has been thus far general quiet in the labor employed in the iron and steel mills, chiefly because most of them under the intelligent leadership of the Steel Corporation have kept wages up to a pretty high level. The settlement of the threatened railroad strike, however, while it relieved immediate expectations of trouble from the steel mills, has been the cause of some apprehension to observers in the trade. What they fear is not a strike for higher wages, but a demand for an eight-hour day. This would be very embarrassing under present conditions. The greater cost of production entailed by substituting three shifts for two could be carried with prices at their present range. The difficulty would be to find the men. Labor is already scarce, and it would be impossible to get enough additional workers to carry out the change. The inevitable result would be a curtailment of production and disorganization of the trade.

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In a paper recently contributed on the general problem of naval warfare, a naval officer of high rank, after discussing at considerable length and with great insight the strategy and tactics of sea conflict, makes this statement:

"Battle is first of all a contest of character; victory will come to the side which can longest sustain the will to attain it, together with the belief of ultimate success." By changing the word "battle," this becomes a perfect definition of success in mining or any other line of endeavor.

*

Copper producers were greatly relieved in reading the new revenue bill as finally enacted, to find that there was no reference therein to copper. The proposed tax on copper was dropped by the Senate, but it remained in the bill as passed by the House of Representatives. Therefore the matter had to be adjusted in conference. Inasmuch as this highly important measure had to be put through in the usual slap-dash way of the closing days of a session, there was a good deal of uncertainty as to what would come out. The whole business was something like drawing from a grab-bag. Copper producers were fortunate in escaping the great injustice that was proposed by the House of Representatives and owe a debt to the Senators who stood up in their behalf.

BY THE WAY

William V. Pettit, whose death was announced in the *Journal* a few weeks ago, was a well-known mining engineer, having operated in Mexico at Parral and Santa Barbara, in Chihuahua, and at Indé, Durango, between 1900 and 1908. He was born in Philadelphia in November, 1874, was graduated from Lehigh University in 1893 and was killed by shrapnel on June 29, 1916, in France or Belgium. He was a lieutenant in the Royal Engineers, of the British Army, having enlisted over a year ago. His family has received a letter from his commanding officer highly commending him as a brave and efficient officer.

*

A California correspondent writes us that he has seen in the papers that Jim Gillis (Mark Twain's "Truthful James") took several hundred dollars from his ground on Jackass Hill. Jim owns most of Jackass Hill. Our correspondent continues as follows: "In early days the stage road passed Jim's house, or cabin, I should say. The old miners make sourdough bread, and Jim had some in a pan trying to make it rise, but it would not, so he said, 'I'll make you rise, durn you.' He put the pan out under the oak that covered the stage road and put a stick of giant powder under it. As a result the dough hung all over the limbs of the tree. The stage came along loaded with Eastern women and 'tenderfeet,' looking for any old curiosity and about as gullible as ducks. A lady asked Jim what kind of a tree it was (Jim is a sober-faced, dry liar), and he said, 'Madam, that is a bread tree.' 'Really, is that bread we see?' 'Oh, yes,' said Jim, 'you can take it in your hands and work it into bread.' Whereupon she took some of it and believed, and told everywhere about Jim Gillis' bread tree of Jackass Hill. Old Jim is as dry as ever and an old bachelor about 65 years of age. Jim lives most of the time at a hotel in Sonora. Every Sunday he takes a crowd of women admirers to dinner, and he amuses them with his dry extravagances of early days. He keeps the whole dining room in an uproar, and many go there to eat just to hear him. Mark Twain's cabin on Jackass Hill is preserved, many going to look, for curiosity sake. Mark played poker here in Jimtown in early days in the Bella Union saloon—it is a saloon today."

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The United States Metals Refining Co. has begun the publication of a "Safety First" periodical that bears the significant title of *Ax-i-dent-Ax*. As introduction, or "turning on the blast," as the editor puts it, this statement of principle is made:

"We are the friends of a man only when we expect of him and help him to express the very highest and best that is in him. We believe that a company paper, such as this, should visualize to both management and men the value, the imperative need, the possibility and inspiration in each to attain the highest efficiency.

"'The world' says A. T. Mercy, editor of *The Commonwealther*, 'has too long erroneously believed that there is attractiveness, necessity, even inevitability, in evil, laziness, carelessness, accidents, inefficiency, bad habits and ignorance. We should cultivate the art of depriving that which is wrong of all power and of showing that only that which is right and strong and lovable and safe and efficient is attractive, sane, necessary or acceptable.'

"We want to make the *Ax-i-dent-Ax* an expression of the things in the plant and the company that are spicy, breezy and newsy. There should be plenty of good wholesome humor throughout, excluding stingers or questionable personalities. Sarcasm or hits that embarass or hurt will be strictly tabooed. There is plenty of good to be said about everybody. We want to be constructive rather than destructive and thus create a dominant progressive attitude that will make our readers think."

The object is good. We wish the editors all success in their efforts to attain it.

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In the event of war it is estimated that this country would need approximately 40,000 tons of nitrogen in the form of 180,000 tons of nitric acid per year. In 1915 enough bituminous coal was mined in the United States to yield, if properly treated, 1,000,000 tons of nitrogen, which could produce 3,600,000 tons of nitric acid, or, on the foregoing basis, enough for 20 years of war. Our present industrial methods of coal treatment would recover but one-fifth of this nitrogen as nitric acid, or in one year enough for four years of war, if we were properly to expand and extend these industrial methods and appliances, and also further, to convert the so-recovered ammonia into nitric acid. To make air-nitrogen now requires about $1,200 worth of plant for each ton of nitrogen recovered per year, or 60c. of plant per pound of nitrogen per year, as nitric acid. In this form nitrogen is worth about 32c. per lb. The apparatus for recovering our coal-nitrogen as ammonia and then converting it into nitric acid is not so expensive. Germany has, since the beginning of the war, increased her annual output of air-nitrates by about 100,000 tons of nitrogen, or about 2½ times our estimated war needs, but by methods far more expensive than those open to us. In view of the dormant nitrogen supplies of our coal beds and the new methods that can be used to make those supplies available to us for agricultural and industrial uses, we can all feel much easier as to our future nitrogen sources. This particular source has not had much attention before.

Progress in Porphyry Coppers

The quarterly reports of Utah Copper, Nevada Consolidated, Chino and Ray have shown great increases in copper production and also in net earnings. Utah copper shows a total production of 48,384,929 lb. of copper during the second quarter of 1916, the monthly output being 14,557,282 lb. for April, 15,950,215 lb. in May and 17,877,432 lb. in June, showing a gradual increase for each month of the quarter. The average monthly production was 16,128,309 lb.

A total of 2,758,500 tons of ore was treated at both plants, the tonnage handled and the gross output of copper being the largest for any quarter in the history of the company. The average grade of the ore milled was 1.3810% copper, and the average extraction was 63.51%. The average cost per pound of net copper produced during the quarter, after allowing for smelter deductions and crediting miscellaneous income from Utah operations only, including Bingham and Garfield Railway earnings, use 6.726c. The total net profit was $9,958,317, from which $4,873,470 was paid in dividends, leaving a net surplus of $5,084,847. The earnings were computed on the basis of 26.758c. per lb. for copper, no unsold being on hand at the end of the quarter.

The Nevada Consolidated Copper Co. for the same period produced 24,091,021 lb. of copper, the monthly production being 7,716,101 lb. in April, 7,723,148 lb. in May and 8,651,772 lb. in June. During the quarter 1,094,879 tons of Nevada Consolidated ore, averaging 1.57% copper, was milled, 88% coming from the open-pits, and 12% from underground workings of the Ruth mine. In addition, 5,084 dry tons of Giroux Consolidated Mines Co. ore was milled during the quarter. The cost of copper, including Steptoe-plant depreciation and all charges except ore extinguishment and after crediting all miscellaneous earnings, was 8.51c. per lb. The outcome is figured on a copper price of 27.23c. per lb. for the quarter, no copper available for delivery remaining unsold. The earnings amounted to $4,853,945, and after deducting dividend No. 26 and extra dividend No. 5, amounting to $1,499,593, the net surplus for the quarter remained at $3,364,352.

Chino Copper Co. produced during the second quarter of 1916 a total of 18,099,182 lb. of copper, an average monthly output of 6,033,061 lb. The monthly production was 4,496,270 lb. for April, 6,359,294 lb. for May and 7,213,618 lb. for June. In addition to the copper recovered by milling, 58,748 lb. was recovered from precipitation plants at the mine, making a total production from all sources of 18,157,923 lb.

The total amount of ore milled for three months was 788,500 tons, the average copper content of the ore treated being 1.79%. The recovery per ton of ore milled for the three months was 22.99 lb., and there was produced 62,241 tons of concentrates, averaging 14.54% copper. The cost per pound of net copper produced for the quarter, after allowing for smelter deduction and crediting all miscellaneous income, was 8.89c. The net profit and miscellaneous income amounted to $3,221,969, and dividend paid was $1,957,455, leaving a net surplus of $1,264,514. Earnings are based on 27.49c. per lb. for copper.

The Ray Consolidated Copper Co. during the second quarter of 1916 produced 18,667,664 lb. of copper, an average of 6,222,555 lb. per month. The monthly production was 6,162,117 lb. in April, 6,106,657 lb. in May and 6,398,890 lb. in June. A total of 503,574 lb. of copper in addition was contained in ore shipped direct to the smelter, making a gross total production of 19,171,238 lb. The total ore milled for the quarter was 865,300 dry tons, averaging 1.579% copper. The average net cost per lb. of all copper produced for the quarter was 10.507c. This includes a charge of 12½c. per ton of ore milled, for the retirement of mine-development cost, but is after crediting dividends of the Ray & Gila Valley R.R., revenues from gold and silver produced, and other miscellaneous incomes. Earnings are based on a price of 28.067c. per lb. for copper. The total net operating profit, including miscellaneous income, amounted to $3,242,542, from which a dividend of $788,589 was paid, leaving a net surplus over dividend requirement of $2,453,953.

In these reports it is shown that all records were broken for copper production which, under the stimulus of high prices, resulted in the maximum endeavor being directed toward metal output. The high output for the second quarter was remarkable in itself, but the prospect of these companies was even more remarkable, since it was expected that even greater production would be accomplished. That this prophecy was well founded is shown in the July output, which for the four companies mentioned amounted to 42,557,354 lb. of direct production, as against 40,171,612 lb. of direct production for June. Both the Utah and Ray again broke their records in July. The production for the four companies was: For Utah, 20,302,228 lb.; for Nevada Consolidated, 8,537,231 lb.; for Chino, 6,883,403 lb.; and for Ray, 6,834,492 lb.

Frank McMillan Stanton

Frank McMillan Stanton died in New York, Sept. 11, aged 51 years. Practically all his life identified with the Lake Superior copper country, he was one of the best-known operators in that region and was recognized as an able successor of his father. He was a son of John Stanton, so widely known as one of the chief representatives of the copper industry in this country. His mother was Elizabeth R. McMillan, of an old New York family. He was born in New York in 1865 and was brought up in the public schools of the city and in the School of Mines of Columbia University, from which he graduated in 1887. For about two years he worked as a mine surveyor and assayer and then decided to embark in the mining field on his own account, which he did successfully. Soon after, he was offered a position with the Atlantic Mining Co., of which his father was president, and in a short time rose to the position of superintendent, which he held for over 20 years. His work with the Atlantic was hard, as is well known. The mine was one of the lowest-grade exploitations in the Lake Superior region, and the closest economy and most careful work were needed to make it pay. This was attained under the management of Mr. Stanton and his father, and for years the company was able to pay dividends on a copper recovery that many engineers would have regarded as entirely insufficient. The mine held the record for low cost of production for many years and has probably never been surpassed for close and careful management. While engaged in this work Mr. Stanton was called upon to act in an advisory capacity to several other mines, among them the Wolverine and Mohawk.

He retired as superintendent of the Atlantic in 1910 on account of ill health and went to Europe for a rest, visiting many Continental countries and inspecting a number of mines. He remained abroad for about three years, returning in excellent health, and in 1914 was made treasurer of the Wolverine and Mohawk mining companies, to which were afterward added the Michigan and the White Pine Extension companies, all of them being under his active supervision. The Wolverine especially was a marked contrast to the old Atlantic, its property including some of the richest lodes in the region. Mr. Stanton's knowledge of mining methods and also of market conditions were apparent in the management of the newer companies. He was also directly interested in the management of the Michigan Smelting Co., which treated the output of his several copper companies, being a director of that company from its formation.

Outside of his copper properties, Mr. Stanton was president of the Fort Mountain Talc Co. in Georgia, which was a successful enterprise. He was a director of the Ohio & Kentucky R.R., which penetrates the Kentucky coal region, and was also interested in the Copper Range Co., which opened mines on the south range in the Lake Superior country. In addition to his commercial interests, he was very active in social and professional life. He was a member of the American Institute of Mining Engineers, the American Society of Civil Engineers, the American Society of Mechanical Engineers, the American Chemical Society, the Lake Superior Mining Institute and many other technical societies. He took an active part in the present movement for national preparedness. He was also a member of many clubs and social organizations. He residence, which for many years was in Houghton, Mich., had been in recent years in New York City, and he also owned a summer home at Whitestone on the north shore of Long Island.

No one else, except perhaps his father and his brother, John R. Stanton, has been better known or more closely identified with mining in the Lake Superior country than was Frank M. Stanton, and he will be widely missed.

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Copper in the Far North

Seven members of Dr. R. M. Anderson's party, southern branch of the Stefansson Canadian expedition into the far North, arrived in Seattle, Wash., a few days ago, whence they will leave soon for Ottawa, to make their report to the Canadian Government. According to the New York *Evening Post*, Sept. 12, 1916, Dr. Anderson said:

We were instructed to survey the copper deposits already known and seek new ones. Every explorer from the earliest times has noted that the Eskimos east of the Mackenzie used knives, spearheads, and other weapons and utensils hammered from copper, and the Coppermine River, which empties into the Arctic, got its name from mineral discovered many years ago. We found on Coronation Gulf and Bathurst Inlet vast deposits of copper ore of low grade. We were not equipped to undertake mining operations, but upon the sides of cliffs we could measure the depth of successive flows of amygdaloidal lava containing native copper. An Eskimo brought to us a lump of copper weighing 10 lb. There were seams in the lava that had been filled with pure copper. Our geologist, Mr. O'Neill, took many samples of rock, which will be assayed. He also made many estimates of the area of ore in sight. This information is for the Canadian government and is not to be published by us.

The ore had many of the characteristics of the Lake Superior copper rock. It is workable from the surface and is near navigable water. It would be feasible to construct a railroad from the Mackenzie River, which is navigable five months of the year, to Great Bear Lake, which also is navigable much of the year. A further railroad line could be built from the lake to the copper fields, enabling the transportation of the ore to the interior of Canada by way of the Mackenzie River.

Our headquarters were on the south side of Dolphin and Union Straits, which run out of the west end of the Coronation Gulf. We took from our vessels enough lumber to build a house. Along the beaches we found nearly enough small driftwood to keep us in fuel, but we also used coal that we took north with us. There is workable coal within 10 miles of Franklin Bay, on the Arctic. This coal outcrops in ravines, veins several feet thick having been found.

NEW PATENTS

United States patent specifications listed below may be obtained from the "Engineering and Mining Journal" at 25c. each. British patents are supplied at 40c. each.

ACIDS—Process of Making Mineral Acids. Henry Howard, Brookline, Mass. (U. S. No. 1,193,552; Aug. 8, 1916.)

AGGLOMERATING—Process of Agglomerating Finely Divided Granular or Friable Materials. Adolphe Victor Marie Kroll, Luxemburg. (U. S. No. 1,196,705; Aug. 29, 1916.)

ALUMINOUS PIGMENT and Paint. Oscar Warren Pickering, Springfield, Mass., assignor to Pickering Paint & Pigment Co. (U. S. No. 1,195,604; Aug. 22, 1916.)

ALUMINUM—Composition of Matter to be Used for the Welding and Soldering of Different Articles Constructed of Aluminum Only. Robert Lee Weatherford, Fort Worth, Tex. (U. S. No. 1,194,101; Aug. 8, 1916.)

BLAST-FURNACE TOP. William H. Bailey, Gary, Ind. (U. S. No. 1,193,750; Aug. 8, 1916.)

BLASTING—Method of Channeling and Severing by Blasting. Tere A. Clark, Chicago, Ill. (U. S. No. 1,195,781; Aug. 22, 1916.)

CHARGING APPARATUS—Improvements in Transporting Apparatus, more Especially Intended for Charging Articles into Furnaces and Withdrawing Them Therefrom. Wellman, Seaver & Head, Ltd., and F. G. Smith, London, England. (Brit. No. 19,597 of 1914.)

CLASSIFYING—Process of and Apparatus for Sizing or Classifying Comminuted Material. Henry M. Sutton, Walter L. Steele, and Edwin G. Steele, Dallas, Tex. (U. S. Nos. 1,196,047 and 1,196,048; Aug. 29, 1916.)

CONCENTRATING TABLE. George Petrie Sandie, Thessalon, Ont. (U. S. No. 1,196,295; Aug. 29, 1916.)

DRILL—Pump Drill. George H. Gilman, Claremont, N. H., assignor, by mesne assignments, to Sullivan Machinery Co., Boston, Mass. (U. S. No. 1,195,350; Aug. 22, 1916.)

DRILL—Rock Drill. Moses Arthur Knapp, Oakland, Calif. (U. S. No. 1,195,478; Aug. 22, 1916.

DRILL—Rock Drill. Niels C. Mickelson, Denver, Colo., assignor to The Denver Rock Drill Manufacturing Co., Denver, Colo. (U. S. No. 1,196,011; Aug. 29, 1916.)

DRILL BITS—Rock-Drill Bits and Chucks. F. C. Macdonald, San Francisco, Calif. (Brit. No. 2,473 of 1915.)

DRILLING—Improvements in Rock-Drilling and Other Pneumatic and Like Tools. J. H. A. Macadam, Johannesburg, So. Africa, and J. Thirlwell, Anston, Transvaal, So. Afr. (Brit. No. 2,779 of 1915.)

DRILLING—Rock-Drilling Apparatus. William A. Smith, Denver, Colo., assignor to The Denver Rock Drill Manufacturing Co., Denver, Colo. (U. S. No. 1,196,041 and 605; Aug. 29, 1916.)

DRILLS—Rotating Means for Drills. Daniel S. Waugh, Denver, Colo., assignor to The Denver Rock Drill Manufacturing Co., Denver, Colo. (U. S. No. 1,196,052; Aug. 29, 1916.)

ELECTRIC SMELTING—Apparatus for Preventing Sintering in Electric Furnaces. Edward Salmon Berglund, Trollhättan, Sweden. (U. S. No. 1,196,202; Aug. 29, 1916.)

ELECTRIC SMELTING—Process of Securing Metal from Ores. James Henry Reid, Newark, N. J. (U. S. No. 1,195,607. Aug. 22, 1916.)

FUMES—Apparatus for Utilizing the Heated Fumes from a Smelter or Ore Furnace. Gustav P. Luedke, Chatham, Ill. (U. S. No. 1,196,123. Aug. 29, 1916.)

PERSONALS

Charles W. Johnston is now at Portsmouth, Va.

T. L. Lee recently in New York is now at Shanghai, China.

J. M. McClintock has gone from Altadena, Calif., to Oxford, Ohio.

Ray D. Anderson, recently in New York, is now at Soldier Summit, Utah.

Charles A. Randolph, lately in Cuba, is now at Kirkland Lake, Ontario.

H. L. Mead is now at Trinity Center, Calif. He was recently in New York.

George Watkin Evans, Seattle, Wash., is in the interior of Alaska on professional business.

J. M. Lovejoy has joined the staff of geologists of the Producers' Oil Co., Billings, Montana.

Edward J. Montoulieu recently at the United States Mint in Philadelphia is now at Havana, Cuba.

H. P. Prather, recently at Section 30 mine on the Vermilion Range in Minnesota, is now at Cleveland, Ohio.

Robert S. Lewis, formerly at Stanford University in California, is now at the University of Utah at Salt Lake City.

James B. Stack is now with the American Smelting and Refining Co. at Maurer, N. J. He was recently at Baltimore.

H. P. Sweeney formerly at Stroudsburg, Penn., is now superintendent of the Fort Montgomery Iron Co., Fort Montgomery, N. Y.

Nelson Dickerman has left San Francisco on an examination trip in Bolivia and Chile. He expects to be back about the first of December.

Francis Church Lincoln, director of the Mackay School of Mines, Reno, Nev., recently returned from Bolivia where he had been for several months.

Paul O. Wels is at La Fundicion, Peru, where he has erected a concentrator for the Cerro de Pasco Mining Co. to test their ores by gravity methods and flotation.

P. J. Freeman has resigned from the professorship of applied mechanics in Kansas State College to become engineer of tests for the Pittsburgh Testing Laboratory.

Adolph G. Carlson, mechanical engineer since 1907 and formerly superintendent of the Sandusky Portland Cement Co., is appointed chief engineer of the Universal Portland Cement Co.

Pope Yeatman and **Edwin S. Berry** announce that they have opened offices at 111 Broadway, New York, Suite 1108-1110, and will take up independent work as consulting mining engineers.

Henry G. Ferguson, of the U. S. Geological Survey, of Washington, D. C., is in the Mogollon, N. M., camp gathering material for a geological folio and other complete data of the district.

G. K. Painter, chief metallurgist of the General Chemical Co., and the Nichols Copper Co., New York, and **W. E. Hill,** general manager of the Pulaski Copper Co., of Virginia, have been inspecting the copper deposits at Mine Center, Ontario.

Hon. A. H. Hudson and **Hugh McNair,** of the Public Utilities department of Manitoba, and **J. A. Campbell,** commissioner for Northern Manitoba, have gone to make a survey of the resources of the territory extending from The Pas to Hudson Bay.

Capt. J. B. Hodgson, former mine inspector of the Copper Queen mines at Bisbee, Ariz., has accepted a position on the consulting staff of the Phelps-Dodge corporation. His time will be divided between the various properties of that company in an advisory capacity.

Frank H. Sistermans, mining engineer of El Paso, Tex., has returned from a business trip to northern Mexico and will again leave for Arizona shortly to investigate several mining propositions for eastern clients. He expects to be back in El Paso in about three or four weeks.

Charles A. Randall has resigned his position as mill superintendent with the Tough-Oakes Gold Mines, Ltd., to accept a position with Messrs. [illegible] & Burns, mining engineers of New York, in the capacity of superintendent of construction and operation of two cyanide plants in Cuba.

OBITUARY

J. Bruce Wallace mining engineer at the Reeder mine, near Bessemer, Ala., was killed in the mine Aug. 26 by a fall of rock. He was 35 years old and lived at Birmingham, Ala. He had been at the Reeder mine for three years.

Judge D. C. Beaman, a former vice-president and one of the organizers of the Colorado Fuel and Iron Co., died in Denver, Sept. 8, aged 77 years. He was widely known as a lawyer and sportsman, being one of the organizers and a former president of the American Trotters' Association. Judge Beaman was a friend of John D. Rockefeller, and assisted John C. Osgood in forming the Colorado Fuel and Iron Co., with which he served for 25 years, retiring in 1910 when general attorney. He was a veteran of the civil war. Judge Beaman left a widow, three sons and a daughter.

Charles S. Prosser, head of the department of geology in the Ohio State University at Columbus, was found dead Sept. 12, in the Olentaugy River. He was 50 years old. Professor Prosser was a graduate of Cornell University, and before going to Ohio was instructor at Cornell, Washburn College, Topeka, Kan., and at Union College. He was the author of more than a dozen books on geology and was a Fellow in the Geological Society of America. He had many relatives in New York. Professor Prosser was an assistant geologist of the United States Geological Survey and of the State Geological Surveys of Kansas, New York, Ohio and Maryland.

SOCIETIES

American Iron and Steel Institute—The eleventh general meeting will be held at St. Louis on Friday and Saturday, Oct. 27 and 28. This will be the first meeting of the Institute west of the Mississippi, and a large attendance is anticipated.

Colorado School of Mines—George J. Young, formerly of the University of Nevada and of the University of Minnesota, is the new head of the Metallurgical Department; while Claude E. Van Nuye will head the Physics Department. A new department of English and Foreign Languages will be under Prof. Carrol G. Dolman. The college year began Sept. 5, with a large attendance.

Colorado Scientific Society, at its meeting, Sept. 2, discussed the subject of "Smoke Abatement," the speakers being Henry Read, chairman of the Denver Art Commission, Dr. J. A. Amesse, Lewis B. Skinner, superintendent of the Western Chemical Mfg. Co.; and Edward A. West, chief engineer of the Denver Tramway Co. The subject was handled with special emphasis on the local Denver conditions.

National Safety Council—The annual meeting will be held at the Hotel Statler, Detroit, Mich., Tuesday, Oct. 17, with the opening session at 10 a.m. The third annual report of the secretary, W. H. Cameron, which will be presented at that time, devotes itself in part to the record for the year 1915-16. The council started work in October, 1913, with $1,400 and 40 members. At the end of June, 1914, there were 731 members and at the end of the second fiscal year 1,211 members. The present membership is 2,120, with over 10,000 representatives and 3,500,000 employees.

Iron and Steel Institute—The autumn meeting will be held in London Sept. 21 and 22, at the building of the Institution of Civil Engineers, Great George St., Westminster. The following is the list of papers that are expected to be submitted for reading and discussion:

1. H. Brearley: "Some Properties of Ingots."
2. Prof. E. D. Campbell: "Influence of Heat-Treatment on the Thermo-Electric Properties and Specific Resistance of Carbon Steels."
3. Dr. H. M. Howe and A. G. Levy: "Heat Treatment of Eutectoid Carbon Steels."
4. J. N. Kilby: "Steel Ingot Defects."
5. Herbert K. Scott: "Manganese Ores of the Bukowina, Austria."
6. Dr. J. E. Stead: "Influence of Elements on the Properties of Steel."
7. Dr. J. E. Stead: "Notes on (a) Nickel Steel Scale. (b) On the Reduction of Solid Nickel and Copper Oxides by Solid Iron. (c) On Effect of Blast Furnace Gases on Wrought Iron."
8. G. F. Zimmer: "Use of Meteoric Iron by Primitive Man."

Editorial Correspondence

SAN FRANCISCO—Sept. 6

The Coast Oil Fields are attracting attention and more interest is being shown in oil development, according to State Mining Bureau reports, than at any time during the last three or four years, especially in drilling in outlying districts. Several wildcat wells are being drilled in the Santa Maria, Ventura and Los Angeles regions. There is little or no indication of such rash and ill-timed boom conditions as existed several years ago leading to overproduction and wasted money. Reports received by the bureau show 7 new wells started during the week ended Aug. 19, making a total of 463 since the first of the year. Twenty wells are reported for test of water shutoff, four for deepening or redrilling and two for abandonment.

Trinity County Dredging Field is receiving much attention this year. Prospecting is being actively conducted with churn drills and shafts on a number of streams and construction of several dredges is under way. On Coffee Creek, the hull of the 9 cu.ft. steel dredge of the Pacific Gold Dredging Co., has been completed, and is expected to be in active operation before winter. The dredge is being constructed under difficulties, as every plate, bolt, and piece of machinery, to say nothing of the supplies for a large camp, have to be hauled 60 mi. by mule-team over a mountain road. The company has about 300 head of stock in service, and over 30 wagons on the road. Recently, wagons transporting the tumbler went over the bank, dropping a steep 130 ft. down the gulch and carrying with them 14 mules and the driver. Fortunately the driver and mules escaped injury, but the two wagons carrying the load were badly wrecked. The dredge hull is 163½ ft. long and 63 ft. wide. Three drills are in constant operation testing the ground in the path of the dredge. They are putting down an average of one hole every two days to a depth of from 40 to 50 ft.

First-Aid and Mine-Rescue Contests at the California State Fair on Sept. 6 attracted a large number of visitors who had never seen a similar demonstration. Some of the spectators believed it was a motion-picture show, alternating with the horse races, the polo exhibition, trapeze stunts and airship demonstrations. So they were at least pleased in the way that one is pleased with variety in vaudeville. Occasional doubts were expressed whether the men were real miners. The small attendance of mine owners and miners who should be vitally interested in the contests was no doubt largely due to the destruction of the exhibit pavilion by fire on Sept. 2. The mining and most of the other exhibits were housed in this building and nothing was saved. Many visitors from the mining counties who might have been attracted to the mining exhibits did not visit the fair. The California Metal Producers Association, under whose auspices the contests were given and the State Industrial Accident Commission, assisting, were largely represented. The first-aid prizes went to teams of the Kennedy Mining and Milling Co. of Amador County; Empire Mines, of Nevada County, Argonaut Mining Co., of Amador County. Their scores were 99.7, 99.2, 97.2 respectively. There were 9 teams in the contest. In the one-man event the Empire Mines team won with a score of 100; in the two-men event the Mammoth Copper Mining Co. team won with a score of 100. The mine-rescue contest was between the following teams, named in the order of the results. Empire Mines, 89.4; Mammoth Copper Mining Co., 88.4; North Star Mines, 74.8. This is the second annual field meet for California miners conducted by the California Metal Producers Association and the State Industrial Accident Commission. The men showed commendable improvement.

The Moral Cleanup of Keeler, Inyo County, in the past week was a lesson to the lawless element that has dominated the camp ever since the Cerro Gordo and other mines have resumed profitable operation. In this section the Inyo Development Co. and the Natural Soda Products Co. have been increasing the output of Owens Lake products and the Saline Valley Salt Co. has been active. The industrial, law-abiding men of the district, having learned that prohibition does not prohibit and that dry towns are often worse than wet, concluded to get rid of the liquor-drinking element as the best means of dealing with the dealers in intoxicants. Things had reached such a condition that an honest man's life was not safe and the vigilantes started in to make a cleanup. It was done without the aid of the sheriff and it did not cost Inyo County a dime. They are a peculiar people in that region, and this is not the first time in the last 10 years that bloodless and inexpensive battles have been won by the law-and-order men who are opposed to paying taxes for unnecessary police protection. During the Western Federation strike at Goldfield several years ago, the effort to shut off the water supply and electric light and power, that have their source in Inyo County, was frustrated by the vigilantes of Bishop. Keeler has now saved itself and the Owens Lake region from a possible reign of terror and bloodshed. To the south, Randsburg is "dry," and in its dry state there has been just an intimation of peevishness on the part of the bad element But if necessary Randsburg, Johannesburg, Atolia and Trona will soon get together and clean up their part of the desert.

BUTTE—Sept. 7

Butte's August Payroll is close to the $3,000,000 mark; with the average price of copper for the month of August at 26.12c. per lb., the August wage scale of the Butte mining companies will be increased 25c. per day over the previous months' scale, probably making the August roll the largest in the history of the Butte district. The Anaconda company alone will distribute $1,630,000 in wages to Butte employees. To this should be added the smelter payrolls of $606,400 at the Washoe works in Anaconda and of $280,750 at the Great Falls reduction works. Other Butte mining companies will distribute approximately $700,000 in August wages. East Butte pays about $130,000; North Butte $165,000; Butte & Superior $230,000 and the balance by Elm Orlu, Timber Butte, Davis-Daly, Pilot Butte, Tuolumne and others. Counting in the Washoe and Great Falls plants, the total payroll for the mining industry alone in the Butte district will be $3,250,000. Payrolls in other lines of business in Butte will swell this to a total of $3,750,000.

SALT LAKE CITY—Sept. 8

Sulphuric Acid Plant of the Garfield Chemical and Manufacturing Co. at Garfield is approaching completion. It is expected to have the plant in operation well ahead of Utah Copper's leaching plant, for which it is to supply sulphuric acid. There has been considerable delay in getting together materials, owing to the unusual activity at manufacturing plants furnishing these. The chemically treated bricks for the chambers are now coming and the chambers will soon be finished. It is expected to have the entire plant ready for operation by the end of October, or early in November.

An Unusual Number of Mineral Surveys were asked for in the year ended June 30, 1916, according to the report of the surveyor general of the Land Office at Salt Lake City. These mining surveys reflect the increased activity both in mining and prospecting. The recent reduction made by the office in the advance fee for office work on such surveys (now $20, formerly $30 per location) may also have had its effect. Better and more economical methods of work have made possible the reduction, the average actual cost per location having been for the first half of year $18.50, and for the latter half, $15.90 per location. For such work the office received a total of $3,988 during the year as compared to $6,396 during the year preceding.

Stockholders of Ohio Copper are making an effort to get together with a view to looking after their interest in the property. A stockholders' protective committee is being formed, and a plan and agreement of reorganization is in preparation Owners of stock are asked to send their names and addresses, with the number of shares held, etc., to the International & Intercontinental Mining and Refining Corporation, at 60 Wall St., New York. A statement to stockholders by this corporation, following the sale of the properties, advises that although a judgment to the sum of $1,432,000 was obtained, properties were bid in by the bondholders for $750,000; and declares it to be manifestly the purpose of the bondholders through a deficiency judgment to secure the stockholders' right of redemption, the loss of which would render the stock valueless. The International & Intercontinental Mining and Refining Corporation goes on to say that in its own interest, as a stockholder and in conjunction with other stockholders it has caused a suit to be instituted and a "lis pendens" to be filled in Utah; and has secured a stay in the United States court, so that the stockholders may have an opportunity to consider a plan to preserve their rights, stating that apparently no effort was made by the officers and directors of the Ohio Copper Mining Co. to call stockholders together to protect their interest at the sale or to advise them of the fact that during the receivership the property has been in profitable operation under a lease yielding a revenue in aggregate sufficient to liquidate all debts of the company including interest on the bonds—there being $369,000 cash on hand, largely from this lease, and demonstrating that the property is capable of earning many times the interest on the $1,142,000 outstanding bonds. On the other hand there has been talk of a $2 assessment on stockholders to release the company from bankruptcy and return the property to the shareholders. It has been stated that the bondholders protective committee, to prevent the stockholders from redeeming the property within six months after the foreclosure sale, as provided by the Utah statutes, offered $40,000 for this right and the bid was accepted by the trustees in bankruptcy. These matters will be discussed at a stockholders meeting on Sept. 15 at Room 1808, 43 Exchange Place, New York. An extension of the lease on the property has been granted for three months from Sept. 1 to Dec. 1 to the General Exploration Co. at present operating the property. This extension has been approved by Judge Ritchie and the receivers, H. G. Catrow and C. T. Lark, have been allowed $35,000 for work and expenses.

HOUGHTON, MICH.—Sept. 9

Isle Royale's Increased Tonnage is worthy of note. It has been gradually increasing "rock" tonnage, and maintaining copper content. This month the ore output will be close to 80,000 tons. When this is compared with 57,000 tons monthly for last year it will be seen that the astonishing results that are coming to notice at this property warrant the increasing interest that is being taken in some quarters. Isle Royale is working out its salvation in the one way possible—substantial increase in tonnage.

Ahmeek, in the Kearsage Conglomerate, has cut 28 ft. of good looking copper rock. Two crews are drifting north and south but it will be several weeks before the worth of this strike will be known; there is hope that it will be another asset of merit to the Ahmeek property, now so well opened on the Kearsarge amygdaloid in its richest zone. The Kearsarge conglomerate has never been found at any point attacked to have commercial value. In the early days it was opened on what was then known as the original Kearsarge mine, now a part of the North Kearsarge branch of the Osceola Consolidated company. The showing of copper, however, petered out before any substantial depth was attained. Back in the early days when the late John Hodgson was superintendent and Frank Kleptko, then a recently graduated mining engineer, were working for the Bigelow interests they opened on the old Ahmeek property two small shafts on the Kearsarge conglomerate, one to a depth of 300 ft. and the other to a depth of 460 ft. Some of the stockpile from these shafts can be seen from the highway and street-car tracks at Ahmeek now. Work was discontinued when the situation looked promising, the Ahmeek being out of funds and financial conditions not warranting a resumption. When the Ahmeek did resume it was on the Kearsarge amygdaloid, then of proved value at so many other properties in that vicinity. Some time after this, samples were made of the stockpiles from the old shafts on the conglomerate and these ran so high in copper that the stockpiles were sent to the stamp mills. Following diamond-drilling results, the present management decided recently to make an examination of the conglomerate from No. 2 shaft. A crosscut was run straight to the west a distance of 1,300 ft. where the Kearsarge conglomerate was cut last week at a depth of 1,500 ft. from surface. There is a great deal of interest in the discovery here as it is quite within the range of possibilities that the Kearsarge conglomerate may add another mine to the present rich mine of the Ahmeek.

JOPLIN—Sept. 9

At Conway, an Old-Time Mining Boom is in progress. This new camp is about midway between Wentworth and Ritchey. Numerous good shallow strikes have been made there recently and 100 operators from Joplin have gone there to try their luck. Ore is found as shallow as 12 ft. and down to as deep as 150 ft.

The Oklahoma Zinc Field has attracted another large Joplin operator. During the last week S. Y. Ramage & Son acquired a lease and half interest in the fee of a 200-acre tract of land immediately adjoining that on which the Picher company is operating at Picher, Okla. Announcement is made that the Ramages will do 10,000 ft. of drilling at once. The Ramage sheet-ground mine in the West Joplin camp is closed, awaiting better ore prices.

Smaller Smelters Are Closing their plants as a result of the poor demand for spelter. The American Spelter Co., the Lanyon Smelting Co., and the Bruce Smelting Co. have all closed their plants within the last two weeks. Six of the eight furnaces of the Pittsburg Zinc Co. are down, and it is understood that the furnaces of the Joplin Ore and Spelter Co. and of the Weir Smelting Co. will be closed as soon as their present supply of ore is exhausted, unless spelter prices become stronger. The Fort Smith Spelter Co. recently contracted for 500 tons of calamine weekly from the Arkansas fields, mostly from Rush, and Manager H. S. Buck declares his plant can operate under low spelter prices, owing to advantageous contracts for natural gas from the new Kibler field.

TORONTO—Sept. 9

Nickel Refineries of the International Nickel Co. and the British Canadian Nickel Co. may both be erected in southern Ontario, as climatic conditions will prevent their placing the plants as far north as the mines. Many localities have endeavored to secure these industries, but the representatives of both companies after full investigation have decided that the severity of the climate during the winter would prevent their selecting a site even in the latitude of Ottawa where they were offered favorable terms, though that is considerably farther south than the mining region. The International Nickel Co. has definitely decided on a site at Port Colborne and has let the contract for construction of the works to the Foundation Co. of Montreal and New York.

The Cobalt Wage Situation is under consideration by a royal commission now sitting in Cobalt hearing evidence regarding the contention of the men that on account of the high cost of living they should receive higher wages. The men are also trying to force the operators to recognize the union. The operators while quite ready to receive committees of their own employees, or of a purely local organization, absolutely refuse to recognize a committee representing the Western Federation of Miners. Last May, the operators, recognizing that there was some unrest among the men on account of the higher cost of living, voluntarily decided to raise wages among all underground men, 25c. a day. In a number of cases surface men were also raised the same amount. A bonus of 25c. a day was also promised to underground men when silver sold for an average of 70c. an ounce for the month. The present scale of wages in Cobalt which is equal to the highest paid in eastern Canada, is $3.50 per 8-hr. day for drill runners, $3.25 for helpers, $2.75 for muckers, and $2.25 and $2.50 for surface labor with only a few men receiving the $2.25 wage. The men are not satisfied with this, however, and want a minimum of $2.75 for surface men and $3.75 for drill runners, with all other men receiving a 25c. increase over the present scale. The men refer to the high cost of living but forget to take into consideration the high cost of mining. Cobalt has paid higher wages for a longer period than any other camp in eastern Canada. In 1907 when there were practically no camps paying over $2 for drill runners, Cobalt was paying $3.25, with other men in proportion, and the increase granted in May puts Cobalt miners on a par with the other camps in northern Ontario which pay the highest wages in eastern Canada. There has also been a decided falling off in the efficiency of labor during the past two years. A large number of the most physically fit men have gone to the front and their places have been filled by a much inferior class of men. The shortage of labor has also contributed to the decline in efficiency and a dollar paid in wages brings a much smaller return in work than it did two years ago. Cobalt is a declining camp, the high point of profit and the value of the output having been reached in 1912. This decline will be a constant one till the end of the mines is reached. A much greater tonnage of ore now has to be treated to get a smaller profit. Some of the mines are so close to the point where operations are unprofitable that a further raise in wages would be a serious matter. While the miners are advancing the argument that the high cost of living is the reason for the request for more wages, the real reason is that they are attempting to take advantage of the labor shortage arising out of the war. The operators believe in paying wages on which the men can live well, and think they are paying this wage. They also believe they are paying high wages for the class of labor they are getting. There was no valid reason for appointing a royal commission which was simply a political move in view of a possible election. Politics being mixed up in the case is likely to result in a finding somewhat unfavorable to the operators. It is a foregone conclusion however that the operators will refuse to make a further raise in wages or to recognize the Western Federation, and in the rather unlikely event of a strike they will simply close down the mines until such time as the war is over when they will be able to offer positions to the men coming back from the front and in this way help to solve what will be a considerable problem in itself.

The Mining News

ALABAMA

Blount County

ONEONTA ORE AND MINING (Oneonta)—Newly organized company in Red Mountain district. Shipping about 100 tons daily. Several new openings being made in mountain side. Ore hauled by teams at present.

ALASKA

ALASKA-GASTINEAU (Juneau)—Milled in August, 169,100 tons; calculated heads, $1.38; extraction, 81.51%; tails, 25c. In July milled 150,403 tons; average value $1.24. In first 10 days of September, milled 50,510 dry tons; calculated heads, $1.51; extraction 82.65%.

ARIZONA

Cochise County

SHATTUCK-ARIZONA (Bisbee)—August copper output was 1,699,575 lb.; July production 1,397,445 lb.

Gila County

OLD DOMINION (Globe)—August copper production 3,600,000 lb.; July production 3,852,000 lb.

INSPIRATION (Miami)—August estimated production 11,450,000 lb. copper, as against 11,300,000 lb. in July.

MIAMI (Miami)—New high record made in August; output 4,698,795 lb. copper. Previous high was in May when 4,596,300 lb. were produced.

ARIZONA COMMERCIAL (Globe)—Mining of the new vein on the 1,200 level is under way, little water having been encountered. Crosscut on the 1,400 is in solid sulphide ore, said to assay 10% Cu.

Greenlee County

ARIZONA COPPER (Clifton)—Estimated August production, 4,800,000 lb.

Mohave County

FESSENDEN (Oatman)—Development is to be resumed about Sept. 15.

BOUNDARY CONE (Oatman)—Drift on 750-ft. level still in milling ore.

SUN DIAL (Oatman)—Hoist and compressor installed and sinking is in progress.

JEROME-OATMAN (Oatman)—Incline shaft down 400 ft. B. P. Delahanty in charge.

IVANHOE (Oatman)—Shutdown necessary pending arrangements to pump about 26,000 gal. daily.

TOM REED (Oatman)—Stoping in big shoot on 1,400 level. Sinking winze to the 1,700. Black Eagle ore developments continue satisfactory.

UNITED EASTERN (Oatman)—Raising from depth of 690 ft. under No. 2 shaft and sinking from the 590-ft. point, which corresponds to 465 ft. in No. 1 shaft. At the new mill, two ball mills are in place and two tube mills have been received; chrome-steel balls will be used instead of pebbles.

Yavapai County

BIG LEDGE COPPER DEVELOPMENT (Mayer)—This company, which is developing the Henrietta and Butternut mines, has leased the old smelting plant at this place and has engaged A. C. Cole to rehabilitate the plant.

CALIFORNIA

Amador County

KEYSTONE (Sutter Creek)—Station being opened at 1,300 level to search for orebody known to exist below the 1,400 level. Since Keystone Mines Co. has been operating (about 4 years), main shaft has been deepened 1,000 ft. Mill operating regularly. C. R. Downes, superintendent.

CONSOLIDATED AMADOR (Sutter Creek)—Unwatering and repairing of shaft has reached 600-ft. point; recent work slightly retarded by small caves that had to be caught up as timbering progressed. Temporary sinking pump to be installed at this level. T. Walter Beam, manager.

Butte County

YANKEE (Oroville)—Placer on Berry Creek purchased by B. J. Carr, of Alameda. Will be worked on small scale.

ORO ELECTRIC (Oroville)—Prospecting of dredging ground in Thermalito district in progress. Installation of steel-hull dredge contemplated by American Dredging Co. which has taken over dredging interests of the Oro Water Light and Power Co. Company expects also to develop dredging ground in Shasta County and is building a new dredge in Calaveras County. R. L. van der Naillen, manager.

Calaveras County

MAYPOLE (Mokelumne Hill)—Cleaning out old tunnel; badly caved. Recent prospecting disclosed a $2,000 pocket.

Eldorado County

MOUNT PLEASANT CONSOLIDATED (Placerville)—Operation by New York men contemplated as soon as reorganization is completed. Property has 1,100-ft. shaft. F. C. Van Schaick, president.

Madera County

MADERA GOLD MINING CO. (Madera)—Permitted to issue 150,000 shares of common stock to D. W. Shank and A. W. Copp in exchange for option to purchase properties and to sell 150,000 shares of preferred stock Company is taking over the idle Josephine and Gambetto mines in Madera County on lease and option to purchase for $60,000. Expect to install electrical equipment and to unwater old shaft.

Nevada County

BRUNSWICK (Grass Valley)—Main shaft down 1,200 ft. vertically. New drum installed on hoist to permit deeper development.

PHOENIX (Nevada City)—Drift mine may reopen in September, under management of Andrew Goering. Closed a month ago account large hard boulders being encountered. Developed by tunnel 980 ft. long.

E. W. KAY AND F. A. ELLIOTT may divert Yuba River channel below Humbug Cañon. Tests indicate pay gravel in river bed. Same men will reopen lode mine at Round Mountain; advancing 500-ft. tunnel 100 ft.

CALIFORNIA MINING CO. (Grass Valley)—Formal transfer of property under bond to King C. Gillette, safety-razor man. Purchase price said to be $80,000, to be made in 3 annual installments. New machinery and building will be installed. Property situated in Rough and Ready district.

GRASS VALLEY CONSOLIDATED (Grass Valley)—Buildings being prepared for hoist, due in September, for the Allison Ranch property. About 600 ft. of drain boxes have been constructed to handle waste water. Ditch line extends from the North Star and has capacity of 260 in. of water; to be used for compressor and emergency hoist.

Plumas County

CHROME ORE being hauled from Onion Valley to Quincy by three motor trucks. Deposits also being worked at Claremont, south of Quincy.

OVERSIGHT (Quincy)—Good milling ore disclosed in 6-ft. vein in this property on Washington Creek.

POORMAN CREEK (Quincy)—Reported that hydraulic plant is to be installed and reservoir enlarged.

Tuolumne County

TARANTULA (Sonora)—Property recently purchased by ex-Governor Gage and associates, temporarily closed.

OMEGA (Sonora)—Water lowered to 300 level; drifts being retimbered. Shaft is 600 ft. deep; new drift will be run from that point.

BELL (Tuttletown)—Recently bonded to Boston men. Will be unwatered and development superintended by Paul S. Bernard. Wide low-grade vein. F. Sutton and Rowe brothers are owners.

COLORADO

Boulder County

ALLGROVE (Cardinal)—Flotation process installed in mill

PRUSSIAN (Boulder)—Will be reopened in near future. Systematic development is planned.

McKENZIE (Nederland)—This mill east of town, formerly used for gold ores, is now running on tungsten ore.

NIL DESPERANDUM MINES CO. (Boulder)—New company recently incorporated by M. S. Brandt will reopen the mine. Active operations will be under way in about 40 days.

TUNGSTEN MOUNTAIN (Stevens Camp)—This 240-acre patented tract will be developed by J. G. Clark and associates. Sinking two shafts; lower tunnel, now 1,400 ft. long, will be advanced.

NELSON (Ward)—Being developed under management of Frank Eckel. Ore from development treated in mill equipped with plates, tables and slimers. Concentrate assays 1.76 oz gold, 1.8 oz. silver and 20 to 65% tungstic acid.

BRACE (Boulder)—Being operated by Mitchell & Co., who recently opened 8-in. vein of 20 to 60% tungsten ore; concentrated at Degge-Clark mill. Recent shipment of 5,000 lb. ran 68%. Shaft will be sunk to 100 ft. and further equipment installed.

LIVINGSTON (Sugarloaf)—Winze on 400-ft level continues in payable ore. Heavy flow in winze exceeds capacity of bailer and pump will be installed to handle 250 gal per min. A motor-driven compressor will also be added. Oxidized ore near surface, considered not payable a few years ago, now treated at a profit.

Clear Creek County

QUEEN (Idaho Springs)—Tungsten ore being mined and treated in Mixell mill. Mine operated by lessees.

BIG FIVE (Idaho Springs)—Rohmer & Mudge lease on 100 ft. winze level of Lake property opened 20 in. shoot of shipping ore. First car shipped netted $25 per ton

Gilpin County

SMUGGLER (Rollinsville)—Reported sold to Eastern men for more than $100,000.

BOODLE (Nevadaville)—Shipments of smelting and concentrating ore being made.

Lake County

IRON MASK (Leadville)—Opened large body of manganiferous ore

LA PLATA (Leadville)—W. E. Bowden has installed electric pumping machinery for draining this California Gulch property

Park County

WHEELER (Alma)—Operations resumed at this Mosquito Range property.

KANSAS (Alma)—Property on Loveland Mountain will resume in near future. Kansas Extension workings being cleaned out and repaired.

COMBINATION (Alma)—New tungsten discovery made on this claim. Hübnerite now found on both sides of Buckskin Gulch; chief discovery on north side of gulch in workings of old J. G. Blaine mine.

MAGNOLIA (Montgomery)—Old mill at Montgomery remodeled; process now consists of crushing, stamp milling in 10-stamp battery, amalgamation, and cyanidation of sands. Water power used in summer months and auxiliary steam plant in winter.

Saguache County

RALEIGH (Bonanza)—Stated operations will be resumed after 3 years shutdown. Long haulage and drainage tunnel driven, cutting workings at considerable depth. Complex sulphide ore.

San Juan County

LITTLE DORA (Silverton)—Mill repaired and test run on lead-copper ore made.

KLONDIKE (Eureka)—This group in Burns Gulch sold to Denver men. Zinc ore opened in tunnel.

IOWA-TIGER (Silverton)—Additional flotation unit being installed, increasing flotation capacity to 50 tons daily.

ADAMS (Gladstone)—First shipment of concentrates assayed 68% tungstic acid. Ore treated in North Star mill.

CHAMPION (Silverton)—Ore being treated at Silver Lake mill. Compressor and tramway repaired and work with good crew of men will be prosecuted.

MAYFLOWER (Silverton)—Work of building tramway from mine to Iowa mill progressing rapidly. Some ore to be treated in Iowa mill and some shipped direct to Durango smelting plant.

NORTH STAR (Silverton)—Milling plant being overhauled and flotation installed. Machines are of Bastion type, used in Gold King mill. Mine workings being repaired preparatory to steady operation.

San Miguel County

TOMBOY (Telluride)—In August, mill ran 30 days, crushing 13,000 tons; bullion yield, $46,800 concentrates $48,000; expenses, $66,800; operating profit $28,000.

Summit County

PUBLIC UTILITIES COMMISSION petitioned to restrain Denver & Rio Grande R.R. from removing third rail between Leadville and Salida. Removal would prevent use of narrow-gage cars over this portion of road and necessitate transfer of freight. This would particularly affect the mining towns of Breckenridge, Alma, Gunnison and, to some extent, Leadville.

CHIEF MOUNTAIN (Frisco)—Lead ore opened. Will ship soon.

ST. JOHN MINES (Montezuma)—Mill being remodeled and enlarged; flotation used; 25 men employed.

PIONEER CONSOLIDATED (Breckenridge)—This company, represented by Samuel Klous, of Boston, acquired 48 claims on Gibson Hill, including Dashwarren, Excelsior, Arab, Extension, Double Extension, Mascot, Jumbo and Jessie, also Extension 20-stamp mill, 160-acre placer tract, timber land, water rights, etc. Buliding road from Jessie mine to site of new mine buildings.

Teller County

STRONG (Victor)—Sinking continues in this Battle Mountain property.

MODOC MINING AND MILLING (Cripple Creek)—Producing 100 tons weekly.

STRATTON'S CRIPPLE CREEK MINING AND DEVELOPMENT (Cripple Creek)—Shipments being made by lessees from four properties on this estate.

IDAHO

Blaine County

NORTH STAR-TRIUMPH (Hailey)—Mine unwatered and mill of 300 tons capacity will be ready in about one month. A 6-mi. branch railway may be constructed jointly by the Oregon Short Line and Federal Mining and Smelting Co., which recently acquired control of this property.

Idaho County

GOLDEN SCEPTER (Elk City)—James McKinnon, owner of this placer, recently cleaned up about $1,000 in gold dust from a 30-day run.

HERCULES (Elk City)—Recently honded to eastern Canada men and is being developed extensively. Vein exposed to 320-ft. depth by three tunnels; about 1,530 ft. of development. A 50-ton mill contemplated. John McDermid, superintendent.

Shoshone County

RAY-JEFFERSON (Wallace)—The 450-ft. raise connecting No. 1 and No. [illegible] levels cut 12 ft. of ore. New mill at junction of Beaver and Carbon Creek nearly completed.

HIGHLAND SURPRISE (Kellogg)—Sinking new shaft to open 4-ft. vein disclosed at depth of about 200 ft. by diamond drill. Shaft at [illegible] ft. encountered silver-lead-zinc vein, 30 in. wide. Mill operating one shift; increased recovery following installation of [illegible] mill. W. W. Papesh, president.

CALEDONIA (Kellogg)—Net earnings for second quarter were $287,932 from [illegible] tons of concentrates and ore yielding $435,346 from [illegible] metals: Lead, 2,574,680 lb.; silver, 294,242 oz.; copper, [illegible] lb. Smelter deductions for freight and treatment [illegible] operating costs $36,486. Development on Keating [illegible] level did not disclose ore but is being continued. [illegible] has about two years ore supply in sight.

RICHMOND (Saltese, Mont.)—Resumed shipping copper gold ore, the first-class ore going to Greenwood, B. C., and the second class (5 to 6% copper and $10 gold) to the Washoe works at Anaconda, Mont. Lower tunnel in 1,650 ft.; driving 280-ft. raise, in ore, to connect with old shaft. Property idle since 1910 when forest fires destroyed surface equipment and mine was flooded. Mine is near Adair but ships from Saltese, Mont., 4½ mi. Charles Heidenreich, manager.

MISSOURI-ARKANSAS

Joplin District

GARDNER (Aurora)—New mill on United Zinc Co. tract almost completed.

REBECCA (Joplin) — Taken over by Bayless & Hood, former owners. Mill started.

SYMMES (Joplin)—Closed down with bins full. May make improvements if market rises.

SANDRIGE (Aurora)—Draining ground near Scottish mine and will treat ore as well as tailing.

GREY EAGLE (Carthage)—Mill rebuilt and operating once more, at present only on tailings, but ground is being drained.

WALKER (Cardin, Okla.)—Unable to start new mill, account scarcity of water. Sinking mill shaft to lower level, 210 ft. Good ore at 120 ft.

D. C. & E. (Webb City)—Installing 12-in. Layne & Bowler oil-balanced pump, capacity 1,700 gal. per min., at No. 2 mine. First of these pumps to be tried in this district.

ONAMENA (Duenweg)—At No. 2, formerly Wilson mine, good ore cut in new shaft southeast of mill. Planning aërial tramway for transporting ore. Shaft was put down on one of richest holes ever brought in in Duenweg camp.

Northern Arkansas

PHILLIPS (Yellville)—New mill completed but lack of water will prevent full operations for present.

MORNING STAR (Rush)—Installed 2,000-ft. trackage to bring ore from Capps property. Mules hauling three to five tons per trip.

SURE POP (Buffalo Creek)—After two years' steady operation, this mine averaging 14 tons concentrates and shipping ore, daily, from mill of less than 100 tons capacity.

MONTANA

Jefferson County

BOSTON & CORBIN (Corbin)—New 100-ton flotation plant placed in operation Aug. 16.

Granite County

NORTHWESTERN MINES CONSOLIDATED CO. (Maxwell)—Shaft, sunk 700 ft. from portal in main tunnel, passed through an 8-ft. vein, carrying from 6 to 10% copper, 4 oz. silver and traces of gold. Six cars of concentrates, shipped to Anaconda smeltery during July, netted $3,000. Damage to power plant by recent cloudburst, necessitated temporary shutdown of mill.

Lincoln County

ROSE CONSOLIDATED (Libby)—Recently made shipment of 2,561 lb. of tungsten concentrates. Ore also contains gold and 10-stamp mill is practically completed. Crosscut tunnels have opened 5-ft. vein at 180-ft. depth about 800 ft. apart. P. S. Rose, superintendent. Oscar Nordquist, of Wallace, Idaho, manager.

SNOWSTORM MINES CONSOLIDATED (Troy)—Standard-gage railway from Troy to millsite of company's Banner and Bangle group of mines completed. Hydro-electric plant well under way and transmission line being built. About $500,000 is being expended in mill, compressor, power plant and railway for exploitation of the silver-lead-zinc ores.

Powell County

MONTANA-CLINTON (Elliston)—May construct hydro-electric plant on Telegraph Creek to operate its Julia and Monarch mines in Elliston district. Propose to further develop the Julia by 2,000-ft. tunnel to tap orebodies and to drain property.

Silver Bow County

BUTTE-DETROIT (Butte)—Equipment for the Ophir mill now arriving and being installed.

BUTTE-DULUTH (Butte)—Leaching operations expected to begin about Nov. 1. Al Frank and associates, lessees.

EAST BUTTE (Butte)—August output was 1,849,120 lb. copper and 49,449 oz. silver, as compared with 1,893,120 lb. copper and 48,892 oz. silver in July.

BUTTE & SUPERIOR (Butte)—August output at company's Black Rock mine was reduced almost a third from normal on account of accident to shaft causing closing of mine and mill for 10 days. Ore production was about 34,000 tons, against the usual 50,000. Production of zinc concentrates was 9,600 tons, containing 10,475,000 lb. of zinc. Recoveries in August, 94.5%. Produced 300 tons of lead concentrates and 192,000 oz. of silver. Company will raise regular dividend from $3 a year to $5. Extra quarterly dividend cut from $10 in preceding quarter to $5.

NEVADA

Humboldt County

GOLDBANKS QUICKSILVER CO. (Winnemucca)—Has its reduction plant in operation and is shipping quicksilver regularly.

WINNEMUCCA MOUNTAIN MINING CO. (Winnemucca)—New gold mill has been started and is gradually being tuned up to capacity.

Nye County

TONOPAH ORE PRODUCTION for week ended Sept. 2 was 9,872 tons, valued at $203,576, as compared with 8,916 tons for week previous. Producers were: Tonopah Belmont, 2,884 tons; Tonopah Mining, 2,300; Tonopah Extension, 2,200; Jim Butler, 1,100; Montana, 230; North Star, 53; miscellaneous, 30 tons.

Storey County

ANDES (Virginia)—Saved 30 tons from development on 350 level; shipped 42 sacks concentrate.

COMSTOCK PUMPING ASSOCIATION (Virginia)—Retimbering 2,700 station of Mexican-Ophir winze about completed.

OPHIR (Virginia)—South stope above 2,700 level shipped 20 tons, averaging $24.65. North drift in dacite and quartz at 315-ft. point.

UNION CON. (Virginia)—Extracted 415 tons, gross value $7,000. From 2,400 level, 212 tons averaging $17.12; 115 tons $17.10; 46 tons $12.52; 22 tons $14.21; 2,500 level, 20 tons $16.49.

MEXICAN (Virginia)—West crosscut 2,500 level advanced to 416-ft. point, face in diorite. Mexican mill received 435 tons ore averaging $17.64 and 30 tons from Mexican storage averaging $10.39.

UTAH

Beaver County

MAJESTIC (Milford)—Has started sinking Hoosier Boy shaft to greater depth. Now 600 ft. deep. Stoping tonnage will be maintained. Old Hickory property shipping about 10 cars of copper-iron ore monthly.

Juab County

GEMINI (Eureka)—Ore running high in silver and lead mined from Carlson-Backman lease on 1,400 level.

SIOUX CONSOLIDATED (Eureka)—Night shift to be put on in sinking winze from 600 for continuation of Iron Blossom copper deposit. Main shaft may also be deepened.

CHIEF CONSOLIDATED (Eureka)—Larger compressor to be installed at Homansville shaft; now down 475 ft. Some manganese ore, carrying 40% Mn, being shipped from Homansville property.

TINTIC STANDARD (Eureka)—Lead ore opened on 1,600-ft. level, and drifted on for 50 ft. New compressor recently installed, and shaft being sunk. Ventilation on lower levels improved by larger fan.

Piute County

DEER TRAIL (Marysvale)—A 2-mi. pipe line will be laid from Threemile Cañon.

WHITE HORSE POTASH (Marysville)—Three claims, 2½ mi. northeast of Marysvale, under option to B. H. Payne.

Salt Lake County

HOWELL (Salt Lake)—Recently shipped car of ore from this mine in Big Cottonwood Cañon.

CARDIFF (Salt Lake)—Promising find of lead-silver ore in west drift, which is being driven 2,600 ft. from mouth of tunnel.

UTAH COPPER (Bingham)—Maintained an average daily output of 36,000 tons during August, as compared with 34,000 tons a day in July.

COLUMBUS-REXALL (Alta)—Columbus Extension and Rexall consolidated under above name. Stocks withdrawn from Salt Lake exchange, and new stock will be listed. Air connections made through Frederick tunnel. Main tunnel on Little Cottonwood side to be continued along Cardiff contact to boundary of properties.

Summit County

PARK CITY SHIPMENTS for August were 9,602 tons, an increase of 224 tons over July. Silver King Coalition shipped 2,833 tons; Judge Mining & Smelting, 1,508; Silver King Consolidated, 2,215; Daly West, 1,137; Big Four, 1,022; Ontario, 352; Park City Mines, 60; W. E. Jones, 80; Utah Ore Sampling, 32 tons.

ONTARIO (Park City)—Lessees working about 70 men.

DALY-JUDGE EXTENSION (Park City)—Shaft is being sunk.

SILVER KING CONSOLIDATED (Park City)—New development and drain tunnel in 250 ft. Good progress being made.

DALY WEST (Park City)—Development being done on the 1,400, 1,700 and 2,000 levels. Increased shipments of crude ore made. Mill handling about 100 tons a day. Working 100 men at mine and mill.

Tooele County

LION HILL (Ophir)—Car shipped from St. Clair lease brought good returns principally in silver.

KEYSTONE DEVELOPMENT (Stockton)—Incorporated Sept. 6 to acquire producing properties in Stockton. Include Galena King, South Port Mining, and Merwin, held by Eastern estates and for some time idle except for work by lessees. Claims extend for 8,000 ft. along strike of lode. Capitalization is 1,000,000 shares, par value 10c., with 500,000 shares in treasury. J. B. Overton, Duncan Mac Vichie, W. C. Alexander, David Keith, L. H. Farnsworth of Salt Lake City are interested.

Utah County

SOUTH PARK (American Fork)—Silver ore opened at surface between Smuggler and Osborne claims.

BELEROPHON (American Fork)—Raising from tunnel level has cut bedded ore showing galena. Drifting started.

UTAH CENTENNIAL (American Fork)—Rock mineralized with lead and silver cut by tunnel. J. W. Thorne manager.

WYOMING

PENN-WYOMING COPPER CO. assets and those of its successor, the United Smelters, Railway and Copper Co. will be sold at Cheyenne, Sept. 21. Claims total $2,376,750. Bonds of subsidiaries will be sold in following order: $518,500 Saratoga and Encampment Ry.; $500,000 Encampment Smelting Co.; $100,000 Encampment Pipe Line Ditch Co.; $50,000 Emerson Electric Light Co.; $350,000 Encampment Tramway Co.; $50,000 Encampment Waterworks Co.; $8,000 Encampment Land and Town Lot Co.; $750,000 Battle Lake Tunnel Site Mining Co.; $1,000,000 Haggarty Copper Mining Co.; $20,000 Carbondale Coal Co.; and $22,000 North American Mercantile Co.

WASHINGTON

Ferry County

SHIPPING MINES in Ferry County during first eight months and their tonnages were: Ben Hur, 2,099 tons; Knob Hill, 1,729; San Poil, 7,728; Tom Thumb, 267; Delphia at Danville, 29 tons; Iron Creek at Keller, 21. First four mines are at Republic.

Stevens County

SHIPPING MINES in Stevens County during first eight months, with shipping point and tonnages were: Bonanza at Bossburg, 345 tons; Edwards, Valley, 13; Electric Point, Boundary, 1,047; Kokoma, Boundary, 5; Lead Trust, Boundary, 9; Loon Lake Copper, Loon Lake, 30; Monarch, Chewelah, 18; United Copper, Chewelah, 6,600; Norman, Northport, 28; Columbia Copper (Turk), Deer Trail, 48; Deer Trail, Deer Trail, 4.

ADMIRAL (Valley)—Recently made preliminary shipment. Force to be doubled next month.

HECLA (Chewelah)—This Cœur d'Alene company will begin shipments from its copper-silver group on completion of a 1½-mi. wagon road.

SPOKANE BELLE (Valley)—Tungsten ore recently opened at this old silver mine. E. H. Belden, of Spokane is developing and may sink shaft to 350-ft. level.

CANADA

British Columbia

GRANBY (Grant Forks)—Seventh furnace blown in Sept. 7; eighth furnace may soon be started as steady coke deliveries by Crows Nest Pass Coal Co. now seem assured.

GRANBY (Anyox)—Receiving from company's Midas mine, Valdez, Alaska, about 3,000 tons monthly and from the Mamie on Prince of Wales Island, Alaska, from 4,000 to 5,000 tons monthly. Ores brought by company's own steamers.

Ontario

DAVIDSON (Porcupine)—Fire on Sept. 4 destroyed office building; fully insured.

JUPITER (Porcupine)—Rich extension of orebody on 400 ft. level, where vein is 2 ft. wide.

VIPOND (Porcupine)—Production in August from about 4,000 tons of ore was approximately $20,000 and operating expenses $11,500.

WEST DOME CONSOLIDATED (Porcupine)—Plans for mill completed and it is proposed to lay foundations this fall and carry on construction through the winter.

DOME MINES (South Porcupine)—In August, milled 40,010 tons—record tonnage. Yield was approximately $180,000 or $4.49 per ton; operating costs were $2.56, which is 6c. lower than in June and 5c. below the July costs.

AUGARITA (Porcupine)—Three diamond-drill holes down about 450 ft. each; 3 veins have been cut, one showing free gold. Main vein, stripped for about 1,700 ft. on the surface, is from 30 to 80 ft. wide.

PORCUPINE CROWN (Timmins)—Vein recently encountered in running a winze from 700- to 800-ft. level is not a new one, but is regarded as important owing to high grade of ore. Winze being continued to 900-ft. level, the vein, 4 to 6 ft. wide.

HOLLINGER CONSOLIDATED (Timmins)—In four weeks ended Aug. 11, gross profits were $220,357, from 43,387 tons of ore; average value $9.61 per ton; working cost $3.78 per ton milled. Expenditures on plant account during period were $44,689. Long crosscuts being made to connect workings in the outlying section of the property with the main shaft. Electric-tramming system will be extended to these, so that when new mill addition is started, next summer, ore will be hauled from points a mile distant.

MEXICO

CANANEA CONSOLIDATED (Cananea, Son.)—August copper production was approximately 5,000,000 lb., as compared with 4,600,000 lb. in July.

ESPERANZA (El Oro, Mex.)—Loss on June operations £572. Production low due to temporary strike and to withdrawal of operating staff from property.

SANTA GERTRUDIS (Pachuca, Hidalgo)—Crushed in July 20,292 tons; estimated profit £1,449; June profit £3,434. Pump station established on 22nd level. Report for quarter ended June 30 gives following review of operating conditions in Pachuca district: "International complications between the Mexican and U. S. Governments, while temporarily arranged, may come up again any time. We have for this reason released all American employees for an indefinite period. The timber situation continues serious; after making four trips our El Oro special train service was cut off by reactionary elements in control of the railroad over which we had to operate. Since then our train contract has expired, with no present chance of renewal. We are making every effort possible to increase deliveries from local sources, but these are limited by the railroad service, which at best is bad, and at frequent intervals entirely absent. The question of labor is not one so much of supply as of attitude. The men are now overpaid and exceedingly independent. They work less hours per day, less days per week, and are more inefficient while at work. All experimental work in hand and still uncompleted was dropped at the time of the recent exodus of Americans. There are no men available at the present time capable of carrying on this work. The profit for the quarter was considerably reduced, due principally to lower grade of ore, lower price of silver and increased labor cost. This condition is likely to be accentuated during the present quarter, and it may be possible that the company may even make some actual loss in the immediate future."

AFRICA

RHODESIAN GOLD PRODUCTION in July is reported at 77,000 oz., being 2,518 oz. less than in June. This makes for the seven months ended July 31 a total of 539,055 oz. Other production for July was 18,446 oz. silver, 347 tons copper, 452 tons asbestos, 8,758 tons chrome ore and 43,103 tons coal. The shipments of diamonds were 94 carats.

The Market Report

Metal Markets

NEW YORK—Sept. 13, 1916

All of the markets were very strong and active during the last week In both lead and spelter there were advances. In copper the range in price became large, according to delivery, there being important transactions for the first quarter of 1917.

Copper, Tin, Lead and Zinc

Copper—A very large business was done, both for domestic and foreign account. There was large buying by American brass manufacturers, which was understood to be for the purpose of covering a large contract for rods previously taken. Some more business of this nature is pending The sales of the week were for the fourth quarter of 1916 and the first quarter of 1917, the major market now including both of those periods. All of the large producers participated in this business. Widely different prices were accepted according to delivery, wherefore the range in quotations of the market is unusually large.

The transactions of which we had reports amounted to about 30 million pounds. The total sales for the week were undoubtedly upward of 50 million pounds.

Reports are confused with respect to the Russian order that was placed during the week It seems that more copper was bought for this account than had previously been talked about, the buyer evidently having asked several concerns to make tenders on a certain quantity and then taking it, or a large part of it, from each of them.

Negotiations for a large quantity of copper for the Allied Governments, which were interrupted recently, have been resumed.

The first electrolytic copper refined in Canada was turned out Aug 20 at the new refinery at Trail, B. C., built by the Consolidated Mining and Smelting Co., of Canada. The plant has a capacity of 10 tons daily.

The Department of State is in receipt of information to the effect that an agreement has been entered into between the Governments of Great Britain and Norway, whereby the Government of Norway places an embargo on the exportation of raw copper and receives without interruption importations of copper from the United States, but releases an amount equivalent to such importations for shipment to England. It is understood that about 3,000 tons will be at once available.

Copper Exports from Baltimore for the week included 1,029,114 lb. copper and 916,364 lb. brass disks to Havre, France; 3,360,371 lb. copper to Liverpool, England; 3,023,978 lb. copper to Archangel, Russia.

Copper Sheets are nominal at 37.5c. per lb. for hot rolled and 38.5c. for cold rolled. Copper wire is 31.5@32c. per lb. for large lots at mill.

Tin—This market was almost idle. The changes in price were insignificant

Lead—A large business was done, chiefly for domestic account, but there were some important foreign orders Lead for September shipment has become very scarce indeed and the market in this metal is now chiefly for shipment in October and later. The situation is such that the market has passed quite out of the hands of the principal producer and the pace is being made by the outsiders.

Spelter A very large business was done, especially with brass makers who purchased to cover a large contract for rods that they had taken. The largest purchases were for delivery from December to February, but there was also important business for prompt and near-by shipments. The buying began in the early part of the week at about 8¼c and the market was rapidly brought upward. At 9c., selers who had previously been standing aloof entered the market. The largest part of the business in spelter was associated with some of the large buying of copper.

Exports from Baltimore for the week included 224,041 lb spelter to London.

Zinc Sheets are in steady demand and business is fair. Quotations are unchanged at $15 per 100 lb., f.o.b. Peru, Ill., less 8% discount.

Other Metals

NEW YORK—Sept. 13

Aluminum—Spot material is still scarce and deliveries are mainly on contract. Demand is good and seems to exceed supplies. Prices are firmer but rather nominal at 61@63c. per lb. for No. 1 ingots, New York.

Antimony—This market continued dull at unchanged prices. We quote 12@12½c. However, there seems to be a slightly better tone, due largely to the refusal of some of the largest producers to take business at present prices.

Quicksilver—This market became very dull. Producers reduced their price to $75. San Francisco reports by telegraph $75, market fair.

Nickel—Demand is good both from domestic and export business. Prices are firm and unchanged at 45@50c. per lb. for ordinary forms, according to size of order. A premium of 5c. per lb. is charged for electrolytic nickel.

Minor Metals—Current quotations for **Bismuth** are $3.15@3.30 per lb., New York—**Cadmium** is quoted at $1.30@1.50 per lb.—**Cerium**, electrolytic, is sold at $8@9 per lb.—**Cobalt Metal** is quoted at $1.25 per lb.—**Magnesium** is steady, with sales at $3.50@3.75 per lb. for 99% pure—**Selenium** is from $3 up to $5 per lb., according to size of order.

Gold, Silver and Platinum

NEW YORK—Sept. 13

Gold Imports in the United States in July are reported by the Department of Commerce at $62,107,665; exports, $9,395,035; excess of imports, $52,712,630, which compares with an excess of imports of $15,071,203 in 1915, and an excess of exports of $30,277,709 in 1914.

Gold Production in the Transvaal in August is reported at 781,150 oz., being 20,063 oz. more than in July, and 2,387 oz. more than in August, 1915. For the eight months ended Aug. 31 the total was 6,174,104 oz., or $127,618,730; being 216,938 oz. more than last year.

Gold in the United States on Sept. 1 is estimated by the Treasury Department as follows: Held in Treasury against outstanding gold certificates, $1,619,201,489; in Treasury current balance, $288,506,199; in banks and circulation, $640,533,785; total, $2,548,241,473. This is an increase of $491,509,335 over Sept. 1 of last year.

Platinum—There was a further advance in this market. Principal producers report sales at $85 for refined platinum.

Silver—The market has ruled fairly steady the past week between 32$\frac{5}{16}$ and 32$\frac{9}{16}$d. in London, and closes firm at 32⅜d. bid. Shipments from New York to London continue moderate and with continuance of buying for English Mint and Continental coinage the undertone is healthy. There have been large shipments of late from San Francisco to China which is interesting in view of the situation of Chinese exchanges.

Mexican dollars were quoted in New York Sept. 7 at 52⅜@55⅜c.; Sept. 8 at 52¾@55⅝c.; Sept. 9 at 52⅜@55⅜c.; Sept. 11 at 52⅜@55⅜c.; Sept. 12 at 52⅛@55⅛c.; Sept. 13 at 52@55 cents.

Silver Exports from the United States in July were valued by the Department of Commerce at $4,336,598; imports, $2,425,782; excess of exports, $1,910,816, which compares with $962,578 in 1915, and $2,712,852 in 1914.

Coined Silver in the United States on Sept. 1 is estimated by the Treasury Department as follows: Standard dollars, $568,270,900; subsidiary coins, face value, $188,015,961; total, $756,286,861. Of the dollars, $182,006,557 are held in the Treasury against outstanding silver certificates.

Corrected and final statements from the Department of Mines put the silver production of Canada at 28,449,821 oz. in 1914, and 28,401,735 oz in 1915; a decrease of only 48,086 oz., or 0.17% last year

Zinc and Lead Ore Markets

Joplin, Mo., Sept. 9—Price quotations per 2,000 lb.: Blende, high, $64.90; per ton 60% zinc, premium ore, no sales, medium grades $60@55, low $50; calamine, per ton 40% zinc, $35@30; average selling price, all grades of zinc, $58.09 per ton. Lead, base price, $70@65, per ton 80% metal content. High price, $70.20. Average selling price, all grades of lead, $67.65 per ton

Shipments of the week: Blende, 3,361 tons; calamine, 496 tons; lead, 1,297 tons. Value, the week, $312,060; the year to date, $26,531,630. The investigation by the Producers' Association into the aggregate tonnage of reserve stock of zinc ore distributed over the district was most timely and aroused mine owners to the necessity of further limiting production. As a result, and to forestall possible labor trouble by the scheduled wage reduction for September, several mines closed on Sept 1.

The report of holders of ore, estimating a stock of 23,000 tons the week ending Aug. 26, was a near coincidence with the reports for smelters, showing for the same week 23,360 tons. So close are the two estimates as to practically confirm both. The next occurrence to upset ore production is the strike of coal miners in

SILVER AND STERLING EXCHANGE

Sept.	Sterling Exchange	Silver		Sept.	Sterling, Exchange	Silver	
		New York, Cents	London, Pence			New York, Cents	London, Pence
7	4.7575	67⅞	32$\frac{5}{16}$	11	4.7575	68	32⅜
8	4.7575	68¼	32½	12	4.7575	67⅞	32$\frac{5}{16}$
9	4.7575	68⅜	32$\frac{9}{16}$	13	4.7575	68	32⅜

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine.

DAILY PRICES OF METALS IN NEW YORK

Sept.	Copper	Tin	Lead		Zinc
	Electrolytic	Spot.	N. Y.	St. L.	St. L.
7	26½ @27½	39	6.55 @6.70	6.40 @6.60	8.25 @8.50
8	26½ @27½	38¾	6.60 @6.70	6.45 @6.60	8.37½ @8.62½
9	26½ @27½	38¼	6.60 @6.70	6.50 @6.60	8.37½ @8.62½
11	26½ @27½	38½	6.65 @6.70	6.50 @6.60	8.50 @9.00
12	26½ @27½	38½	6.65 @6.75	6.55 @6.60	8.75 @9.25
13	26½ @27½	38½	6.65 @6.75	6.55 @6.60	8.87½ @9.37½

The quotations herein are our appraisal of the average markets for copper, lead, spelter and tin based on wholesale contracts for the ordinary deliveries of the trade as made by producers and agencies; and represent, to the best of our judgment, the prevailing values of the metals, reduced to basis of New York, cash, except where St. Louis is basing point.

The quotations for electrolytic copper are for cakes, ingots and wirebars. Electrolytic copper is commonly sold at prices including delivery to the consumers and is subject to discounts, etc. The price quoted for copper on "regular terms" (r.t.) is the gross price including freight to the buyer's works and is subject to a discount for cash. The difference between the price delivered and the New York cash equivalent is at present about 0.25c. on domestic business. The price of electrolytic cathodes is 0.05 to 0.10c. below that of electrolytic. Quotations for lead represent wholesale transactions in the open market for good ordinary brands. Quotations for spelter are for ordinary Prime Western brands. Only St. Louis price is given, St. Louis being basing market. We quote New York price at 17c. per 100 lb. above St. Louis.

Some current freight rates on metals per 100 lb. are: St. Louis-New York 17c.; St. Louis-Chicago, 6.3c.; St. Louis-Pittsburgh, 13.1 cents.

LONDON

Sept.	Copper			Tin		Lead	Zinc
	Standard		Electrolytic				
	Spot	3 Mos.		Spot	3 Mos.	Spot	Spot
7	109½	106½	131	170¼	171¾	30¼	48½
8	110	107½	131	170	170¾	30¼	50
9							
11	111	108	131	169½	170½	30	59
12	111	108	132	169½	170½	30	52
13	114½	110½	132	169¾	170⅝	30	54

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2,240 lb. Copper quotations for electrolytic are subject to 3% discount. For convenience in comparison of London prices, in pounds sterling per 2,240 lb., with American prices in cents per pound the following approximate ratios are given, reckoning exchange at 4.80. £15 = 3.21c.; £20 = 4.29c.; £30 = 6.43c.; £40 = 8.57c.; £60 = 12.85c. Variations, £1 = 0.21⅜ cents.

the Kansas coal fields. The strike should have no very serious effect on this district, as the dependence upon coal-fuel power is limited Natural gas and electricity furnish the larger proportion of power.

Platteville, Wis., Sept. 9—Quotations for the week are according to the following figures: Base price per 2,000 lb. ton for material assaying 60% zinc is $56 for premium ore down to $50 for medium grade. For material assaying 80% lead the base price per 2,000 lb. ton is $71. Shipments for the week were 3,094 tons of zinc ore, 147 tons of lead ore and 907 tons of sulphur ore. For the year to date, the figures are 81,669 tons of zinc ore, 3,031 tons of lead ore, and 20,220 tons of sulphur ore. Shipped during the week to separating plants, 3,780 tons of zinc ore.

OTHER ORES

Manganese Ore—Brazilian ore continues to be quoted at about 60c per unit at seaboard; Indian ore at 50@55c. per unit.

Arrivals at Baltimore for the week included 12,655 tons manganese ore from Brazil.

Tungsten Ore—Exports of tungsten ore from Japan in 1915 were 85 tons to the United States, 214 tons to France, and 110 tons to the United Kingdom; 409 tons in all. Estimated shipments to July, 1916, are placed at 480 tons, most of it going to the United States. The tungsten output of Japan is reported as 25 to 40 tons of ore per month from the Kiwada mine, 10 to 11 tons per month from the Takitori mine, and 75 tons per month from several small mines. Those in Chosen produce between 50 and 60 tons per month.

Tungsten Ore—Following the large business consummated in recent weeks this market became very dull. Small quantities are still offered around $17 per unit, which we quote as the market. However, most of the interests in New York that have this ore for sale are holding for $20. It is reported that the Atolia Mining Co. has closed its mill for repairs, and it is thought that the withdrawal of this production may have a stiffening effect on the market.

Antimony Ore—This market is a little firmer. A small business was done at $1@1.10 per unit for immediate delivery.

EXPORTS AND IMPORTS

Spanish Ore and Mineral Exports, six months ended June 30, as reported by "Revista Minera," in metric tons:

	1915	1916	Changes
Iron ore... ..	2,161,930	2,366,439	I 204,509
Copper ore .	26,053	26,871	I 818
Zinc ore... .	13,227	57,170	I 43,943
Lead ore.... . .	385	1,196	I. 811
Manganese ore...	4,534	2,310	D 2,224
Pyrites.... .	828,492	1,543,340	I 714,848
Salt . . .	248,760	232,438	D. 16,322

Imports of coal for the half-year were 857,017 tons, an increase of 100,621 tons; of coke 86,652 tons, a decrease of 7,560 tons.

Iron Trade Review

NEW YORK—Sept. 13

The position of the iron and steel markets continues extremely strong. While at present the new demand for steel is only moderate the mills are so fully sold up that there is a strong market, and premiums for early delivery are paid on as many classes of finished steel as formerly, even lap-weld pipe being held at premiums by many mills In the past three months, despite the apparently quiet market, the mills have booked substantially as much business as they have filled and they regard it as settled that there will be heavy pressure for deliveries for 10 or 12 months to come.

While there is a feeling of relief in the iron and steel industry that the threatened railway strike did not occur, there are apprehensions over the unrest in iron and steel labor caused by the manner of settlement. Some observers who appear to be in close touch with the situation predict that before the end of the year there will be strikes for an eight-hour day, to replace the 10 and 12 hours worked by many of the men. Such a demand could not be granted, irrespective of the cost of production, as there would not be enough men to maintain the output. There is no surplus now, rather some scarcity of labor.

The strongest home demand at present is for plates and shapes for shipbuilding. The ship yards are all full of work and are in need of material. Structural work is about the same as last reported, with many small contracts to be placed, but only a few large ones under consideration. Railroad business is larger Some large foreign orders have been placed, and the rail mills are sure of abundant work next year.

The pig-iron market has been a little quieter, though there is still a heavy demand for basic iron, and foundry pig is selling quite freely, especially in seaboard territory.

Exports from Baltimore for the week included 4,197,051 steel billets, bars and forgings, 909,617 lb pipes and tubes, 226,082 lb. wire, 717,704 lb nails and 408,730 lb. tinplates to Great Britain; 14,750,425 lb. steel billets and blooms, 3,981,363 lb. steel rails and fastenings and 1,306,830 lb. pig iron to France; 4,640 tons old rails and scrap to Italy

United States Steel Corporation common stock on Sept 8 sold over par on the New York Stock Exchange. Later it went even higher, selling Sept. 9 up to 103⅛. Sept. 12 it sold at 105½ and promises to go higher.

The United States Steel Corporation reports unfilled orders on its books Aug 31 at 9,660,357 tons of material. This is 66,765 tons more than on July 31, but is 277,411 tons less than the maximum reached on May 31. It is 4,751,902 tons more than on Aug. 31 of last year.

Pig-Iron Production in August showed a slight decrease from July. The reports of the furnaces, as collected and published by the "Iron Age," show that on Sept. 1 there were 320 coke and anthracite stacks in blast, having a total daily output of 104,500 tons, being 1,100 tons more than on Aug. 1. Bad weather and scarcity of labor kept down production during the month. Making allowance for the charcoal furnaces the total make in August was 3,240,700 tons; for the eight months ended Aug. 31 it was 26,121,700 tons Of the total production 18,440,860 tons, or 70.6%, were made by the furnaces owned or operated by the steel companies.

PITTSBURGH—Sept. 12

The Steel Corporation's gain during August of 66,755 tons in unfilled obligations was less than had been expected in the trade but the showing is distinctly favorable in that it follows two months of decreases. The tonnage reported on books would carry the corporation into next April, on an average, but bars, plates, shapes and rails are sold much farther ahead than this, while wire products, sheets, tinplates and pipe mill products are sold a much smaller distance ahead, the divergence being due chiefly to differences in trade habits.

The steel mills regard it as assured that they will have full operation until the middle of next year, at the least, and on the surface the steel market promises a fulfillment of the expectation, but there are many doubters among the ranks of buyers. There are many who believe consumption in important lines will be reduced when it is necessary to pay the present prices on actual shipments, for at present there is still considerable cheap steel being shipped. The jobbers are particularly doubtful.

Steel production is increasing as the hottest weather has been passed but doubts are expressed whether October will show its usual large tonnage, as labor is scarce. The restricted production of the past two months has certainly helped to support the situation.

The general tone of the steel market is aided by the unwillingness of the great majority of mills to sell unfinished steel, except the fancy priced war steel, for delivery in the first half of the new year, as well as the tendency pig iron is showing to grow scarce and advance in price. Higher prices are claimed to be bid for scrap, particularly heavy melting steel.

Pig Iron—The buying movement has broadened further. The Brier Hill Steel Co., formerly a regular seller, has bought 20,000 tons of basic pig iron, but whether because its enlarged steel plant is outrunning its pig-iron production or because the company prefers to sell bessemer and buy basic is not disclosed. The United Steel Co. at Canton has also bought 20,000 tons of basic, and there are rumors of other purchases. The Standard Sanitary Manufacturing Co. today closed on purchases of 25,000 tons of foundry, about two-thirds southern, paying $14 and $14.50, Birmingham, for the southern and $18.50 at furnace for the northern. It is using half southern iron in its Pittsburgh district plants now, on account of the more favorable delivered price. Reports are that the merchant furnaces are almost fully sold for the remainder of this year and there are more predictions of an impending scarcity and a sharp advance. We quote: Bessemer, $21@21.50; basic, $18@18.25; malleable and foundry, $18.50@18.75; forge, $18@18.25, f.o.b. Valley furnaces, 95c. higher delivered Pittsburgh.

Steel—Reports are confirmed that there have lately been heavy sales to foreign consumers of shell steel billet discards, practically cleaning up the accumulations and making the unfinished steel situation still stronger. There are only occasional odd lots of soft steel offered for this year's delivery, and for next year the mills generally refuse to quote. The market is regarded as $45@50 for soft steel, bessemer or openhearth, but practically nominal at this range or any other.

FERROALLOYS

The production of ferromanganese and spiegeleisen in the United States, eight months ended Aug. 31, is reported at 133,934 gross tons in 1915, and 253,837 tons in 1916; an increase of 119,903 tons this year.

Ferrosilicon is nominally unchanged High-grade, 50%, is quoted at $86@89 per ton at furnace, according to size of order Bessemer ferrosilicon ranges from $30 for 9% up to $41 for 16%, at furnace.

Spiegeleisen, 20%, brings $40@45 per ton at furnace, with high grade, 25 to 30%, quoted at $55@65 per ton.

Ferromanganese—The market shows a somewhat easier tone, prompt being usually available at $170 or a shade less, while there is some domestic offered on contract at this figure, imported on contract remaining at $175. Fears of a shortage appear to be entirely allayed.

Arrivals at Baltimore for the week included 2,075 tons of ferromanganese from Liverpool.

FOREIGN IRON

German Pig-Iron Production in July is reported by the German Iron and Steel Union at 1,134,306 metric tons, being 52,799 tons more than in June. For the seven months ended July 31 the production was 6,581,840 tons in 1915, and 7,631,338 tons 1916; an increase of 1,049,498 tons. The make for the seven months in 1911, before the war, was 10,852,192 tons; so that this year's make was a little over 70% of that of a normal year

IRON ORE

Shipments of iron ore from the Lake Superior region by ports are reported by the "Iron Trade Review" as follows, in gross tons, for the season to Sept. 1:

Port	1915	1916	Changes
Escanaba	2,995,862	4,708,477	I. 1,712,615
Marquette.	1,773,653	2,469,705	I. 696,052
Ashland. .	2,801,219	4,796,384	I. 1,995,165
Superior .	4,439,088	7,815,795	I. 3,376,707
Duluth. .	9,378,530	12,718,548	I. 3,340,018
Two Harbors. .	5,418,068	6,706,955	I. 1,288,887
Total	26,806,420	39,215,864	I 12,409,444

The shipments for the season at this rate will easily reach 60,000,000 tons and perhaps exceed that figure, even if there should be an early close of navigation. The August shipments were 9,850,140 tons, the largest on record.

COKE

The Alabama coke market is strong and supplies are hardly up to the demand Coke production in the Birmingham district is being rushed.

Connellsville—Bids of $2.85 were made this morning for a few carloads of furnace coke for shipment today. The market is quiet with very light offerings and small inquiry. There is ample oven capacity but labor is scarce. Car supply has become practically normal again We quote: Spot furnace, $2.80@2.85; contract, nominal, $2.50@2.75; prompt and contract foundry, $3.25@3.50, per net ton at ovens.

Anthracite Shipments in August are reported at 5,531,797 gross tons, which is 98,919 tons more than in July and 69,670 tons more than in August, 1915. For the eight months ended Aug. 31 the total shipments were 42,891,783 gross tons in 1915, and 44,386,340 tons in 1916; an increase of 1,494,557 tons this year.

Chemicals

NEW YORK—Sept. 13

The general market is improving, showing a stronger tone and increased business. The heavy chemicals generally report sustained prices and more interest in futures.

Arsenic—Supplies are equal to the demand, which continues moderate. Quotations are unchanged at $6@6.25 per 100 lb., for both spot and futures.

Copper Sulphate—Demand seems to be improving and there are more inquiries for export material. Prices have again hardened a little and sellers are quoting $9@11 per 100 lb., according to size and terms of order

Nitrate of Soda—Demand is reported as improving, the statistical position is not strong, owing to large production and prospective imports, in addition to good stocks on hand Nevertheless prices are firm, and sellers continue to quote $3 per 100 lb. for both spot and futures.

Sulphur—A fair business is forward and prices are firm. Spot material is scarce and commands a premium, sellers holding for $35 per gross ton. Futures can be had at about $30 per ton for November and later.

Sulphuric Acid—Business is fair and there is some inquiry for futures, including some large contracts. Prices are steady at $1 per 100 lb for 60-deg. and $1.50 per 100 lb. for 66 deg. acid

Magnesite shipments from Greece in 1915 are given by U. S. Consul General A. W. Waddell, of Athens, as follows, in metric tons:

To	Raw	Calcined	Total
United States.	33,641	6,318	39,959
England.	43,545	7,627	51,172
Other Europe..	15,475	4,781	20,256
Total...	92,661	18,726	111,387

All Grecian magnesite mines are located in the Athens district, most of them being on the Island of Euboea. In 1914 the mines produced 117,430 metric tons of raw magnesite. The total 1915 output is placed at 133,858 tons. The United States bought more heavily in 1915 than formerly.

Assessments

Company	Delinq.	Sale	Amt.
Alta Silver, Nev.	Sept. 1	Sept. 25	$0.03
Beaver Gold, Utah	Aug. 19	Sept. 16	0.01
Beaver Mines, Utah	Sept. 30	Oct. 21	0 0025
Blue Star, Ida	Sept. 25	Oct. 21	0 02
Bull Valley, Utah	Oct. 10	Oct. 31	0 004
Cash Boy, Nev.	Sept. 1	Oct. 15	0 01
Challenge, Nev.	Aug. 23	Sept. 13	0 05
Coal Creek, Ida	Aug. 25	Sept 26	0 005
Con. Virginia, Nev.	Sept. 29	Oct. 20	0 05
Crown Point, Utah	Sept. 16	Oct. 10	0 005
Eagle Mountain, Ida.	Oct. 2	Nov. 4	0 001
Exchequer, Nev.	Sept. 5	Sept. 26	0 03
Emerald, Utah	Aug. 15	Sept. 9	0 00½
Fortuna, Utah	Aug. 25	Sept. 14	0 005
Friend, Ida	Aug. 26	Sept. 16	0 002
Great Bend, Nev.	Aug. 15	Sept. 20	0 01
Great Western, Nev.	Sept. 26	Oct. 18	0 01
Hector, Ida.	Aug. 7	Sept. 15	0 005
Idaho-Nevada, Ida	Sept. 14	Oct. 14	0 002
Jacket-C.Point-Belcher, Nev.	Aug. 14	Sept. 7	0 05
Leonora, Utah	Sept. 27	Oct 16	0 005
Nevada-Stewart, Ida.	Aug. 3	Sept. 2	0 003
Nevada Zinc, Nev.	Aug. 14	Sept. 2	0 01
Old Veteran, Ida	Sept. 9	Oct. 7	0.002
Paloma, Utah	Aug. 21	Sept 9	0 01
Phedora, Ida	Aug. 29	Sept. 29	0 001
Rio Grande Grubstake, Nev.	Sept. 22	Oct. 31	0.002
Sandstorm Kendall, Nev	Aug. 22	Sept. 26	0 01
Santaquin Chief, Utah	Sept. 11	Sept 21	0.0025
Santaquin King, Utah	Sept. 11	Sept. 21	0 0025
Sells, Utah	Sept. 21	Oct. 7	0 06
Silver Pick, Nev.	Sept. 25	Oct. 30	0 01
Smuggler, Utah	Sept. 20	Oct. 18	0.005
Springfield Tunnel, Calif.	Aug. 15	..	0 05
Syndicate, Utah	Sept. 18	Oct. 14	0.0015
Tarbox, Mont	Sept. 28	Oct. 28	0 005
Tyler, Ida	Sept. 12	Oct. 12	0 0015
Umatilla, Nev	Sept. 18	Oct. 24	0 0025
Uvada, Nev.	Oct 9	Oct. 26	0 02
West Toledo, Utah	Sept. 12	Oct. 3	0 01
Whale, Utah	Sept. 5	Sept. 25	0.05
Wonderful, Ida	Aug. 30	Sept 20	0.001

Stock Quotations

SAN FRANCISCO Name of Comp.	Sept. 12 Bid.
Alta	.05
Andes	.09
Best & Belcher	.06
Bullion	.02
Caledonia	35
Challenge Con	05
Confidence	.15
Cons. Imperial	.01
Con Virginia	.10
Gould & Curry	.03
Hale & Norcross	06
Jacket-Cr. Pt.	07
Mexican	17
Occidental	70
Ophir	24
Overman	‡ 04
Savage	.08
Seg Belcher	02
Sierra Nevada	31
Union Con	68
Utah Con	01
Belmont	4 30
Jim Butler	84
MacNamara	06
Midway	30
Mont.-Tonopah	25
North Star	.17
Rescue Eula	22
West End Con	68
Atlanta	09
Blue Bell	‡ 01
Booth	13
C.O.D. Con	.02
Comb. Frac	.07
D'field B.B.	.02
D'field Daisy	.03
Jumbo Extension	36
Round Mountain	37
Sandstorm Kendall	03
Silver Pick	20
Central Eureka	08
Argo	.07
Ariz. Central	.15
Big Jim	1 12½
Lazy Boy	.12
Oatman No. Star	‡ 10
Tom Reed	1 60
United Eastern	3 50
United Western	08

LONDON	Aug. 31
Alaska-Mexican	£1 6s 3d
Alaska Tre'dwell	5 10 0
Burma Corp	3 5 0
Cam & Motor	0 11 6
Camp Bird	0 8 0
El Oro	0 9 6
Esperanza	0 11 3
Mexico Mines	3 12 6
Nechi, pfd	0 13 0
Oroville	0 16 9
Santa Gert'dis	0 12 0
Tomboy	1 2 6

SALT LAKE Name of Comp.	Sept. 11 Bid.
Alta Con	.27
Black Jack	05
Colorado Mining	.15
Crown Point	.03¼
Daly-Judge	7.75
Emma Cop	.63
Gold Chain	.16
Grand Central	.62
Iron Blossom	1.47½
Lower Mammoth	.03
May Day	.06
Opohongo	‡.01
Prince Con	1.45
Seven Troughs	‡ 02¼
Silver King Coal'n	3 00
Silver King Con	3.55
Sioux Con	09¼
Uncle Sam	02
Yankee	.10

COLO. SPRINGS	Sept. 12
Acacia	03⅝
Cresson	5 65
Doctor Jack Pot	10½
Elkton Con	15¾
El Paso	.51
Findlay	03¾
Gold Sovereign	05⅞
Golden Cycle	2 16½
Granite	‡ 73
Isabella	20⅛
Jack Pot	05
Jerry Johnson	‡ 04
Mary McKinney	26
Portland	1 66
Vindicator	1 95

TORONTO	Sept. 11
Adanac	25
Bailey	08
Chambers Ferland	18
Coniagas	4 55
La Rose	60
Peterson Lake	21
Right of Way	05½
Seneca Superior	27
T. & Hudson Bay	55 00
Temiskaming	60
Wettlaufer-Lor	12
Dome Exten	35
Dome Lake	49
Foley O'Brien	55
Hollinger	6 90
Jupiter	31
McIntyre	1 56½
Newray	.65
Porcu. Crown	76
Preston E. D.	‡ 03
Vipond	40
West Dome	38

N. Y. EXCH. Name of Comp.	Sept. 12 Clg.
Alaska Gold M	14
Alaska Juneau	7½
Am.Sm.&Ref.,com	107
Am. Sm. & Ref., pf.	114
Am. Sm. Sec., pf. A	96
Am. Sm. Sec., pf. B	85
Am. Zinc	39⅝
Am. Zinc, pf	78¾
Anaconda	88⅝
Batopilas Min	1⅛
Bethlehem Steel	524½
Bethlehem Steel, pf.	138
Butte & Superior	69¾
Chile Cop	20⅝
Chino	55⅞
Colo. Fuel & Iron	52¾
Crucible Steel	84½
Dome Mines	24½
Federal M. & S.	22
Federal M. & S., pf.	43⅞
Great Nor., ore ctf.	42¼
Greene Cananea	50
Homestake	132
Inspiration Con	61½
International Nickel	45
Kennecott	53¾
Lackawanna Steel	84
Miami Copper	37½
Nat'l Lead, com.	67⅜
National Lead, pf.	110
Nev. Consol	22¾
Ontario Min	7
Quicksilver	3¼
Quicksilver, pf	4
Ray Con	25¼
Republic I&S, com.	66⅞
Republic I&S, pf.	114⅞
Sloss-Sheffield	58¼
Tennessee Copper	26⅝
Utah Copper	87⅜
U. S. Steel, com	104½
U. S. Steel, pf.	118⅜
Va. Iron C. & C.	51

N. Y. CURB	Sept. 12
Beaver Con	42
Buffalo Mines	80
Butte & N. Y.	1⅜
Butte C. & Z.	5½
Caledonia	.59
Can. Cop Corpn.	1⅝
Cashboy	.06½
Cerro de Pasco	35½
Con. Ariz. Sm.	$1\frac{9}{16}$
Con. Coppermines	2⅜
Con. Nev.-Utah	.28⅛
Crystal Cop	1
First Nat Cop.	4⅜
Florence	.75
Goldfield Con	.78
Goldfield Merger	08
Granite	.20
Hecla Min	5
Howe Sound	5¼
Jerome Verde	2⅜
Joplin Ore & Spel	50
Kerr Lake	4⅝
Magma	16½
Majestic	⅜
McKinley-Dar-Sa	59
Mother Lode	.35
Nevada Hills	.16
N. Y. & Hond.	15¾
Nipissing Mines	7½
Oro	04
Ray Hercules	3½
Rochester Mines	54
St. Joseph Lead	- 16⅛
Standard S. L.	$1\frac{3}{16}$
Stewart	.25
Success	.34
Tonopah	5⅝
Tonopah Ex.	$5\frac{7}{16}$
Tribullion	⅜
United Zinc	5⅝
White Knob, pf.	1⅞
White Oaks	5¾
Yukon Gold	2

BOSTON EXCH Name of Comp.	Sept. 12 Bid
Adventure	3
Ahmeek	105
Algomah	1¾
Allouez	69⅝
Ariz. Com., ctfs.	12¾
Bonanza	‡ 25
Butte-Ballaklava	‡¾
Calumet & Ariz.	70½
Calumet & Hecla	550
Centennial	19
Copper Range	62½
Daly West	2½
East Butte	16½
Franklin	8
Granby	88
Hancock	13½
Helvetia	.25
Indiana	3½
Island Cr'k, com.	44
Island Cr'k, pfd.	90
Isle Royale	30¼
Keweenaw	5¾
Lake	13¾
La Salle	4
Mason Valley	2⅛
Mass.	13½
Mayflower	2½
Michigan	3¾
Mohawk	90½
New Arcadian	6½
New Idria	13
North Butte	21
North Lake	2
Ojibway	1½
Old Colony	2¼
Old Dominion	71¾
Osceola	91
Quincy	91
St. Mary's M. L.	80½
Santa Fe	2⅛
Shannon	9¾
Shattuck-Ariz.	30¾
So. Lake	6¼
So. Utah	.20
Superior	17
Superior & Bost.	5
Tamarack	37¼
Trinity	6½
Tuolumne	.50
U. S. Smelting	79⅛
U. S. Smelt'g, pf.	51½
Utah Apex	4⅜
Utah Con	14
Utah Metal	7¾
Victoria	3½
Winona	5
Wolverine	48
Wyandot	1½

BOSTON CURB	Sept. 12
Bingham Mines	9¾
Boston Ely	$1\frac{3}{16}$
Boston & Mont.	94
Butte & Lon'n Dev.	.60
Calaveras	6
Calumet-Corbin	.02
Chief Con	$1\frac{15}{16}$
Cortez	.25
Crown Reserve	.43
Davis-Daly	2⅛
Eagle & Blue Bell	1¾
Houghton Copper	1½
Iron Cap Cop., pf	5½
Mexican Metals	35
Mines of America	2⅛
Mojave Tungsten	4¼
Nat. Zinc & Lead	$1\frac{1}{16}$
Nevada-Douglas	1⅜
New Baltic	2¼
New Cornelia	15
Ohio Copper	07
Oneco	80
Raven Copper	‡ 07
Rex Cons	26
Rilla	.16
United Verde Ext.	43¾

‡Last Quotations.

Monthly Average Prices of Metals

SILVER

Month	New York 1914	New York 1915	New York 1916	London 1914	London 1915	London 1916
January	56.572	48.855	56.775	26.553	22.731	26.960
February	57.506	48.477	56.755	26.573	22.753	26 975
March	58 067	50.241	57 935	26.788	23.708	27 597
April	58.519	50 250	64.415	26.958	23.709	30.662
May	58.175	49 915	74.269	26.704	23.570	35.477
June	56.471	49 034	65 024	25 948	23.267	31 060
July	54 678	47.519	62 940	25.219	22.597	30.000
August	54.344	47.163	66.083	25 979	22.780	31.498
September	53.290	48.680	....	24.260	23.591	....
October	50.654	49.385	......	23.199	23.925	......
November	49.082	51.714	......	22.703	25 094	......
December	49.375	54 971	......	22.900	26.373	......
Year	54 811	49 684	.....	25.314	23 675	......

New York quotations cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0 925 fine.

COPPER

Month	New York Electrolytic 1915	New York Electrolytic 1916	London Standard 1915	London Standard 1916	London Electrolytic 1915	London Electrolytic 1916
Jan.	13.641	24 008	60.756	88.083	65.719	116.167
Feb.	14.394	26.440	63.494	102 667	*	133.167
Mar.	14.787	26.310	66.152	107.714	*	136.000
April	16.811	27.895	75.096	124.319	*	137.389
May	18.506	28.625	77.600	135 467	*	152.522
June	19.477	26 601	82 574	112 432	95.333	137 465
July	18.796	23.865	76 011	95 119	91.409	125 500
Aug.	16.941	26.120	68 673	110 283	82.333	126.304
Sept.	17.502	......	68 915	......	85.250	......
Oct.	17.686	.....	72 601	......	88.000	....
Nov.	18 627	......	77.744	......	93.273	....
Dec.	20.133	....	80 773	.....	100 43	....
Year.	17 275	......	72 532	.....	....	....

TIN

Month	New York 1915	New York 1916	London 1915	London 1916
January	34 260	41.825	156 550	175.548
February	37 415	42.717	176.925	181.107
March	48 426	50.741	180 141	193.609
April	47 884	51.230	166 225	199.736
May	38 790	49 125	162.675	196.511
June	40 288	42 231	167.636	179.466
July	37.423	38 510	167 080	168.357
August	34 389	38.565	151 440	169.870
September	33.125	...	152 625	....
October	33 080	.....	151.554	......
November	39 224	......	167.670	....
December	38 779	.....	167.000	.....
Av. year	38 590	...	163.960	....

LEAD

Month	New York 1915	New York 1916	St. Louis 1915	St. Louis 1916	London 1915	London 1916
January	3.729	5.921	3.548	5.826	18.606	31.167
February	3 827	6.246	3.718	6.164	19.122	31.988
March	4 053	7.136	3 997	7.375	21.883	34.440
April	4 221	7.630	4.142	7.655	21 094	34.368
May	4 274	7.463	4.182	7 332	20.347	32 967
June	5 932	6 936	5 836	6 749	25.170	31.011
July	5 659	6.352	5.531	6 185	24.611	28.137
August	4 656	6.244	4.520	6 088	21.946	29.734
September	4 610	......	4 490	.....	23.151	......
October	4 600	......	4 499	....	23.994	......
November	5.155	......	5 078	....	26.278	......
December	5.355	......	5.266	......	28 807	......
Year	4.673	......	4.567	......	22.917	......

SPELTER

Month	New York 1915	New York 1916	St. Louis 1915	St. Louis 1916	London 1915	London 1916
Jan.	6.386	16.915	6.211	16.745	30.844	89 810
Feb.	8 436	18.420	8.255	18.260	39.819	97 762
Mar.	8.541	16.846	8.360	16.676	44 141	95 048
April	10.012	16.695	9 837	16.525	49.888	99.066
May	14 781	14.276	14 610	14.106	68.100	94 217
June	21.208	11.752	21.038	11 582	100.614	68 591
July	19.026	8.925	18 856	8.755	97.250	50 750
Aug.	12.781	8.730	12.611	8.560	67 786	51.587
Sept.	13.440	......	13 270	.....	67.841	......
Oct.	12.800	......	12 596	.....	66.536	......
Nov.	15.962	......	15.792	....	88.409	......
Dec.	15.391	......	15.221	....	89.400	......
Year	13.230	......	13 054	....	67.553	......

New York and St. Louis quotations, cents per pound. London, pounds sterling per long ton. * Not reported.

PIG IRON IN PITTSBURGH

Month	Bessemer‡ 1915	Bessemer‡ 1916	Basic‡ 1915	Basic‡ 1916	No. 2 Foundry 1915	No. 2 Foundry 1916
January	$14.59	$21.60	$13.45	$18.78	$13.90	$19 70
February	14.55	21.16	13.45	18.93	13.90	19.51
March	14.55	21 81	13.45	19.20	13.95	19.45
April	14.55	21 65	13.45	18 95	13.95	19.45
May	14 61	21.78	13.60	19 11	13.83	19 58
June	14.70	21 95	13.67	18 95	13.77	19.34
July	14.94	21 95	13.91	18 95	13.68	19.20
August	16.01	21.95	15.31	18.95	14 75	19 25
September	16.86	......	15.95	......	15.70	......
October	16.95	......	15.96	......	15.80	......
November	17 57	......	16.47	......	17.20	......
December	19.97	......	18.44	......	18.95	......
Year	$15.82	......	$14.76	......	$14.95	......

‡As reported by W. P. Snyder & Co.

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Silver-Tin Mining in Bolivia

By Joseph T. Singewald, Jr.,[*] and Benjamin Le Roy Miller[†]

SYNOPSIS—The three most important silver-tin mines of the Oruro district, all working the same system of veins, are the Socavon, the San José and the Itos. Low-grade ore used for stope filling centuries ago is now handled at a profit. Metallurgical treatment comprises chloridizing roasting and leaching of copper and silver, followed by concentration of residues to recover tin.

The ore deposits of the Oruro Hills, Bolivia, have features of more than usual interest, due to the fact that they afford the best illustration known today of this type of silver-tin ore deposits. This association of silver and tin, which is so common in Bolivia and so unusual elsewhere, has always made these Bolivian deposits peculiarly attractive to students of ore deposits. The ores mined at Oruro are particularly interesting for the reason that the ratio of silver to tin is higher than in most of the ores of this type now being mined, and because the silver and tin minerals are so intimately associated in much of the ore.

The most famous of all the old silver districts of Spanish colonial days in South America was Potosi. Next to it in fame came Colquechaca and Oruro. Potosi is now principally a tin producer, Colquechaca lies idle, while Oruro is still essentially a silver producer. The silver ores of these Oruro Hills were known to the natives before the arrival of the Spaniards, but upon the death of the Inca Atahualpa the Indians destroyed all evidences of their work in order to hide the deposits from the Spaniards. In 1575 the mines were rediscovered by the Spaniards and for a long time rivaled in richness those of its more illustrious competitor, Potosi. In the seventeenth century the City of Oruro grew to be a town of over 75,000 inhabitants, and the small group of hills rising above it was dotted with hundreds of mines.

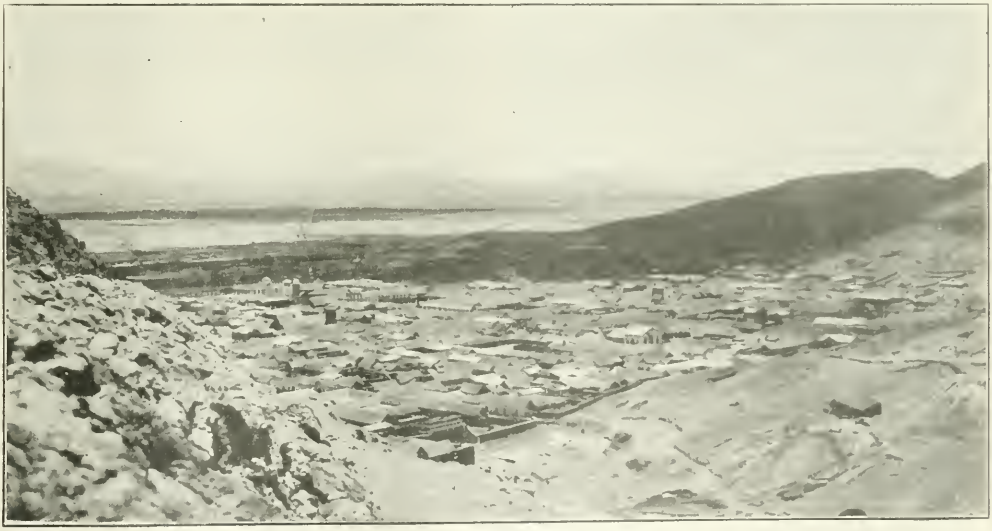

FIG. 1. CITY OF ORURO, LOOKING FROM THE HILLS ACROSS THE "ALTIPLANICIE"

During the following century the rich silver chlorides near the surface were approaching exhaustion and the production of the mines was decreasing, when in 1780 an Indian uprising put an end to mining through the assassination of all the Spanish miners. Early in the next century when A. D'Orbigny visited the place, he found only one tin vein near the summit of the mountain being worked, and the site of the once prosperous city was occupied by a mere village. In 1861 the silver production scarcely amounted to 30,000 oz., but a slow revival was setting in and the output continued to increase for some years afterward. In 1885 the present Chilean company known as the Compañía Minera de Oruro was founded and purchased the Socavon de la Virgen. This mine increased its output from 150,000 oz. in 1886 to 800,000 oz. in 1891, with a total for that period of 3,333,000 oz. About the same time another Chilean company purchased the Itos mine near the west end of the mineralized belt, which is now also the property of the former company, and for several years produced 400,000 oz. silver annually. Between the two mines just mentioned lies the San José mine, which was then owned by a Bolivian company, but which is now the property of the Compañía Minera de San José, a Chilean company. The Compañía Minera de Oruro and Compañía Minera de San José now controls the district.

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[*] Associate in economic geology, Johns Hopkins University, Baltimore, Md.

[†] Professor of geology, Lehigh University, South Bethlehem, Penn.

In the year 1891 the total output was 1,800,000 oz. of silver. Since then the depreciation in the price of silver and the neglect of silver mining in Bolivia attendant on the development of the tin-mining industry have seriously affected the production, so that in 1915 it amounted to only 780,000 oz. Nevertheless, this is one-third of Bolivia's silver output and ranks the district second among her silver-producing districts, being excelled only by Huanchaca. At the same time it has become an important tin district and the same mines are producing over 1,000 tons of tin concentrates annually, which have a value about equal to that of the silver they yield.

The Oruro Hills are a group covering an area of about 4 sq.mi. rising above the "altiplanicie," or high plateau, of Bolivia near its eastern edge, on the west side of the Antofagasta & Bolivia R.R. about 233 km. south of La Paz. They constitute a western outlier of the Cordillera Oriental, or Cordillera Real, that borders this plateau on the east. The elevation of the plateau is a little over 12,000 ft., and the hills rise 1,200 ft. above it.

GENERAL GEOLOGY OF THE ORURO DISTRICT

The main mass of the hills is made up of igneous rock intermediate in composition between quartz porphyry and dacite, which frequently carries large phenocrysts of orthoclase. On the southern side and on the west slope are numerous areas of dark-colored shales which are part of the series of early Paleozoic shales that are so widespread in their occurrence in the main range. In the mine workings these shales are frequently encountered as isolated blocks in the igneous rocks that probably represent pieces broken off as the intrusion forced its way through the shales.

At the foot of the eastern slopes of these hills lies the City of Oruro, seen in Fig. 1, which, with a population of 25,000 or more, has become the second most important commercial center of Bolivia. For many years it was the terminus of the Antofagasta & Bolivia R.R.; in 1908 this road was extended to Viachi, making connection with La Paz and the Ferrocarril Central del Perú, giving a second outlet to the Pacific at Mollendo. The opening of the Arica-La Paz line in 1913 gave Oruro a third outlet. In addition there is the branch line to Cochabamba, so that aside from being the center of an important silver- and tin-producing district, Oruro is a place of considerable industrial importance.

The mineralized area includes the northern part of the hills, and the richest portion is a belt extending diagonally across them from Oruro in a direction a little north of west, which is marked on the surface by countless old openings and dumps, evidences of the extensive activities of years gone by. There are now three important mines located on this belt, known from southeast to northwest as the Socavon, the San José and the Itos, which are all working the same system of veins, the most important and persistent of which is the vein known as the Purisima in the Socavon ground. The country rock is almost entirely the igneous rock, but more shale is encountered in the Itos mine than farther east.

The Socavon mine is located on the east slope just above the City of Oruro; in fact, the main level of the old workings known as the Socavon de la Virgen enters the hill at the offices of the company in the town itself. This is a crosscut to the Purisima vein. The old workings extend to a depth of 75 m. below this tunnel, but the newer workings reach a depth of 150 m. more. An incline from the surface cuts this level a little to the north of where the crosscut reaches the vein and continues to the 125-m. level below it. From the latter level a vertical winze has been sunk 100 m. at the junction of the Inch and Nueva veins.

The Purisima vein has a strike N 15° W and dip 45° to 70° west, and branching from it are several subordinate veins, the more important being the Nueva, Inch and Razgo, the relative positions of which are indicated in Fig. 2. The veins are fissure fillings with frequent inclusions of fragments of the wall rock. Only occasionally is there a well-defined parting, but for the most part the veins are frozen to the walls and at some places there has been replacement of the wall rock so that the vein material gradually merges into the barren country rock.

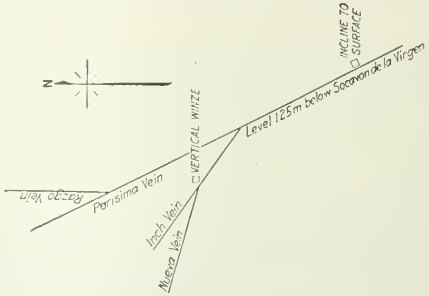

FIG. 2. PLAN OF 125-M. LEVEL, SOCAVON DE LA VIRGEN MINE

VEIN CHARACTER ALTERED AT SLATE CONTACT

The Razgo vein runs into slate and changes its character completely at the contact, for whereas in the porphyry it is a well-defined vein rich in tin, in the slate it splits up into a number of minute stringers less than 1 cm. wide, which carry no tin or iron sulphides, but consist entirely of the argentiferous sulphantimonides carrying 1% to 2% silver. Otherwise the veins are quite uniform in character and filling. The average width is 4 ft. and the maximum 20 ft. On the level of the Socavon the ore is practically continuous, but it breaks up into three nearly vertical oreshoots the stope lengths of which are decreasing in depth.

The main mass of the vein filling in the present workings consists of the iron sulphides with but a small percentage of nonmetallic gangue. A little quartz occurs, but no boron- or fluorine-bearing minerals were seen. Next in prominence to the iron sulphides are cassiterite and the silver-bearing minerals. The cassiterite is usually of a light-brown or yellow color and for the most part massive or finely crystalline. The principal silver minerals are tetrahedrite and jamesonite. The former occurs massive in bunches and stringers in the pyrite, the latter commonly in thick tufts of acicular crystals or fine needles in druses in the pyrite. This manner of occurrence is equally characteristic of the lowest and of the higher levels. The tin and silver minerals occur in part separate and distinct in the pyrite, and in part very intimately intermingled. It would seem that they must be essentially contemporaneous, with the silver-depositing stage showing a tendency to continue just a little later than the period of tin mineralization. There is no sphalerite and only a small quantity of galena in the ore.

Low-Grade Stope Filling Now Mined at Profit

To a variable depth of 50 to 100 m. the sulphide ores have undergone oxidation, and it was the rich accumulations of horn silver in this oxidized zone that were sought in the early history of the camp. Now only the leaner parts are left, and the ores after sorting do not average more than 5 to 6% tin and 8 oz. silver. Immediately below the zone of oxidation was formerly a zone of rich sulphides which is now practically exhausted. This zone furnished picked ore running several thousand ounces per ton. It is succeeded by the zone of primary ores in which the silver content is much lower. In years gone by no ore carrying less than 150 oz. silver was profitable, so that many of the old stopes were filled with material that can now be worked, and except for the ore from the new deeper parts of the mine the present output comes from lean pillars that were not removed, and from the old filling. This filling sorted down to 1 in 7 yields a product that averages 4 oz. silver and 1½% tin. It has become so indurated and cemented as a result of the chemical decomposition it has undergone that it stands of itself and can be mined in the same way as the untouched parts of the vein. In fact, the oxidation of the sulphides is going on at such a rate that the air in some parts of the mine is extremely irritating to the mucous membrane of the throat and lungs, and at the bottom of the vertical shaft the temperature is 75° F. The crude ore is subjected to hand sorting, reducing 3 tons to 2 tons, and the sorted material averages 35 oz. silver, 2 to 3% tin and about 30% sulphur. In addition it carries ½% copper, which must occur chiefly in the tetrahedrite.

San José Deepest Bolivian Tin Mine

On passing into the San José territory the Purisima vein takes a westward swing, and by the time it reaches the Itos mine it has an east-west strike. The mine is being worked by the Itos tunnel, which is 76 m. above the Socavon de la Virgen, but on the opposite side of the hills. Going down from it is a 300-m. shaft at whose bottom is an 80-m. inclined winze, which makes this the deepest tin mine in Bolivia and one of the deepest of Bolivian mines. In the levels of the incline, the vein enters a mass of slate in which it splits up, but on passing out of the slate into the porphyry on the opposite side again assumes its original character. Some very rich silver ores have been encountered in these lowest levels, running as high as 500 to 600 oz. silver, and the rich silver ores of this mine carry 150 to 300 oz. silver. In these same levels patches of almost pure cassiterite are found. After having gotten below the zone of secondary sulphides there seems to be no further impoverishment with depth down to the present limits of the workings. Some excellent specimens of "ring ores" can be obtained at this mine. They consist of centers of pyrite coated with brown cassiterite and the interstices filled with the silver minerals. Here again is evidence to show that the silver mineralization continued later than the tin, though in part the two must be contemporaneous. In the vicinity of the Itos are several cross-veins, the oxidized zone of which is being worked on a small scale for tin. This material runs as high as 6% to 10% tin and is sorted into a shipping grade containing 60% tin and a milling ore with 5% to 6% tin. The ores from the Itos mine are taken over the hill by means of an aërial tram.

Concentration of Tin Follows Leaching

Before the consolidation of the mines under the ownership of the two large Chilean companies the ores were treated in a number of small mills, but now each of these companies has a single large mill. Owing to the scarcity of water about Oruro, these mills are not located at the mines, but at other stations on the Antofagasta & Bolivia R.R. The mill of the Compañía Minera de Oruro is situated at Machacamarca, 24 km. south of Oruro, and that of the Compañía San José at the next station, Poopoo, 18 km. from Oruro.

The copper and silver are recovered from the sulphide ores by subjecting them to a chloridizing roast and leaching. The copper is recovered from the first washing after the chloridizing, and then the silver. The residue is subjected to concentration to recover its tin. At the Machacamarca mill the coarser than 100-mesh material is jigged in three-compartment Harz jigs with 1½-mm. screens and a bed 2½ mm. thick using but little water. The product of the three hutches furnishes a 71% concentrate. The jig product constitutes one-half of the concentrates. The other one-half comes from the tables that treat the less than 100-mesh size. The silver recovery averages about 84% and that of the tin about 93%. The process employed by the Compañía Minera de San José is essentially the same.

The oxidized ores are usually treated for the recovery of the tin only. Occasionally they are mixed with the sulphides and given a chloridizing roast in order to recover the silver, but the cost of fuel generally makes this inexpedient. The recovery of the silver content by the cyanidation of the tailings is under consideration.

The Compañía Minera de Oruro is treating daily 60 tons of sulphide ore and 20 tons of oxidized ore. The company struggled along for many years with indifferent success, but since the erection of the new mill about six years ago it has been highly successful, having not only wiped out a large accumulated deficit, but having paid dividends as well. This is largely due to the efficient management of H. F. Grondijs, who was for several years resident manager and who now, as consulting engineer, spends about four months on the property each year.

Aramayo Francke Mines, Ltd., Moves Head Offices

Aramayo Francke Mines, Ltd., has recently moved its headquarters from London to Geneva, Switzerland, to escape the super-tax imposed on mining and other companies with headquarters in Great Britain. This company has extensive holdings in the south central part of Bolivia and produces tin, tungsten, bismuth, silver and copper. What has now developed into a great mining undertaking was initiated as a private concern in Bolivia in 1867. Upon the acquisition in 1906 of the interests of Carl Francke, a private limited company was incorporated under the English law under the style of Aramayo Francke & Co., Ltd. Following the acquisition of various properties in the Chorolque district and other neighboring sections, the title of the company was changed to its present name in January, 1911. All the original partners had meantime or previously established their residence in various cities in Europe, F. A. Aramayo, the chairman, having taken up his residence in London on account of early school associations in England. The company has paid handsome dividends in times of good metal prices.

As some of the principal shareholders reside in other places than England, it was felt that the super-tax resulting from the war was hardly justified in its application to these holdings. After considering various places in which to establish the new company, the directors finally settled upon Geneva, Switzerland, as offering all the advantages required. The cost of registration was only a few hundred pounds; there are a trade license and a municipal duty on profits amounting to 1½%, but when no trading is done in the district and all business is reduced to office work, these charges are greatly reduced or exempted.

There is no great advantage to shareholders resident in England from the proposed change, as they will receive their dividends with income-tax deducted as heretofore. Shareholders resident in foreign countries, however, will derive considerable benefit. For the sake of illustration it may be assumed that the profits of the company will be £100,000 net in any one year. In England £25,000 would have to be paid as income tax and for other contingencies at least the sum of £15,000, leaving for distribution £60,000. In Geneva, out of the same amount of profits the company would be able to distribute about £90,000 to shareholders. British shareholders will thus enjoy a slight advantage by reason of the greater amount to be available for distribution as dividends. This may in a measure be counterbalanced by the sentimental objection of moving the company to a foreign or neutral country during the time of war and the possibility of the products getting into enemies' hands. In this connection it is interesting to know who are the principal German shareholders in this important Bolivian enterprise. The chairman stated that the most important of all was the "Ernst und Matilde Francke Stiftung," a philanthropic institution created by one of the original partners, which holds 78,880 shares. The other principal shareholder, holding 20,740 shares, is V. M. M. Braun, for many years connected with the company in Bolivia and later one of the members of the board of directors, and especially in charge of the sale of the company's products. His father was a Bolivian born, and his grandfather, General Braun, of Montenegro, one of the leaders in the war for South American independence.

The directors of the new Swiss company are to be F. A. Aramayo, chairman; Carlos Aramayo; Nicholas Veja, a Chilean gentleman residing in Paris; Alberto de Aguilar, son-in-law of the chairman, residing in Madrid; and Gustave Ferriere, who has lately been at the head of the Huanchaca Co. in Paris and who will take charge of the new headquarters in Geneva.

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The Consolidated Interstate-Callahan Mining Co.

The Consolidated Interstate-Callahan Mining Co., operating near Wallace, Idaho, reports a profit of $3,100,491 for the year ended June 30, 1916. From this and a previous surplus, dividends of $3,254,930 ($7 per share) were paid and new property acquired valued at $181,817, leaving a profit balance at the end of the year of $806,711. As much ore was opened in orebodies already developed as was extracted, without recourse to sinking. Sufficient ore is developed above the No. 6 level to insure operations for three or four years. The report also states that work will shortly be completed to enable explorations to be made (on level No. 7) about 225 ft. below anything before explored.

During the year development work amounting to 6,493 ft. was performed: Sinking, 570 ft.; crosscuts, 3,229 ft.; drifts, 2,073 ft.; raises, 211 ft.; assessment tunnels, 380 ft. Stations and skip chutes amounting to 41,999 cu.ft. were cut. There was 123,684 wet tons of ore taken from the mine, from which 10,244 tons of ore was sorted from the belt and shipped direct. This ore had a tenor of 49.2% Zn. The balance of the output, 113,440 wet tons, ran 2.6 oz. Ag, 6.3% Pb, 27.8% Zn and 5.8% Fe. The mine worked 361 days and the mill 351 days. The mine output was 342.6 wet tons per day, and the mill and sorting plant had an output of 187.2 tons. The mill during the latter part of the year recovered 90% of the zinc value in the ore. Detailed results of milling operations are given in the accompanying table.

DATA OF THE INTERSTATE-CALLAHAN MILL

	Mill Feed	Zinc Product	Lead Product
Tons	120,198	61,211	4,504
Lead contents, %	8.85	5.84	49,87
Lead contents, lb.	11,642,219	7,149,901	4,492.318
Zinc contents, %	46.50	48.60	18.59
Zinc contents, lb.	61,174,840	59,500,386	1,674,454
Silver, oz. per ton	3.66	2.42	20.52
Silver, oz.	240,756	148,315	92,411

The gross value of lead and zinc crude ore and concentrates as sold to smelters was $4,631,205. The average cost of mining and milling was $5.457 per ton of ore mined.

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Japanese Mineral Production

The figures of production from Japanese mines for the first six months of 1916 show in general a considerable increase over the like period in 1915. Owing doubtless to heavy absorption in war munitions for Russia, the increases recorded for copper and iron are 20.1% and 38.9% respectively. The following tabulation comprises the figures of the Department of Agriculture and Commerce:

JAPANESE MINERAL PRODUCTION FOR SIX MONTHS

Mineral	Production	% Increase*
Gold	3,959 kg.	7.5
Silver	80,385 kg.	10.0
Copper	39,123 m. tons	20.1
Iron	33,219 m. tons	38.9
Coal	10,001,417 m. tons	8.3
Petroleum	225,811,800 liters	1.5
Sulphur	40,366 m. tons	38.1

*Over corresponding period for 1915.

The Inspiration Mine Plant*

SYNOPSIS—The description of a mine plant designed to work a deposit containing 100,000,000 tons of ore at an average depth of 500 ft. A discussion of the requirements of each section is given, together with the reason for the choice of equipment finally adopted. The salient features of the mine plant are as follows: The dual arrangement of the entire plant; the automatic loading and hoisting of ore; the application of the elevator principle for handling men; and the reduction of the crude ore for mill treatment in two simple stages.

The Inspiration Consolidated Copper Co.'s plant at Miami, Ariz., was designed and built to make possible the profitable working of a low-grade finely disseminated copper deposit containing 100,000,000 tons of ore averaging 1.61% in copper values.

From the beginning it was evident that the plant could not be kept integral, but that a break would have to be made somewhere in the flow sheet, removing at least the concentrator to a site more suitable than any that was available near the mine. It was finally decided, after considering numerous alternative arrangements, to do the coarse crushing at the mine, Fig. 1, to store the crushed ore in a bin from which it could be loaded into railroad cars and to haul it to the concentrator, an excellent site for which was available about 1¾ mi. from the mine.

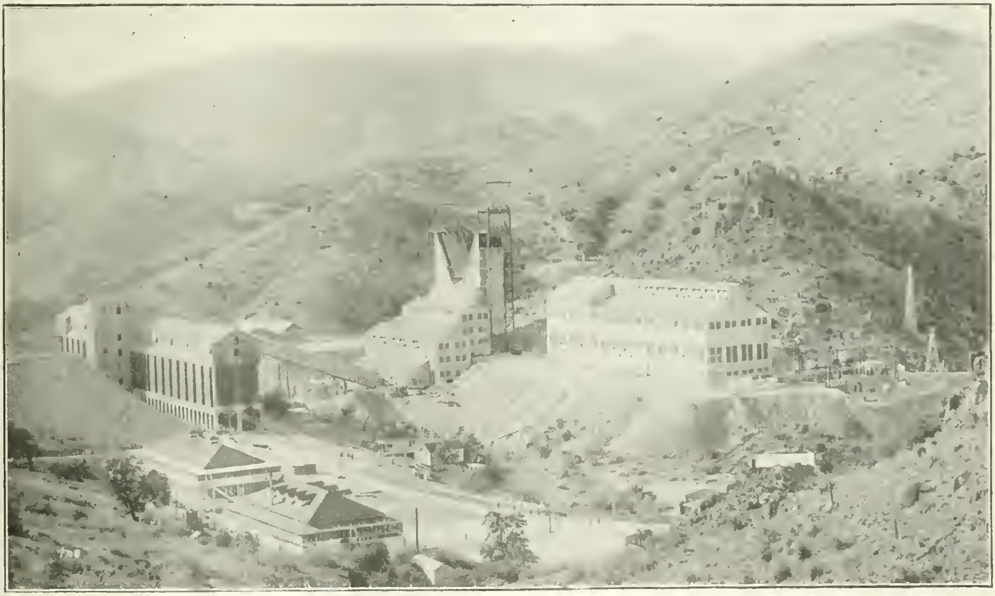

FIG. 1. INSPIRATION MINE PLANT, LOOKING WEST

The original intention was to equip a plant to treat 7,500 tons of ore per day, but through the acquisition and proving up of additional ore reserves, the introduction of the Ohio caving system and the excellent results obtained in the test mill (which made it possible to treat a lower-grade ore than had been thought possible), it was evident that a plant of much greater capacity could be supplied. It was therefore decided to treat approximately 15,000 tons of ore per day, the duties of the four main divisions to be as follows:

DUTIES OF MAIN DIVISIONS OF THE PLANT

Division	Operating Time in Hr	Capacity in Tons per Hr.	Daily Capacity in Tons	Available Capacity, Tons
Hoisting plant	15	1,000	15,000	....
Crushing plant	15	1,000	15,000	....
Storage bin	..	....	.....	25,000
Concentrator	24	625	15,000	.....

The sites for the plants as finally decided upon permitted of an arrangement entirely adequate to meet the proposed requirements, but the following important features may be noted:

The mine-plant site is contiguous to the orebodies, but at a safe distance from ground to be caved; it occupies a position as regards elevation well suited to a favorable hoisting arrangement and allows of a downgrade to the concentrator of 0.3%. The shortest line from the shafts to the orebodies approximately bisects them, making possible a very direct underground haulage system; the site occupies a remote corner of the property and does not lie in the general trend of the mineralized zone. The mill site has a slope favorable to the type of mill erected and is of sufficient area to allow of an economical arrangement of the various units of the plant. There is ample storage space for tailings and an excellent reservoir site available for the storage of water.

As the life of the property was estimated to be 17 years or longer, depending upon new developments in the treatment of lower-grade ores, it was decided to make the various structures of a semipermanent character. The buildings are of steel with corrugated steel coverings, except the concentrator, which has a four-ply composition roof. All windows as well as skylights are of rubber-glass. The floors throughout are of concrete, the retaining walls of reinforced concrete and machinery foundations of massive concrete with little or no reinforcing. Reinforced concrete was used wherever applicable.

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*Excerpts from an article by H. Kenyon Burch, B. S., chief engineer, Inspiration Consolidated Copper Co., to be presented at the Arizona meeting of the A. I. M. E., September, 1916.

Electric power is obtained from two sources. The Reclamation Service of the United States Government from its hydro-electric plant at the Roosevelt Dam, 40 mi. away, furnishes energy at 40,000 volts 25 cycles three-phase.

In conjunction with the International Smelting Co. the Inspiration company built a power house which utilizes the waste heat from the reverberatories under one set of boilers. There is also another set of boilers, oil-fired, which is used when the power demand is greater than can be supplied by the waste-heat boilers alone. This power house contains three 7,500-kv.-a. steam-turbine driven generators, delivering energy at 6,600 volts 25 cycles three-phase; and also three 15-lb. reciprocating blowing engines, each having a capacity of 15,000 cu.ft. of free air per minute. The air is for the smelter use exclusively, while the electric energy is for the mining, smelting and ore-dressing plants.

The distributing system is so laid out that any division of the plant can take power from either source. When available, the Reclamation power is used for the greater part of the Inspiration load. Each unit of the plant has its transformer station for stepping down the transmission-line voltage. Motors of 50 hp. or greater are run on 2,200 volts, smaller motors on 440 volts and lighting circuits on 110 volts. Synchronous motors are used as required, to maintain a satisfactory power factor.

Under the general heading of mine plant will be considered that portion of the plant with its adjuncts which takes the ore from the mine cars, hoists it to surface, reduces it to a size suitable for mill treatment and places it in storage, ready for transportation to the concentrator.

The subject will be handled according to the following general scheme: First, the reasons will be given that led to the adoption of the type of plant finally decided upon; this in turn will be followed by a general description of the plant, and finally, each step will be dwelt upon as much in detail as is consistent with the novel features that any particular method or appliance may possess. Reference to Fig. 2 will aid in following the description.

The relation between the orebodies and the mine plant can be described as follows: Conceive of a chain of orebodies, which in their lateral extension take the form of a parabola, with its vertex pointing to the north and having a length of approximately 9,000 ft. Place the main haulageways on either side of the axis, 60 ft. apart, and open them to surface through two three-compartment shafts, 102 ft. centers and distant from the nearest approach of the orebodies about 750 ft. Group the mine plant symmetrically about the axis between the shafts and the orebodies, and a general idea of their relation is obtained (Fig. 2).

As a result of the preliminary studies, the dual arrangement of the mine plant was evolved, the primary consideration being the necessity of handling 1,000 tons of ore per hour, which in itself precluded the use of a single shaft. Two shafts would also insure continuity of service. It was then considered advisable to follow this idea a step further and to make the whole mine plant duplicate in its arrangement, which would give reasonable assurance against total shutdowns and also permit of a better load factor.

Crude ore from the stope chutes is hauled in trains of 25 cars each by compressed-air locomotives to the loading stations at the main shafts (Fig. 3). All ore tapped from the chutes has been broken to pass a 12-in. grizzly, so that no further attention has to be given it after it is once in the cars. At the shafts the cars are dumped, five at a time by motor-operated tipples, one for each shaft on the 600 or main haulage level, with a third on the 400 level. All hoisting is done from the main haulage level. The tipples on the 600 level dump

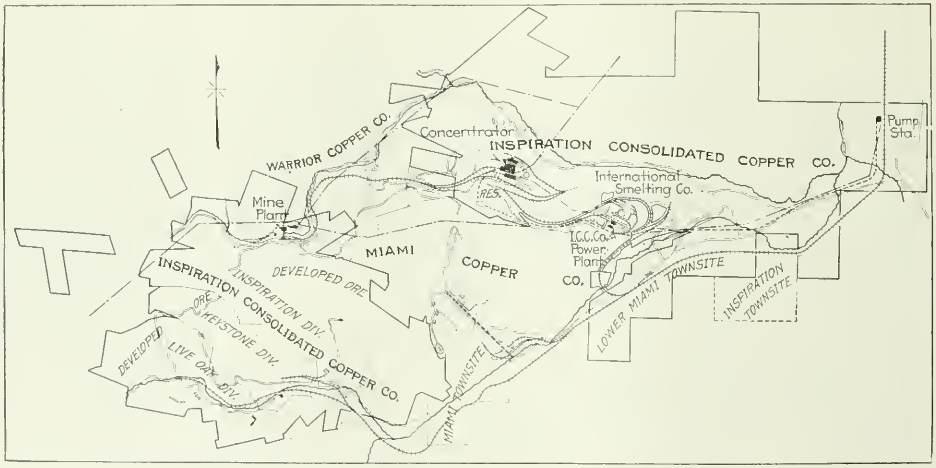

FIG. 2. MAP SHOWING RELATION OF THE SEVERAL UNITS OF THE PLANT

directly into 1,600-ton pockets, beneath which are the automatic measuring and skip-loading devices. There are four of these, two for each shaft. Here the ore is automatically measured and loaded into 12-ton skips. On the surface it is dumped into a 2,000-ton crude-ore bin lying between the shafts and serving both (Fig. 4).

The crushing plant is composed of four similar units, one of which is here described: A 18-in. apron feeder takes the ore from the crude-ore bin and discharges it over a 3-in. bar grizzly, feeding a No. 8 gyratory crusher set to crush to 4-in. cubes. The discharge from the gyratory and the throughs from the grizzly are conveyed by a 30-in. inclined belt conveyor to two 48-in. disk crushers, the ore first passing over a 1½-in. bar grizzly. This conveyor has a magnetic head pulley for removing tramp steel. The 48-in. disk crushers are set with a maximum opening of 2 in., their discharge and the throughs from the 1½-in. grizzlies joining on two 36-in. horizontal cross-belts, which in turn discharge at the center of the building on the two main inclined belts, also, of 36-in. width. These belts are 300 ft. long, travel at 350 ft. per min. and are equipped with hand-adjusted tail-pulley takeups and also with weighted tension carriages. They discharge on four 24-in. horizontal conveyors over the storage bin, each of which has an automatic tripper which distributes the ore uniformly throughout the bin. Weightometers are placed on the two main inclined belts, thus giving a record of the ore handled. Fig. 5 is a cross-section of the plant.

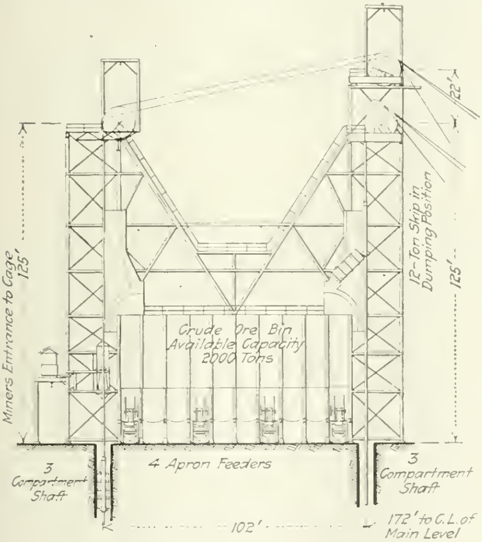
22°
12-Ton Skip in Dumping Position
125'
Miners Entrance to Cage 125'
Crude Ore Bin Available Capacity 2000 Tons
4 Apron Feeders
3 Compartment Shaft
3 Compartment Shaft
102'
172' to C.L. of Main Level

FIG. 3. SECTION THROUGH HEADFRAMES, SHAFTS AND BINS

At the point where the main inclined belts discharge on the horizontal cross-belts is placed the heads sampler. This consists of a rectangular cast-iron bucket, 9x30 in. on the end of a revolving arm 10 ft. in length. The bucket runs on a circular track 12 ft. 1 in. in diameter and is driven through a wormwheel mounted on a vertical shaft making a revolution every forty seconds. The bucket has a swinging cutoff type of gate for a bottom. In its travel it cuts the two main ore streams taking out $^1/_{120}$ and at a point 180° from the ore stream strikes a tripper which causes the gate to open and the sample to be discharged into a 10-ton hopper. From the hopper the sample is fed by a roll feeder and started on its way through the sampling plant, which is placed against the center of the storage bin opposite the main conveyors. Here the sample is first passed through a 24-in. disk crusher, a $^1/_{15}$ cut is then made with a Snyder sampler and this cut is delivered to a set of 27x14-in. rolls. The roll product is cut by a second Snyder sampler, this $^1/_{15}$ cut going to a mixing drum which equalizes the flow. The resulting stream is delivered to a duplex Vezin sampler making two $\frac{1}{10}$ cuts. These samples are duplicates and weigh 110 lb. each and represent a day's run. The rejects from the three samplers go to an elevator which discharges into the storage bin. Fig. 2 shows the exterior of the sampling plant. Having the general scheme of the mine plant well in mind, a more detailed review can now be made.

UNDERGROUND HAULAGE BY COMPRESSED AIR

Underground haulage is confined to two levels, the 600 or main haulage level, and the 400 level. The main haulage level is, in turn, made up of two distinct systems each serving its main shaft. All haulage is to be controlled by a block-signal system. Two types of motive power for underground haulage were considered—electric and compressed air. On account of less danger to life due to the elimination of bare conductors, the compressed-air locomotives was chosen rather than the electric. The difference in the efficiency of the two systems is probably a very small percentage of the total cost.

The locomotives are of the two-stage, four-wheeled type and have a weight on the drivers of 10 tons. The initial cylinder air-pressure is 250 lb. and the charging pressure 800 lb. per sq.in. The haulage capacity per charge was estimated at 50 ton-miles. The locomotives haul 25 cars, each of five tons capacity on a 30-in. gage track over a 0.4% grade in favor of the load, and will negotiate a curve of 38-ft. radius.

Three tipples are in use, two in accordance with the dual arrangement of the main haulage level station and the third on the 400 level. Each tipple is designed to dump five cars, each car weighing 14,000 lb. loaded. They have an overall length of 56 ft. and make a complete revolution in 15 seconds. The driving shaft is connected through suitable gearing to a 35-hp. motor which runs continuously in one direction, the starting and stopping of the tipple being accomplished by means of a friction clutch on the intermediate shaft. Each tipple is provided with an automatic stop which brings it into the proper position for running on and off the cars, this stop being released by means of a foot lever on the operator's platform. The two main tipples are operated from a centrally located platform.

The two main underground pockets serve as storage for the automatic measuring and loading devices which are placed beneath them. The capacity of each pocket is 1,600 tons, or 800 tons for each loader, which, with full pockets, will run the crushing plant about 3 hr. They are of reinforced-concrete construction throughout and are lined with 2-in. planks. The upper pocket has a capacity of 500 tons and is connected to the lower pockets by an inclined chute.

Taken individually, the shafts do not deviate materially from usual designs, being of reinforced concrete throughout. They are of the same size, each being made up of three compartments 5 ft. 6 in. by 5 ft. 11 in., the two south compartments of either shaft being for the ore skips. The north compartment in the West Main serves the man elevator and the corresponding compartment in the East Main is taken up by pipe lines, ladderways and the elevator counterweight. All platforms, supports and ladders in this compartment are of steel. The conduits carrying the power and lighting circuits underground are in the end walls, being brought to junction boxes every 100 ft.

The ore skips are built according to special designs. They have a nominal capacity of 12 tons and weigh 17,000 lb. each. The overall length is 21 ft., the skip proper being 14 ft. deep. The body is of 3/8-in. steel plate with liners to take up concentrated wear.

In order to keep the sumps at the bottom of the shafts clean and to facilitate the handling of ore which does find its way below the skips, spillage skips have been installed. These rest on chairs 17 ft. below the ore-skip chairs and by means of hinged aprons completely close off the shaft. When one is filled, it is attached to the bottom of the ore skip and hoisted to the top of the underground pocket, where by opening a hopper bottom it is discharged. They have a capacity of nine tons each.

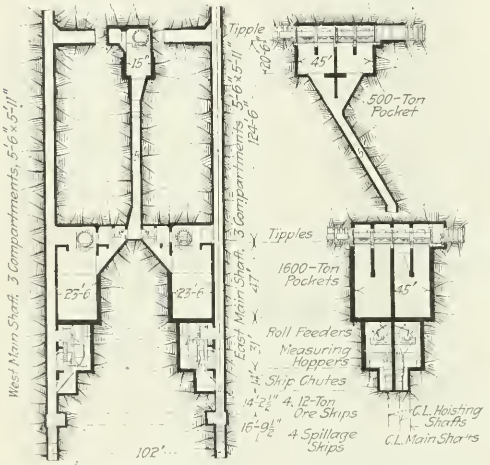

FIG. 4. UNDERGROUND POCKET ARRANGEMENTS

At the time it was decided to sink two shafts, the conditions seemed to favor the use of two entirely independent hoists, located symmetrically on either side of the main headframes. It was next proposed to put the two hoists under the same roof, but to operate them independently of each other. Then on account of the advent of several new conditions it was deemed advisable to see what could be done toward making the operation of the hoists automatic. The conditions were as follows: (1) The contract with the United States Reclamation Service for the supply of power called for flywheel equalization of peak loads which in turn made necessary the use of a motor-generator set. This condition was in perfect accordance with the equipment as finally decided upon as being best suited for automatic hoisting. (2) All supplies and waste rock were to be handled through a tunnel opening, thus leaving the main hoists with no other duty than that of hoisting ore. (3) Extending over considerable periods of time all ore was to be hoisted from one level, thus permitting of always running the two skips in balance. (4) Men were to be handled by a separate hoist. (5) The moderate depth of shafts permitted the use of low-speed hoists.

Both shafts are vertical, with a present depth of 585 ft., although an ultimate depth of 1,000 ft. will be used and had to be provided for in the hoist designs. The nominal capacity of the two hoists when running automatically is 1,000 tons per hour. The ore skips operate in balance, each weighing 8½ tons and carrying 12 tons of ore.

The hoist drums are of the cylindrical type, 10 ft. in diameter by 65 in. face and have a capacity of 1,000 ft. of 1¾-in. rope. One drum of each hoist is provided with a clutch which is air-operated. The brakes are of the post type, air-operated with oil cataracts and compensating levers. Each hoist is driven through gearing by a direct-current motor of 585 hp.

The hoists are entirely automatic in their operation, but either can be manually operated independently of the other if so desired. The problem as presented has been solved in a most efficient manner, sufficient proof being the entire satisfaction that the equipment has thus far given.

Elevator for Lowering and Hoisting Men

When the question of handling men came up, several courses as regards point of distribution presented themselves. They could be handled through an existing tunnel, hoisting or lowering to the working levels through an inclined shaft, or entirely through an inclined shaft, or through one of the main shafts, whichever scheme proved the most feasible, the idea was to have the men do as little walking as possible, ample provision to be made for transferring them from changehouse to working places. It was finally decided that distribution from the main shafts was the most logical, and the shafts were equipped accordingly.

The next consideration was the type of hoists to be used. Standard mine practice favored a separate hoist manually operated and working against a counterweight. This type made necessary the services of two attendants, one on the cage and one at the hoist, but in working out probable operating costs the idea was conceived of eliminating the hoist attendant by an application of the elevator principle. Studies along this line were at once begun, but no great amount of enthusiasm among the manufacturers could be aroused on account of the unusual conditions. Equipment was wanted to handle a counterweighted, double-deck cage, weighing 7,100 lb. and loads of 7,500 lb., the maximum speed of the cage to be 800 ft. per min. The fact that the hoist and counterweight would have to be removed from the elevator shaft also presented a new feature in the design. It may be stated, however, that placing the hoist in the headframes directly above the shaft, as is the usual practice in office-building design, was at one time considered.

The equipment as installed is operated entirely from the cage, the hoist, motor-generator set and control apparatus being in the hoisthouse about 220 ft. away. The motor driving the d.c. generator on the motor-generator set has a rating of 190 hp., the generator developing 130 kw. The hoist is driven by a d.c. motor of 158 hp. It is provided with a safety brake so arranged that when the hoist is stopped the brake is automatically applied to hold the cage. This brake is actuated by spring pressure, is constantly in service except when electrically released during normal operation of the hoist and is therefore instantly applied in case the current supply is interrupted from any cause. Additional safety devices are provided which take care of overwind, overload on motor, slack cable, etc. Two oil-cushioned buffers are provided at the bottom of the shaft, being so designed as to bring the loaded cage to a gradual stop in case from any cause, while running at normal speed, it should not stop at the lower terminal. The cage is equipped with a telephone that keeps the attendant in touch with the hoisthouse, also with an annunciator system covering the several levels (Fig. 4).

Each level and the collar is provided with a two-story station, which makes it possible to load both decks without shifting. The cage accommodates 36 to 40 men besides the attendant. The surface station, which is in the headframe, is connected with the changehouse by a covered runway. From the underground stations the men are transferred to the various working places in cars accommodating 12 men each and drawn by the haulage locomotives.

AUTOMATIC MEASURING AND LOADING DEVICES USED FOR SKIPS

To carry out the automatic feature of the hoisting equipment, it was desirable to make the loading of the skips automatic. There being nothing on the market that could be used for this purpose, it was necessary to work up complete designs in accordance with original ideas. In a few words the device can be described as follows: Ore from one of the 1,600-ton underground pockets rests on a roll feeder actuated by a pawl-and-ratchet wheel and is fed into a 12-ton measuring hopper. This hopper is suspended between the legs of a U-shaped scale beam with fulcrums at the ends. Through a link at the middle of the yoke the proportional weight of the hopper and ore is transferred to the main scale beam, which carries a counterweight of 1,370 lb. Motion obtained from the counterweight scale beam when the hopper becomes filled is utilized to operate a system of levers and lift the pawl from the ratchet wheel, thus stopping the roll feeders. The hopper is now ready to be emptied.

As the returning empty skip settles on the chairs, it strikes an arm projecting into the shaft. This arm is connected by a system of links to the shaft on which the yoke of the gate forming the bottom of the hopper is hinged. The motion imparted to the system by the skip trips the gate yoke, the weight of the ore in the hopper causes the gate to drop into the skip chute, and the hopper is emptied into the skip. As soon as it is empty, a counterweight on the gate causes it to close, all motions are reversed, and the measuring hopper is again filled.

A cutoff gate is provided which prevents the roll feeder from becoming bare in case the pocket should be emptied. A 5-ft. layer of ore thus protects the feeder and does away with excessive impacts due to the dumping of the ore from the tipple 50 ft. above. A 5-hp. motor furnishes the required power for the roll feeders of each pair of loaders.

A FOUR-UNIT COARSE-CRUSHING PLANT

The loaded skips assume a dumping position at a point about midway between the shaft collars and the center of the sheaves, leaving about 25 ft. for possible overwinding. The sheaves are 125 ft. above the shaft collars. They are 12 ft. in diameter and pressed on $8\frac{1}{2}$-in. shafts, 8-ft. sheaves on 6-in. shafts being used for the man-elevator ropes. The dumping tracks are of usual design. By means of chutes leading away from one compartment of each shaft, an even distribution of the ore is effected throughout the length of the crude-ore bin. This bin is of rather unusual design and very nearly self-cleaning. The bottom slopes down 45° either way from a hip center toward the vertical back and front, a section resembling a capital M inverted. Gates are placed under the bin on the slope toward the back as well as on the front of the bin. This arrangement of bottom and gates not only allows the bin to be emptied, but the ore is prevented from packing or hanging up by drawing off alternately from the rear and front gates. The gates are 18 in. wide and are operated by rack and pinion from runways. For each unit of the crushing plant two gates, one under the bin and one in front, discharge on an apron feeder which travels across and under the bin (Fig. 5.).

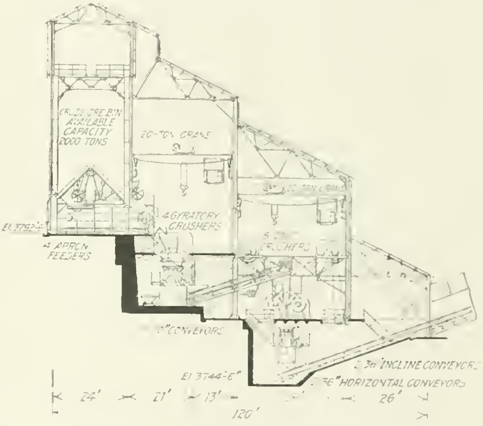

FIG 5. SECTION THROUGH CRUSHING PLANT

The feeders are of the apron type, have a width of 48 in., a length of 25 ft. 6 in. between centers and travel at 7 ft. per min.; 20-in. belt conveyors traveling at 7 ft. per min. and driven from the feeder sprockets are placed beneath the feeders to take care of drippings. These discharge into chutes that join the undersize from the grizzlies. Wood scraps are removed from the ore at the discharge end of the apron feeders and also from the inclined conveyors leading to the disk crushers. These scraps are carried away by two 20-in. belt conveyors traveling at 75 ft. per min., running across the building and dumping outside.

The four units of the crushing plant are driven by four 200-hp. motors in two dustproof rooms, symmetrically arranged on either side of the plant. Except for some minor reductions, belt transmission is used throughout.

Two 20-ton electric cranes are installed in the plant—one to serve the gyratories, the other the disk crushers, motors, etc. These are in turn connected to the yard track by transfer cars and a 20-ton electric trolley hoist, running at right angles outside of the building. Each 200-hp. motor is served by a 6-ton crawl so arranged as to allow of crane handling after leaving the motor room. A repair car and track near the gyratories permits of easy handling of their driving mechanisms, or bottom plates.

Storage Bin of 25,000 Tons Capacity

The purpose of the storage bin in connection with a mine plant is identical with that of a flywheel on an engine—to give out and absorb energy when variation in the load occurs suddenly. It does away with the necessity of maintaining a nice balance between mine and mill and allows either, for a short time, to cease running altogether or to run at a lessened capacity. Where the mill is removed from the mine plant, it also furnishes an economical means of transferring the ore into railroad cars. Besides this, it allows of a hoisting and crushing period considerably less than full time running, a very important consideration, since there are always repairs to be made in shafts, to loaders, tipples, hoists and crushing machinery.

The Inspiration storage bin is double-tracked, has an available capacity of 25,000 tons and will load a train of 14 cars without switching. The base is of reinforced concrete and is provided with four expansion joints. The bin proper and conveyor housing are of steel. The main dimensions of the bin are as follows: Overall length, 465 ft.; width, 40 ft.; depth, 40 ft. The bin is divided into three compartments, the two end compartments being for the storage of special ores if any such are ever encountered. They are comparatively small, accommodating one car on each track and having an available capacity of 1,700 tons each.

As noted before, an even distribution of the incoming ore is effected by the use of automatic trippers on four 24-in. conveyor belts. These belts are driven by two 50-hp. motors placed at either end of the bin. The ore is drawn off through hand-operated gates of the swinging cutoff type, there being three openings for each car.

Compressor Equipment for 1,000- and 100-Lb. Air

Compressed air is used for two distinct purposes—for underground haulage and for mine drills. For the first 1,000-lb. air is used and 100-lb. for the second. The haulage system is served by two compressors, each having a capacity of 1,125 cu.ft. of free air per min. at 107 r.p.m. These are of the duplex four-stage motor-driven type, the cylinders being cross-compounded, water-jacketed and having intercoolers between each stage. These compressors have an automatic regulating scheme whereby, when a predetermined high-pressure point has been reached, the 1,000-lb. discharge line is cut out and the four cylinders are converted into a double-compound compressor discharging directly into the 100-lb. main. Each compressor is driven by a 430-hp. self-starting synchronous motor.

The low-pressure equipment consists of two 100-lb. compressors having capacities of 3,000 and 7,270 cu.ft. of free air per min. Both compressors are of the parallel two-stage type, all cylinders being water-jacketed with intercoolers between the two stages. The 7,270-ft. machine is equipped throughout with Hoerbiger-Roegler plate valves, which, on account of the very short movement and exceedingly light construction, permit of a very high compression efficiency. The cylinders of this machine are 46 in. and 28-in. by 36-in. stroke. It is driven by a self-starting synchronous motor of 1,150 hp. The 3,000-ft. machine is driven by a 500-hp. self-starting synchronous motor at 107 r.p.m.

Two 100-kw. 125-volt motor-generator exciter sets arranged to operate in parallel serve as exciters to the compressor motors. Cooling water for the jackets and intercoolers is obtained from a circulating system consisting of a duplicate installation of 750-gal. triplex pumps and a spray cooling pond.

The compressors and hoisting equipment are housed in a spacious and well-lighted building which has a 25-ton electric crane running its entire length and connecting at one end with a well into which railroad cars can be run and unloaded. A 22-panel remote-control switchboard, together with the low-tension (2,200-volt) bus equipment, occupies a room along one side of the building, the high-tension transformer station being outside near one end of the building. Only two attendants per shift are required, one being an oiler. Without the automatic features for hoisting ore and the elevator for handling men, at least four would be required.

The Taxation of Montana Mineral Lands

By A. L. H. Street*

The Anaconda Copper Mining Co. conveyed certain lands to purchasers, reserving underlying minerals, the right to remove them and a right-of-way across the surface for the purpose. Subsequently the tax assesor listed the entire property to the purchasers at its full cash value and at the same time assessed the mineral reservations to the company at $5 the acre. The tax authorities refused to cancel the latter assessment, and the company, having paid the tax against it under protest, sued the county to secure a refund.

In affirming a judgment in favor of the county, the Montana Supreme Court holds that, under the constitution and laws of the state, the mineral interest in the land was taxable apart from the interests sold to the purchasers of the real estate proper and that, although there was an invalid double assessment of the property in that the minerals were assessed both to the company and to the purchasers of the land, the company showed no right to complain. The court intimates that if there was any just cause for complaint, it was in favor of the owner of the land. (158 Pacific Reporter, 682.)

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A Silver-Palladium Alloy is recommended for use in contact-and-spark devices to replace platinum, according to "Journal Society of Chemical Industry," Apr. 29, 1916. An alloy of silver with 2% Pd gives satisfactory results under many circumstances. When the contacts or spark points are exposed to sulphur compounds, 5% Pd or more should be used. The alloy which gives the greatest resistance to spark erosion is that of 60% Pd and 40% Ag. Additions of palladium to silver raise the melting point and lower the thermal conductivity.

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*Attorney at law, 829 Security Building, Minneapolis, Minn.

Importance of the Human Factor

By Fred H. Rindge, Jr.*

SYNOPSIS—Success in all business today, whether in mining or industrial lines, depends in a constantly increasing degree upon the workers' character, efficiency and friendliness. The employer's responsibility for the welfare of his employees is greater than ever. Worldwide conditions of change demand increased efficiency of the employee. Personal sympathy between employer and employee is necessary to effect this increase.

Let any skeptic of the increasing importance of the human factor in the success of any business ponder this well: It is almost impossible to read any high-class publication today without finding the subject of the human factor thrust well to the fore. Let the skeptic investigate a pile of his own mail accumulated during an absence, with an eye to investigating the truth of this statement, and he will probably be suppressed by an experience similar to my own.

Returning to my office after two months' absence and finding the usual accumulation of mail, a rapid sorting and sampling yielded the following results: Several engineering magazines contained articles dealing with management and its relation to the human factor. Three issues of one business man's magazine contained such articles as "Handling Men," "Changing Over Wage-Payment Systems," "How to Organize for Safety." A succession of booklets described the profit-sharing scheme of a large manufacturing company, the welfare activities of another, etc. Bulletins of the American Iron and Steel Institute contained such articles as "The Scope of Welfare Work," "How to Reach the Man and Reduce Accidents," "The Cooling of Heated Working Places," "Restaurants Versus the Dinner Pail for Industrial Workers."

Judge Gary Advocates Generosity to Employees

My thought at this point was that such things cost money and times are uncertain. But turning to a recent address of Judge Elbert H. Gary, chairman of the board of directors of the United States Steel Corporation, I read: "In times like these I ask you to consider not only the propriety but, more than that, the pleasure of being fair, reasonable and generous in our treatment of our employees." I recalled that during the past year the Steel Corporation spent more than $7,000,000 in improving the conditions surrounding its men. Surely Judge Gary and many other leaders in industry believe that consideration of the human factor is right and that it pays.

Several bulletins of the American Museum of Safety contained the usual number of articles on accident prevention and safety devices, and papers on "A Successful Experiment in Educating Illiterate Workers" and "Alcoholism in the Industries." This was indeed getting close to the human factor. In the last article I read: "It has now been proven beyond a doubt that the use of alcoholic drinks impairs the health and the efficiency of the laborer, slows the fingers of the textile operator, dulls the mind of the financial accountant and impairs the discernment and judgment of the railroad engineer." This was not a temperance sermon, but a matter-of-fact efficiency discussion. Surely any agency that might help men to "cut out the booze," that might educate men and improve character, would help to increase efficiency. Even a motion picture booklet contained the phrase, "The bitter battle waging between the motion picture and the grog-shop."

College Course in Industrial Management

Several college catalogs showed that some of the engineering courses are giving considerable attention to the problems of management and the human factor in industry. An announcement of a University of Wisconsin extension course in industrial management reads: "Business policy reflects the ideas of the individual behind the business, and the adoption of the right policy is a most important factor in the success of the enterprise. Similarly, the solution of the problem of the relations of individuals within a business is of first importance in bringing about efficient management and efficient operation." In the record of a Western college I read: "The world needs today, more than it can know, leaders equal to the growing opportunities for improving human life in manifold forms of social service. The world needs today in commerce, in manufacturing, in banking, in mining, in distribution, in transportation, men with a conception of the meaning of their enterprises and their opportunities far beyond the scope of technical preparation." I found also the engineering journal of a large university containing a series of articles on "The Human Side of Engineering" and another college periodical with a discussion entitled "Socializing the Engineer." Surely these are steps in the right direction, for they lead to the day of future engineers, who must be as never before men who consider always the human factor.

A reprint of a scientific paper described the industrial service movement of the Young Men's Christian Association, read by Prof. J. W. Roe, of Yale, at a meeting of the American Society of Mechanical Engineers. Also another article by J. Parke Channing read before the American Institute of Mining Engineers. It is significant that these national engineering societies are also taking a leading part in the promotion of the human side of the engineering profession.

Of course, if one wanted to mention other books and publications of the day dealing directly or indirectly with the human factor, there would be no limit. But I am merely drawing illustrations from a part of the material found on my desk after a two-months' absence. The whole country is becoming increasingly interested in, and is giving more consideration to the human factor in industry. And this is my theme. If anyone doubts its importance, let him look through any newspaper, glance at the titles on any good bookshelf, witness the awakening of our schools and colleges, talk with industrial and social leaders, read the platforms of political parties, observe the progress of big business, note the propaganda of labor organizations, stumble over work of socialists and anarchists, be impressed by the ten million industrial workers in America, and live in the world of real people with reawakened senses—for on the human factor all success depends and within the human factor are the potentials for great evil or for great good.

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*Secretary for Industrial Service Movement, International Committee of Y. M. C. A.s, 124 East 28th St., New York.

In one sense the human factor is profoundly influenced—yes, practically controlled—by the whole "social switchboard," and each of us is one of the operators. Arthur D. Dean, of the University of the State of New York, has admirably developed this idea:

> The progressive sees the educative process as a huge, complicated switchboard—distributing, it may be, the heat of physical needs; or the power of a national material supremacy; or the light of the higher impulses of a people. He sees the main feed wire leading to it, carrying the burdens of humanity—a bulky, low-voltage current of mysterious life forces. He sees switches, connections, lead wires of agencies social, industrial, educational, emanating from the switchboard. He sees wires leading into the pathways of men, carrying currents of human desires and needs into every darkened pathway of human relationships. And over it all he sees the community—the civic conscience of a people manipulating these switches, readjusting connections, plugging in a new agency in order that the income current of a common humanity may be rehabilitated, redistributed, redirected, into a world of service adapted in amperage and voltage of personal power and accomplishment to do the task assigned—a task of service-rendering with knowledge, power and joy.
>
> Yes, the switchboard distributing these human agencies is complicated. It is a network of wires confusing in such a civilization as ours. In the hands of the standpatter, the switchboard is a blurred mass and all its paraphernalia appears to him so useless, so unlike the days of candles, so utterly confusing in its ignorance and narrowmindedness, he turns away in disgust.
>
> To the radical the switchboard is equally complicated, but instead of studying out its connections and making necessary readjustment, he would, with a big movement of his hand, maybe with bombs and dynamite, tear off the switches, short-circuit the connections, and pull out the plugs. He glories in the smash, dances fanatically before the flashes of light and goes down into the darkness of the chaos.
>
> The progressive stands on an insulated mat; follows the blueprinted diagram in the pulling out of the plugs, connecting the wires, and labeling the connections—all for a purpose. You ask, "What is this purpose?" It is the increase of human wealth and happiness.

We might sum up this whole question historically in terms of modern industry somewhat as follows:

INCREASED RESPONSIBILITY OF EMPLOYER

With successive changes in the basis of labor, the relations between employer and employee have become more complex. The transition from early slavery, through serfdom to the modern wage basis, has increased the distance between employer and employee, while elevating the plane of their relationship. While employers may no longer have to clothe and feed their workers, they still have a direct responsibility for their welfare. The slave was supported and could be compelled; the serf was protected and could be controlled; but the wage-earner of today is presumed to be independent and may therefore be neither compelled nor controlled. He must rather be coöperated with and encouraged. The employer is now upon the plane of mutuality with his employees instead of being the owner, autocrat or "housefather" that he once was. Employers have not been freed from responsibility by the changing order; while their direct authority over the worker has decreased and they have been further removed from actual contact, their responsibility has actually increased.

Ambassador Bryce has said that in no country is public opinion so powerful as in America. Today public opinion is placing emphasis upon the responsibility of employers. Their obligations are being emphasized not only by critics, moralists and reformers, but by the widespread sentiment of the people, expressed in sympathy with the demands for a living wage, reasonable hours, good working conditions, one day's rest in seven, employer's liability for injuries, sick and death benefits, pensions, profit sharing, welfare club, etc.

It has been said that the successful employer is probably neither hero, saint nor philanthropist, and that he will probably fail in business if he attempts to become any of these. This is largely true; but on the other hand, if public opinion prevails and the new standards now above the horizon are established, the employer will have to embody something of all these qualities. Employers generally will have to do what some have already learned to do so splendidly; namely, to serve the interests of the business, the worker and the community. This is a high but not unreasonable ideal for the employer.

Turning to the other side of the question, what conditions have the changes in the basis of labor brought about for the employee? Certainly each change has meant improvement. Better conditions by far obtain today in the leading industrial countries than ever before. In North America particularly we have shorter hours of labor, higher wages, improved health and increased safety for the worker. There has been developed also a far more independent, self-reliant spirit than in other countries. The working man in America, being better paid and working amid better conditions, has better standing socially and politically than in other countries, and it is not overstating the case to say that at least the skilled worker is more intelligent and efficient.

INCREASED EFFICIENCY DUTY OF EMPLOYEES

We may not assume, however, that because this is true now it will always remain so. Some of the conditions that have favored the American workingmen are changing. The abundance of raw material and the New World energy has made it comparatively easy for America to forge to the front by shear force of output. But material is becoming relatively scarce, and keener competition must be waged hereafter with certain other nations. Tariffs are no longer a dependable protection for wages.

As each of these factors in former industrial advantage disappears, there comes the demand for some compensating factor, and we can find it only in increased skill and efficiency on the part of the worker. This is a most serious matter for both employer and employee. Efficiency and skilled workers are already scarce—every employer knows this—and there is not enough supply in sight. The increase in skill has not kept pace with industry's progress. Is our American system of education at fault, and are the boys being educated away from the industries? Has society looked down upon the industrial worker while smiling upon the clerk and the professional man? Or has industry imposed too heavy demands upon the workers? I do not try to answer. But a remedy for this condition must be found. It is evident that the needed skill and efficiency cannot come without education. More attention must be given to vocational training of workers, and it is encouraging to note that educators, employers, philanthropic agencies, and more recently trades unions, are recognizing this. If organized labor would do as much toward increasing efficiency as it has toward increasing wages, what a contribution it would make!

But the change that has done most to prevent the larger prosperity and progress of industrial workers is the increasing distance between the employer and employee. The growth in size of manufacturing plants has separated those who are bound together in interest, and the contacts that formerly made friendliness possible are diminishing. This personal intercourse and sympathy between employer and employee is the medium for the transmission of that subtle something which, while having no place on the records of industry, has been the basis of industry's greatest achievements. Call it morale, loyalty, esprit de corps or good will, it is that which is described by one under the "art of war." "In all periods of war," he says, "under all conditions of arms, the moral forces which affect armies have been the great determining factors of victory, and upon the nice feeling of the moral pulse of armies the skill of great commanders has chiefly depended." The present war illustrates this better than any other war in all history.

What I have in mind is illustrated by an employer whose testimony is entitled to respect because as president of a large mill he has been successful in paying dividends and in winning the good will of his employees. He says: "The financial interests of my corporation require that I shall do everything possible to improve the workers' character, efficiency and friendliness." Notice the emphasis on the economic value of these three things—character, efficiency, friendliness. The conditions surrounding and affecting employees are not only the employer's concern, but his responsibility as well—this responsibility to be expressed not in paternalism but by fraternity, which is the real need of industrial workers. How shall the general public as well as the business man view all these things? What is our individual responsibility? Are we sufficiently cognizant of the importance of the human factor in industry today?

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In the Recent Zeppelins the angle-brackets are stated by "Le Genie Civil" to be: Al, 90.27%; Zn, 7.8%; Cu, 0.73%, with small amounts of Fe, Si, Mn and Sn. For the channel sections the main constituents of the alloy were 88.68% Al and 9.1 Zn. The braces were commercial aluminum.

Manganese in Tennessee

By Joel H. Watkins*

A shortage in imports of manganese ore at a time when the steel mills were never more active has caused a strong advance in the price of both manganese alloys and ores. This increase in price and unprecedented demand for ore has so stimulated the mining of manganese in this country that many of the old abandoned mines and prospects have been reopened and exploited and some new deposits have been brought to light. One of the most interesting of these recent discoveries of manganese is in Bradley County, Tennessee, about eight miles south of Cleveland and about one mile east of Weatherly, a siding on the Southern Ry.

The underlying rocks of this area, as shown on the Cleveland Tennessee folio, United States Geological Survey, are mostly Silurian and Cambrian sediments. Those horizons which are exposed in the immediate vicinity of the manganese deposits are the Tellico sandstone, Holston marble, Chickamauga limestone, Knox dolomite and Caunasauga shale. The rocks of this area are much folded and faulted, the folds having a general northeast-southwest trend and the major faults being parallel with the axes of the folds.

REMOVING THE MANGANESE FROM BETWEEN PINNACLES OF MARBLE

The rocks to which the manganese deposits owe their origin are the Tellico sandstone and the Holston marble, which in this area dip to the southeast at an angle of about 25° with the horizontal. Normally, beds of Athens shale lay between the Tellico sandstone and Holston marble, but at this point the shale seems to have disappeared and the standstone rests directly upon the marble. Near the contact between the two formations thin ribbons of sandstone are interbedded with the marble. The Tellico sandstone when perfectly fresh is a hard, compact, coarse-grained gray rock, the grains of sand being cemented with calcareous and ferruginous cement. On weathering the cementing material is largely leached out, leaving a porous, light, friable mass and often reconcentrating the iron oxide into a soft, purple, low-grade residual iron ore. A deposit of iron ore formed in this way has been worked to some extent at a point about two miles north of Sweetwater, Tenn., which is in the same general district. The analyses of ten samples of soft ore taken from this mine showed an average iron content of 38.77%, and an average manganese content of 5.51%.

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*Economic geologist, Washington, D. C.

Manganese in Clay and Sandstone

The manganese ore occurs for the most part as disseminated fragments in a mantle of highly ferruginous sandy residual clay which rests directly upon Holston marble. With the Tellico sandstone carrying about 2% and the residual about 5% manganese, conditions would seem particularly favorable for the deposition of botryoidal or "kidney ore," which is the usual mode of occurrence of manganese oxide in residual clays. On my first examination of the deposits, soon after development work had begun, considerable ore was being taken out of openpits in the residual clay and it was natural to suppose that the lumps of ore were formed in the clay as a result of the breaking down of the Tellico sandstone. It was observed at this time, however, that the smooth round masses of manganese were entirely absent and that the ore only occurred in angular massive blocks with sharp and sometimes ragged edges. On a later visit, when the prospects had been more extensively worked, it could be plainly seen that the manganese was not deposited in the residual, but that it represented the replacement of Holston marble along crevices near its contact with the Tellico sandstone, the seams of manganese being later weathered out of the marble. This was perfectly shown in one case where a seam of manganese about 6 in. thick extended entirely through a pinnacle of marble and the broken remains of the portion of the seam that had been weathered from the marble rested in the residual around the pinnacle. This same condition was also observed at several other places, leaving absolutely no doubt as to the origin of the ore. Along the contact of the manganese with the inclosing marble for about an inch or more there was a complete gradation from the manganese into the marble.

The ore is of excellent quality, very low in phosphorus and silica and high in manganese content. Unfortunately, however, it proved to be too high in iron for use in the manufacture of dry batteries. Two average analyses of the ore are as follows:

AVERAGE ANALYSES OF MANGANESE ORES

	No. 1	No. 2
Phosphorus	0.142	0.100
Silica	0.70	0.50
Iron	3.33	2.24
Manganese	54.20	56.10

Up to the present only about 200 tons of the ore has been shipped, which has all been taken from within a few feet of the surface. The pits and opencuts have been located without regard to system or economy. Men were set to work anywhere that a small amount of float could be found, and at first one man would some days dig out from one to two tons of ore. Some of the blocks of ore weighed from 400 to 600 lb. and had to be broken up before they could be lifted from the pits. Some of the pits showed but little ore and some were entirely barren. In one field about 10 tons of ore was simply plowed up from within a foot of the surface. As the mine was being developed by several local men who were not experienced in mining, this splendid surface showing of course caused considerable excitement. They have later, however, gotten down to a working basis and are now stripping the top of a low hill along the zone in which the manganese is disseminated.

The Tellico sandstone is exposed almost continuously in a northeast-southwest direction through the valley of east Tennessee for a distance of about 75 mi. Similar occurrences have recently been observed both north and south of Cleveland, but it is now reasonably certain that the ore will not be found in very large deposits. It is probable, however, that at other points in Tennessee where the Tellico sandstone is exposed and where all the physical conditions are favorable, similar deposits may be found from which several hundred tons of high-grade ore can be handily mined.

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The Nature of Private Reports

By A. H. Purdue*

Doubtless much has been written on what should be the general nature of private reports on mineral properties, but from a large portion of those that have come to my attention I am prompted to make the following suggestions on what such reports should *not* contain:

They should not, except in possible rare instances, deal at all with the age of the rocks in which the minerals occur that are being reported upon. This for two reasons: First, because clients hardly ever know or care anything about the age of rocks. To them it makes no difference whether the rocks are of Ordovician, Devonian, Cretaceous or some other age. What they want to know is whether they contain mineral, and if so, whether it occurs in such quantity and under such conditions as to permit of its recovery at a profit. The second reason is because such reports are often made by engineers who are not geologists, or by geologists who are not familiar with the stratigraphy of the area being reported upon. In either case what is said of the age of the rocks must be second-hand. Many times I have seen private reports that attempted the detailed descriptions of the geological sections involved, these having been taken from the writings of some highly capable geologist who had worked out the stratigraphy only after long effort over wide areas. The regrettable fact is that such descriptions usually are given without any credit at all. However, as they are nearly always bungled, it is perhaps as well, from this point of view, that credit is not attempted.

The recommendation to omit all reference to the age of rocks does not mean that attention should not be given such phases of the geology as deal with lithologic character, structure, topography and such other features as relate directly to the occurrence of the deposit described and to its recovery.

Another thing that should be omitted is all discussion relating to the origin of the deposits. Such is of interest to geologists and engineers and forms most desirable material for professional papers, but if embodied in private reports, it makes them tiresomely long and rarely has any meaning to the man who is interested in a mineral deposit for the money he can make out of it. A commercial report showed some commercial ends.

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*State geologist of Tennessee.

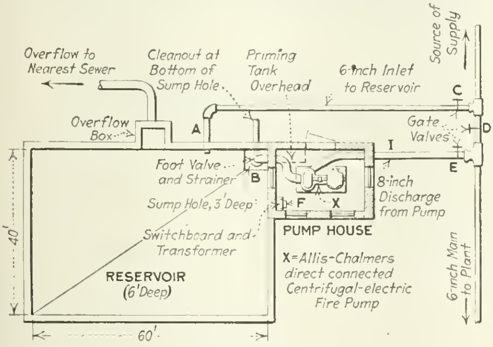
Details of Practical Mining

A Reservoir and Pumphouse

By G. F. Alderson*

The reservoir and pumping equipment herein described was installed recently to be used as a means of raising the pressure in a system to 80 lb. for fire-protection purposes, under normal conditions the supply being available at 20 lb. A 100,000-gal. concrete reservoir was first constructed. This was filled from the ordinary water supply of the plant, and it was used as an emergency supply for an electric pump; which in case of fire pumped against the pressure head in the plant main and increased this ordinary pressure up to that of a high-pressure system during the time that the requirements demanded.

By referring to the accompanying diagram the scheme of the new system may be seen at a glance. The reservoir is filled from the source of supply through the inlet pipe *A*. The floor of the reservoir drains toward a sump *B*, in which is placed the foot valve and strainer on the suction end of the pump. Normally, the valves at *C* and *E* are closed and the valve at *D* is open. Thus the reservoir is shut off from its supply except in case of fire, when the valve at *D* is closed and valves *C* and *E* are opened. These valves are controlled by a single handwheel within the pumphouse. Should a fire alarm be turned in, the pump is started by throwing the switch at the board *F*. The valves *C* and E are open, and the valve at *D* is closed. In starting the motor, the pump is primed automatically by means of a priming tank placed above it in the pump house. Immediately the pump begins to draw the water from the reservoir and pump it to the discharge *I* into the main leading to the plant, which action at once increases the pressure in the main up to that necessary for producing the desired result through the firehouse.


Overflow to Nearest Sewer
Cleanout at Bottom of Sump Hole
Priming Tank Overhead
6-inch Inlet to Reservoir
Source of Supply
Overflow Box
A
C
Gate Valves
D
I
E
Foot Valve and Strainer
B
8-inch Discharge from Pump
Sump Hole, 3' Deep
F
X
PUMP HOUSE
Switchboard and Transformer
X=Allis-Chalmers direct connected Centrifugal-electric Fire Pump
6-inch Main to Plant
40'
RESERVOIR (6' Deep)
60'

PIPING ARRANGEMENT FOR RESERVOIR AND PUMPHOUSE

When starting the operation, the valve at *C* is opened and the water at ordinary pressure flows into the reservoir, thus virtually increasing its capacity, for perhaps 30,000 gal. has flowed into the reservoir while the pump is drawing out 100,000 gal., and so the water is drawn out much faster than it enters. The quantity that flows in is enough to increase materially the length of time that the pump may draw from the reservoir.

The dimensions of the reservoir are 10x60 ft. with an average depth of 6½ ft. It was constructed of concrete reinforced with ½-in. square twisted steel rods. The floor of the reservoir is 6 in. thick, and the side walls are 12 in. thick. Both the walls and the floor were poured in one continuous operation, thus securing a proper bond. In the shallow portion of the reservoir the water is 6 ft. deep, and in the deepest part at the edge of the sump there is a depth of 7 ft. The sump is 3 ft. square and 3 ft. deep. It gives ample room for the foot valve and strainer on the suction pipe and also provides space in the bottom for the collection of sediment. From the bottom of this sump a 4-in. pipe drains into the sewer system, and at regular intervals the valve is opened and the sediment washed out. At one side of the reservoir an overflow box is provided from which an 8-in. terracotta pipe connects with the nearest sewer.

To prevent dust and scum from accumulating on the water and to make freezing in winter more difficult, an ordinary sloping roof was built over the reservoir. This roof is supported by nine timbers, 8x8 in., resting on the floor of the reservoir. For a roof covering, a good quality of 2-ply prepared roofing paper was used.

The concrete used was a 1 : 2 : 4 mixture of portland cement, clean sharp bar sand and clear pit gravel. The concrete was hand-mixed, four boards working continuously until the floors and walls were finished.

The total cost of the reservoir was $2,819.63, with cost distributon as follows:

COST OF BUILDING THE RESERVOIR

Labor $1,672.23 (60%)	
Excavation, 804 cu.yd. (labor at $0.24 per hr.).......	$868.32
Forms for concrete (carpenters at $0.53 per hr.)....	230.55
Laying outside piping (plumber at $0.45 per hr., helper at $0.35 per hr.)........................	71.82
Pouring concrete, 136 cu.yd. (labor at $0.24 per hr.)	422.01
Roof (carpenters at $0.53 per hr.).................	79.50
Material $1,129.40 (40%)	
Lumber (average $20 per M)......................	248.64
Nails (average $0.0175 per lb.).....................	1.64
Concrete, 1 : 2 : 4 mixture........................	500.22
Cement, 181.25 bbl. at $1.30 per bbl.	
Sand, 56 yd. at $1 per ton.	
Gravel, 112 yd. at $1.30 per ton.	
Reinforcing rods, 9,000 ft. (108 ft. per 100 lb. at $4 per 100 lb.)............................	333.00
Wire, No. 12 (200 lb. at $0.112 per lb.)............	22.50
Roofing paper (34 squares at $0.60)..................	20.40
Total cost of reservoir { Labor	$1,672.23
Total cost of reservoir { Material	1,129.40
	$2,801.63

A fireproof pumphouse, 12x18 ft., was constructed at one end of the reservoir. This building housed an Allis-Chalmers high-duty, 1,000-gal. electric fire pump, together with all necessary fittings and appliances for its proper operation. The motor was connected to a 2,200-volt service line. The pump running at 1,750 r.p.m. operated under a head of 260 ft. To provide a means of priming the pump, a wooden tank was built and lined with copper. This tank was supported above the pump by brackets placed on the wall. An automatic ball float valve keeps the tank properly filled.

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*Civil engineer, Kennett Square, Penn.

The pumphouse is of fireproof construction, with cement floor, brick walls and concrete-slab roof supported by an 8-in. I-beam and reinforced with Hy-Rib. The I-beam is protected from fire with a covering of cement.

The cost of the pumphouse complete, but not including the pump or motor, was $784.03, itemized as follows:

COST OF ERECTING THE PUMPHOUSE

Labor $536.07 (68%)	
Masonry (masons at $0.70 per hr., helpers at $0.24 per hr.)	$176.04
Forms for roof (carpenters at $0.53 per hr.)	40.78
Carpenter work, setting window and door frames	31.80
Installing pump (plumber at $0.45 per hr., helper at $0.35 per hr.)	129.75
Installing motor (electrician at $0.45 per hr., helper at $0.35 per hr.)	130.00
Lining tank (coppersmith at $0.45 per hr.)	8.50
Painting (painter at $0.375 per hr.)	11.25
Labor at $0.24 per hr.	7.95
Material $247.96 (32%)	
Brick (9,000 at $8.50 per M)	76.50
Concrete work, foundation, roof, floor and mortar 22 bbl. cement at $1.30 per bbl. 7 cu.yd. sand at $1 per ton. 14 cu.yd. gravel at $1.30 per ton.	49.60
Four window frames at $1.75 each	7.00
Paneled door and door frame	3.50
8-in. I-beam, 11 ft. 6 in. long	4.00
Lumber, forms for roof at $20 per M	20.00
Hy-Rib (270 sq.ft. at $0.022)	6.00
Paint (3 gal. at $1.75)	5.25
Pipe and fittings for connecting pump	71.61
Material for priming tank	4.50
Total cost of pumphouse { Labor	$536.07
Total cost of pumphouse { Material	247.96
	$784.03
Total cost of system { Reservoir	$2,801.63
Total cost of system { Pumphouse	784.03
	$3,585.66

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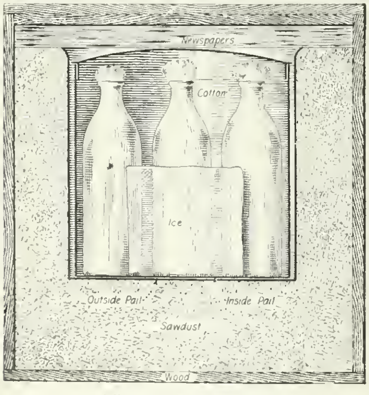
Home-Made Ice Box

The following suggestion for a home-made ice box is given in "Miners Circular 20," issued by the Bureau of Mines, entitled "How a Miner Can Avoid Some Dangerous Diseases." It can be made at a small cost and will keep milk cool with a few pounds of ice a day.



A SIMPLY MADE ICE BOX

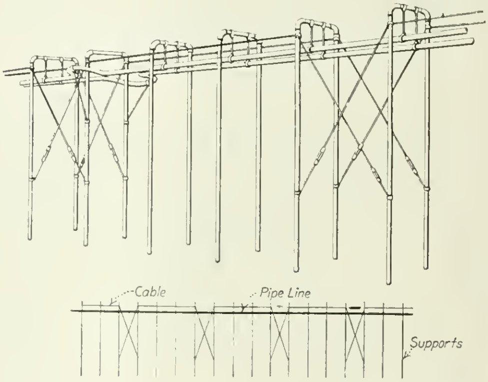
Get two tin pails, one of which will just fit within the other. The inside pail should have a cover and be large enough to hold the bottles and several pounds of ice. The outside pail should be placed in a box about 18 in. square and surrounded by sawdust, as shown in the figure. Be sure that a layer of sawdust separates the bottom of the outside pail from the bottom of the box. About 50 layers of newspapers should be tacked to the bottom of the wooden cover of the box.

Effective Pipe-Line Support

The support of pipe lines in and about mine plants is a problem common to every superintendent. Where the lines are long, it often involves considerable expense, and where the topography is irregular or where a stream has to be crossed by the lines, it often resolves itself into an important matter.

Where timber is scarce or only obtainable in short lengths and where it is necessary to support the pipe line at a considerable height, say 30 to 40 ft. from the ground, the following method has proven cheap and effective. Where the material is at hand and haste is desired in erection, this method will also be found very rapid.

The materials necessary are: First, ordinary pipe, the diameter depending on the height of the line from the ground and the weight of pipe supported. In this particular instance a double 8-in. pipe line was supported at a height of 35 ft. with 3-in. pipe supports, placed 15 ft apart. Two elbows of the same size are used to connect these supports. Second, sufficient steel cable to run two lengths parallel to the entire pipe line and allowing for the cables to come down ⅔ of the height of the vertical supports and cross between every fourth one, as shown in the sketch. Third, flat iron, hanger iron, bolts and turnbuckles for attaching cable, keeping it taut and supporting the pipe from the frame. The cable runs through eyes in steel or wrought-iron collars attached to the vertical supports. The pipe line is supported by ordinary pipe hangers.



METHOD OF SUPPORTING HIGH PIPE LINES

A wooden sill embedded a few feet in the ground is usually sufficient to keep the supports from settling. In wet or marshy ground, however, it is safer to let the sill rest on a bed of broken stone or slag. Expansion bends may be put in the pipe and supported as shown. The cables should be kept taut by means of the turnbuckles and tested at regular intervals.

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Timber Chutes in stopes where timbering is used and subsequently withdrawn are often advantageous. The chutes are usually placed next to the usual ore chute. This is often merely a skidway of three logs fastened together and projecting through the bulkhead and the side of the stope, through which it is more convenient to remove timber than through the ore chute. In some mines these skidways are several levels in height and are useful in the downward transferrence of timber. The stope is sufficient to produce motion but not to permit falling.

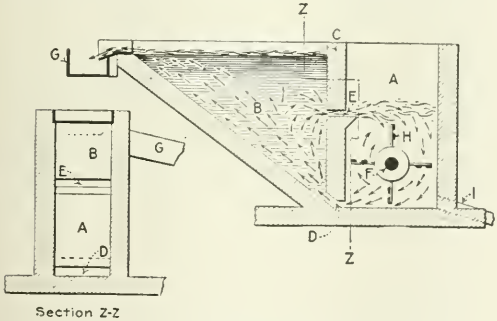
Details of Milling and Smelting

Eberenz and Brown Concentrator

By employing vertical, instead of horizontal, rotation of agitation blades it is proposed to accomplish with this machine in one cell as efficient work as now performed in a series of cells. The object is to economize floor space by increasing the agitation of a single cell.

A sectional view of the agitation cell and spitzkasten is shown in the accompanying diagram. The agitation cell *A* is separated from the spitzkasten *B* by the partition *C* in which are cut the transverse slots *D* and *E*. Within the agitation cell revolve vertically the impellers mounted upon the horizontal shaft *F*.

It will be seen on the diagram that the agitator is placed slightly below the transverse slot *E* and its blades in their travel extend down to a point approximately opposite to the slot *D*. The rapid revolution of the impellers mixes the air, oil and ore pulp, driving the intermingled mass of material from cell *A* into the spitzkasten *B* through the transverse slot *D*. The metallic particles buoyed to the surface by the froth discharge into the launder. The tailings or gangue particles in the spitzkasten return to the agitation cell via the transverse slot *E* and thus are subjected to further agitation in contact with the frothing agent and air. During agitation the water in the spitzkasten rises to the level of the overflow, while within the agitation cell the level remains barely above the vanes *H* of the impellers, thus providing all the air necessary to create the froth. It is of course understood that the transverse slots *D* and *E* are so proportioned as to maintain the liquid level in the agitation cell lower than that in the spitzkasten. Tailings sinking to the bottom of the agitation cell are discharged through the spigot *I*. By thus repeatedly returning to this one cell middlings which ordinarily would be treated in a series of cells, this machine effects an economy of space and power.



EBERENZ AND BROWN FLOTATION CELL

The machine is the invention of George B. Eberenz and James I. Brown, of Cripple Creek, Colo., to whom U. S. Patent 1,187,822 was issued June 20, 1916.

Purchase and Inspection of Leather Belting

The numerous forms of belting on the market may be divided roughly into three groups—first-quality oak-tanned leather, second-grade oak-tanned leather and novelties, according to an article in *American Machinist*, July 13, 1916.

First-quality oak-tanned leather belting shows the lowest cost per belt per year, provided it is properly installed and well cared for. For 30% more than the price of the cheaper grades the best that the market affords may be obtained.

Large users would do well to divide their orders between two sources of supply as a protection against the failure of one to make deliveries and to get the benefit of healthful rivalry.

Having chosen one or two sources of supply and found them satisfactory, every endeavor should be made to avoid frequent changes. Once a manufacturer has become accustomed to the particular needs of his customer, it is greatly to the advantage of both parties to retain the connection. Coöperation is essential to best results.

When belting is being bought or contracted for, it is always well to keep in mind that it may not prove satisfactory. This suggests at once that the kind of material desired should be specified definitely in writing and provision made for its rejection, if defective. Small consumers should order by brand from a reliable house, trusting to its fairness to make good any shortcomings in its product. Large buyers have an opportunity to specify more definitely what they require to meet their special needs and to safeguard themselves against the acceptance of poor material.

Specifications having been determined upon, bids should be invited from five or six of the leading manufacturers for the ensuing six months or a year. The leather market is always a very uncertain factor, especially at this time, and most manufacturers do not look with favor on long-time contracts. Six months is probably a fair period to all concerned.

There are decided advantages in keeping a good stock on hand. Rush orders are thereby obviated, ample time for inspection is available, and most important of all, the manufacturer is able to accumulate from stock in progress the kind best suited to the needs of the customer. The value of such selection cannot be over-estimated.

It is a long road from the cattle range to the pulleys of the mine plant or mill, and many operations are necessary to transform a steer hide into a leather belt. At almost every one of these stages the value of the product to the consumer can be influenced for better or for worse. The skill and knowledge of the workman, the condition of his equipment and the kind of supervision under which he works—all combine at each operation to determine whether the belt shall finally be a powerful aid to successful factory operation or the source of endless trouble. Unfortunately, the conditions under which his product is sold and consumed do not give the belt manufacturer much incentive to keep all his processes at high efficiency. Most of his product goes to jobbers and supply houses, from which it is passed on in small quantities to the consumer, generally with price as the incentive rather than quality. Under these conditions a good appearance is often considered more important than invisible quality. This situation leads to practices akin to the coloring of butter, bleaching of flour and polishing of rice, largely practiced by manufacturers of foodstuffs. Only by constant and vigilant inspection can such practices be eliminated and defective material or workmanship discovered. The mere fact that delinquencies are promptly detected and reported to the manufacturer is sufficient to minimize their occurrence.

Where purchases are being made from more than one source, detailed inspection will soon point out their relative merits and the causes. It has the further advantage, also, that defects discovered before installation save the time and money involved in repairs, replacement and loss of production. A large user can well afford to assign a high-grade man to this duty, preferably one who is in close touch with operating conditions throughout the plant.

Two inspection tables with rotating tops should be provided and set a convenient distance apart in a good light. When a shipment is received, each roll should be placed on one table and wound onto the other. The entire length of the roll is thus exposed for inspection, and the rewound roll is left ready for storage or use. While the belt is passing before the inspector, he can readily check up the length, width, uniformity of thickness, shimming, excessive evening and other external characteristics. The most important points to watch are injurious blemishes, piping, cracking and the length of section. The overall length of the individual sections of which the belt is composed should not exceed 54 in., nor should many of them be less than 42 in. Longer lengths have been cut into the shoulder area, the least desirable part of the hide for belting, while shorter sections, even if of good material, introduce too many cemented joints, each of which is a potential trouble maker in service.

Another point to be watched is uniformity of character, especially as to pliability. Color, however, has no significance if the material is otherwise satisfactory. The manufacturer's name, brand and date should be plainly stamped every 10 ft. as a means of identification in case the service rendered should later prove unsatisfactory.

It is well, also, to unroll a length of about 50 ft. on the floor, noticing whether the belting remains flat at all points without pressure and shows straight laps. A little curvature will be observed, but it should not exceed a foot or two, should be all in the same direction and fairly uniform throughout the entire length. Such belting will run true on the pulleys under a slight tension.

All but the largest consumers can safely conclude their examination at this point, with the assurance that they are getting a very good belt. The process sounds elaborate; but as a matter of fact, when the proper facilities are provided and the inspector has become accustomed to his duties, a speed of 1,000 ft. per hr. can easily be attained. All the foregoing tests need not be applied to each roll, but the most important should be applied to every foot of belting purchased. In this way the consumer makes sure that the belt is going to give satisfactory service.

Occasional tests should be made to determine the percentage of greases introduced during manufacture to promote pliability and to protect the belt from absorption of foreign matter such as lubricating oil, water, fumes, etc. This examination should follow the standard practice of the American Association of Leather Chemists.

The presence of mineral oils, inorganic acids or anything detrimental to the strength, pliability or durability of the leather should be detected by suitable tests. Likewise, loading for artificial weight by means of white lead or other foreign matter can be detected by burning a sample and weighing the ash.

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Radium from Carnotite

Extraction of radium from Colorado carnotite ores is described by H. Schlundt in the *Journal of Physical Chemistry*, Vol. 20, p. 485. The experiments were made on 10-kg. portions ground to 20-mesh and gradually introduced into 18 liters of 78% sulphuric acid at 190° C. contained in a 50-liter cast-iron vessel and then heated to 220° C. for at least 15 min. The calcium, barium and radium are held in solution as bisulphates. The liquid is then cooled to 130° C., and the insoluble silicates are filtered off on "Filtros" under a pressure of 5 to 10 cm. of mercury. The washing is done with two portions (5 liters each) of hot concentrated sulphuric acid. The acid filtrate is then poured into eight times its bulk of hot water, precipitating the radium and barium. If dilute barium-chloride solution be added, the resulting precipitate will carry down 2% more of Ra. After standing at least three days the solution is siphoned off and the sulphates washed on a stone filter with hot water containing a little barium chloride. If the residue of the filter is agitated several times with hot water and filtered, a deep-blue solution is obtained from which a white precipitate gradually deposits, containing 3 to 9% of the original radium content of the ore. With low-grade ore the radium concentration is about 235:1; with high grade ores, about 35:1.

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Magnet for Charging Scrap

In steel plants there is a certain amount of scrap iron and steel produced from the rolling mills. This is usually collected into a waste pile and mixed with the charges of raw ore and then retreated. This scrap iron is loaded into charging boxes at the scrap heap and from them into the furnace. The scrap for the most part consists of structural-steel shapes, rails, rods, etc., and owing to the diversity of shape is not conveniently handled by mechanical means.

To overcome this an electromagnet was designed to remove, with a certain amount of selection, these steel parts and load them into the charging boxes. The magnet is of the compound type—composed of several magnets of the usual spool type mounted on a yoke in the form of a circle, the centers being on the circumference of an inner circle. A single magnet having its center coincident with the center of the outer circle completes the larger magnet and presents the maximum surface density. This large magnet is suspended from an overhead traveler and is provided with the usual horizontal and vertical motions. Each magnet is individually controlled so that material may be handled to a nicety by the application of current to the proper magnets.

The Assayer and Chemist

Qualitative Separation of Tin, Arsenic and Antimony

The method of Noyes and Bray for the qualitative separation of arsenic, antimony and tin consists in treating a mixture of the higher sulphides with concentrated hydrochloric acid in the steam bath, thus leaving the sulphide of arsenic undissolved, then diluting the liquid with about four volumes of water and precipitating sulphide of antimony in hot solution with hydrogen sulphide, and finally precipitating sulphide of tin after further dilution.

According to J. M. Welch and H. C. P. Weber (*Journ. Amer. Chem. Soc.*, Vol. 38, p. 1011) this does not give satisfactory results in the hands of inexperienced operators on account of failure to adhere to the exact conditions. They observed that when antimonious and stannic sulphides happen to precipitate together, they frequently show a brown color which is not intermediate between the usual colors of the two sulphides, but much darker. The authors consider this dark precipitate as a characteristic test for both tin and antimony, and they prefer to allow the hydrochloric-acid solution to cool while hydrogen sulphide is being led in, so as to obtain this test if possible. To finish the analysis they dissolve the sulphides by evaporating or using an oxidizing agent, then add oxalic acid (F. W. Clarke's method), precipitate antimony with hydrogen sulphide, boil the filtrate with granulated lead and test for tin with mercuric chloride.

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The Assaying of Copper Bullion

By G. W. Partridge*

In the autumn of 1913, owing to revolutionary disturbances, a large part of the copper ores coming to the Aguascalientes smeltery was cut off, and at the same time the receipts of gold and silver ores from southern Mexico were greatly increased. In consequence the blister copper produced began to carry abnormal amounts of precious metals. The method of assay in use at the time was the "combination" nitric acid for silver and "all scorification" for gold. This proved unsatisfactory under changed conditions, so I did some experimenting with the sulphuric-acid method in use at Anaconda, finally adopting it altogether in preference to the other.

Four charges of 15 grams each are weighed into 800-c.c. beakers; about 30 c.c. of water is added to each, and then 10 c.c. of mercuric nitrate solution (10 grams of mercuric nitrate per liter). This is shaken till the copper is coated with mercuric amalgam, then 60 c.c. of con, sulphuric is added, the beaker covered and put on the hot-plate. Action begins at once with evolution of SO_2 gas. Heating is continued for about 1½ hr. till the solution becomes bluish-gray. I find the best results are obtained by starting the action at a rather high heat.

When the action is finished, as shown by the bluish-gray color, the beakers are removed from the hot-plate and allowed to cool. When cold, the sides are washed down and sufficient salt solution added to precipitate the silver as chloride (the greater part of the silver is reduced to metallic state by the copper, but salt solution is always added). The solution is then brought to a boil and, when possible, allowed to stand over night. It is then filtered, washed a couple of times and the paper and contents transferred to a 20-gram crucible. The paper is burned at a low heat, flux added and the contents fused. The resulting buttons are cupelled, weighed and parted as usual.

The comparative results on fifteen lots are given in the table.

ASSAYS GIVEN IN KILOGRAMS PER METRIC TON

Lot No.	Au by Scorification	Au by H_2SO_4 Combination	Ag by HNO_3 Combination	Ag by H_2SO_4 Combination
1	0 2820	0 2817	33 307	33 342
2	0 3821	0 3814	45 740	45 734
3	0 3733	0 3739	49 053	49 072
4	0 2806	0 2861	37 335	37 332
5	0 2920	0 2927	34 846	34 972
6	0 2762	0 2778	29 992	30 083
7	0 2383	0 2381	24 995	25 017
8	0 2283	0 2287	23 930	23 913
9	0 2211	0 2221	22 618	22 689
10	0 1935	0 1928	20 780	20 680
11	0 1363	0 1386	19 272	19 334
12	0 1368	0 1363	19 412	19 384
13	0 1432	0 1446	18 925	18 901
14	0 1964	0 1956	31 818	31 869
15	0 3450	0 3465	40 988	40 984
Average	0 2483	0 2491	30 200	30 221

As the sulphuric-acid method gave good results, the other was discontinued and no further comparisons were made. It may be of interest that the values in the bullion increased to a high mark of 88 kg. of silver and 1,200 kg. of gold.

The combination nitric-acid and scorification method cost 81c., while the sulphuric-acid method cost 29c. per assay for materials only.

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*American Smelting and Refining Co., Hayden, Ariz.

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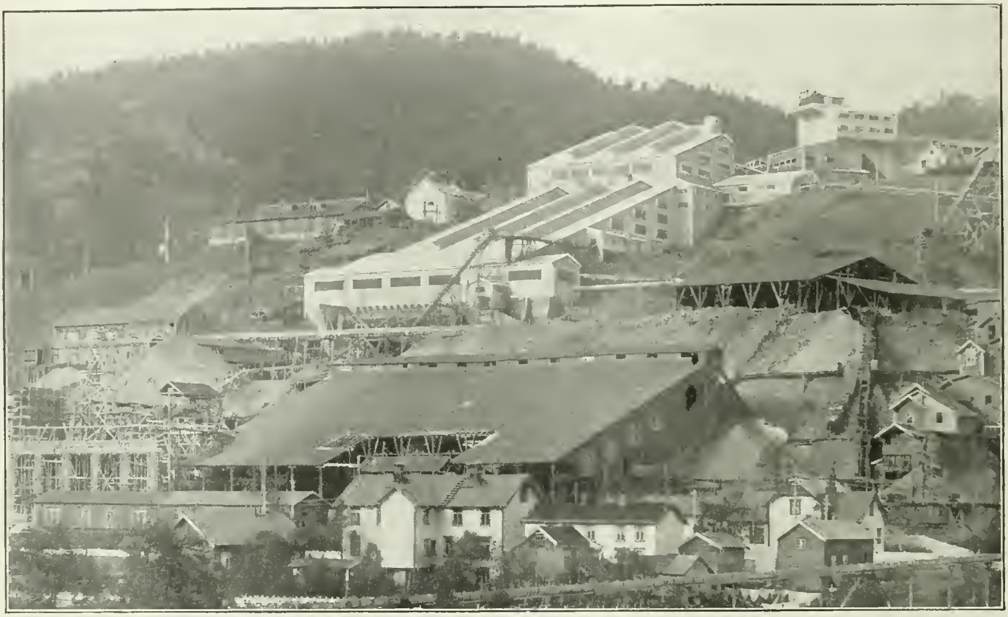
Separation of Aluminum

A new gravimetric separation for aluminum from zinc, manganese, nickel, cobalt, iron and chromium was described by Louis Kahlenberg and K. P. Young at a recent meeting of the American Chemical Society. The following abstract is taken from *Science:*

When ammonium salicylate is added to a dilute solution of an aluminum salt and this solution is then boiled, there separates out in granular form a basic aluminum salicylate of the composition $(Al(C_6H_4.OH.COO)_2)_2.Al(OH)_3$. This may be readily filtered off, washed with hot water, ignited and weighed as Al_2O_3. The precipitate is much more readily handled than the usual slimy and gelatinous precipitate of aluminum hydroxide. Zinc, manganese, nickel, cobalt, ferrous iron and chromium are not thus precipitated by ammonium salicylate, which fact is the basis for the direct and simple separation of these metals from aluminum. The solution should be fairly dilute, lest the basic aluminum salicylate occlude notable amounts of the other metals. If this should occur, redissolving the precipitate and then reprecipitating from the dilute solution will secure a good separation. Sodium salicylate may be used as the precipitant instead of ammonium salicylate, but the latter is preferable.

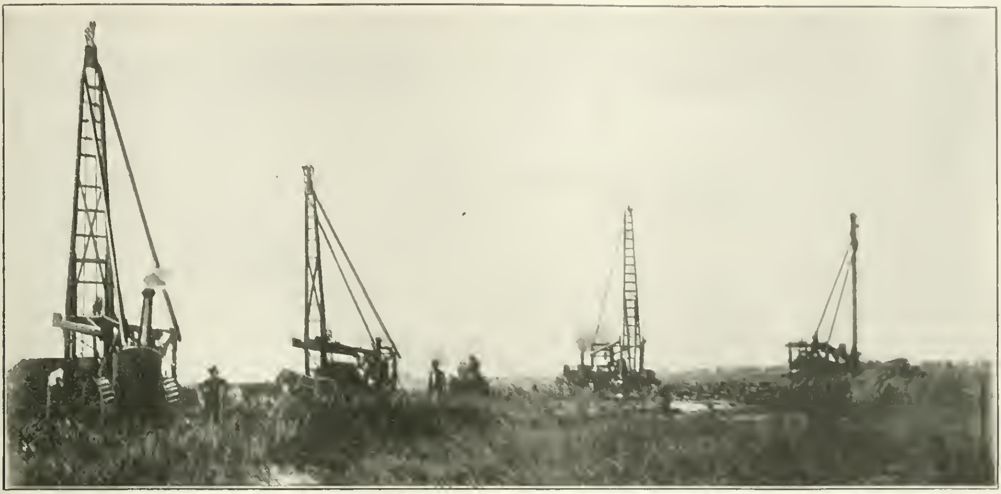
Photographs from the Field



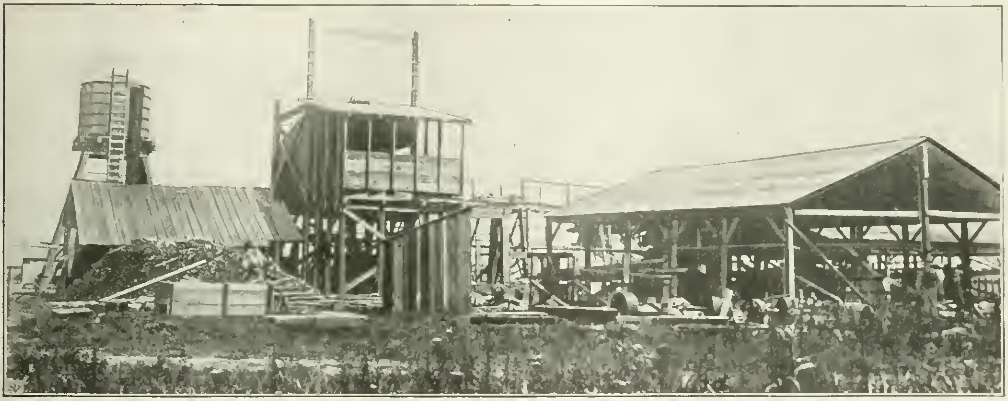
ORKLA MINING CO.'S CUPRIFEROUS PYRITE MINE AT LÖKKEN, NORWAY

New mill and Wallenberg shafthouse in background. The Orkla company, planning an output of 1,000,000 tons per year, let the contract for sinking the Wallenberg shaft to a depth of 1,200 ft. to an American company. The shaft is 12x18 ft., outside of timbers, and was to be sunk at the rate of 20 m. (66 ft.) per month. The E. J. Longyear Co., of Minneapolis, Minn., which took the contract, has averaged over 85 ft. per month, though Norwegian laws prohibit shaft work on Sunday

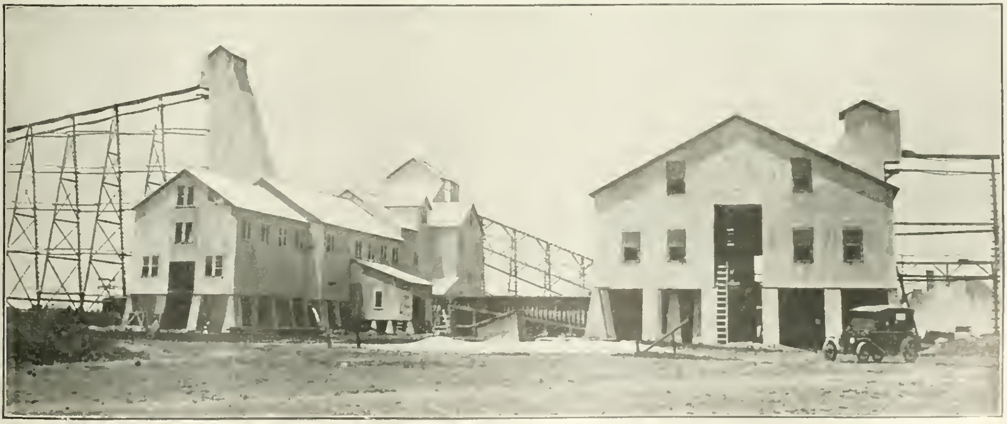
CREW OF THE E. J. LONGYEAR CO. SINKING THE WALLENBERG SHAFT WITH JACKHAMER DRILLS



Not an oil field. Drilling for zinc ore north of Picher, Okla.



The Montreal mine, near Cardin, Okla., one of the richest mines in this field



New Netta mill of Picher Lead Co., Picher, Okla., one of the largest and best in the district

VIEWS IN OKLAHOMA SECTION OF JOPLIN ZINC FIELD, NOW BEING ACTIVELY EXPLOITED

Correspondence and Discussion

Geological Relations of Sudbury Nickel Ores

In a letter in the *Journal* of July 8, 1916, A. P. Coleman repeats his well-known reasons for believing that the nickel-copper sulphides at Sudbury, Canada, are the products of magmatic segregation. Before replying to his letter, and for the sake of clearness, I would like to outline again, briefly, the probable succession of events that culminated in the formation of the Creighton orebody. This deposit is selected because it has been considered by many writers as a type example of a magmatic-segregation orebody.

The oldest rocks in the immediate vicinity of the Creighton are greenstones. Norite was intruded into these greenstones. Then came the granite intrusion, which formed the foot wall of the orebody. The granite forced its way mainly along the norite-greenstone contact. After the granite had solidified, there followed a period of tremendous crushing and brecciation along the norite-granite contact, and great "crush breccias" and "crush conglomerates" were formed. The fragments of this brecciated material vary in size from immense blocks 100 ft. long to microscopic specks—rocks ground to powder. The shape of the fragments and blocks is infinite in variety, varying from sharply angular to round. Solutions circulated through the "crush breccia" and "crush conglomerate," depositing sulphides that cemented the fragments together and partly or almost wholly replaced them. Some replacement of the granite foot wall also took place, but the norite hanging wall, particularly where it has been slightly sheared and brecciated, was more severely attacked, often forming what has been called "spotted" norite. In short, the immense stopes of the Creighton mine have demonstrated that the orebody is merely an enormous "breccia" or "conglomerate" of crushed rocks, granite, greenstone and norite, cemented together by sulphides. The contact between this orebody and the lean, noncommercial hanging wall of "spotted" norite is comparatively sharp—a few feet more or less. The "spotted" norite, on the other hand, becomes gradually less and less impregnated and replaced with sulphides as the distance from the orebody increases. It may be added that every other commercial orebody in the nickel field is mainly of this character; that is, a mass of crushed rock fragments cemented together by sulphides. Keeping this outline in mind, and particularly the fact that the granite foot wall at the Creighton is younger than the norite hanging wall, the following remarks may be of interest:

Coleman's letter is in part a criticism of a brief article by me that appeared in the *Journal* of May 6, 1916. In that article it was suggested that deposition of the ores from solution accorded best with the facts. It was further shown that the theory of gravity segregation at the Creighton orebody appeared to be untenable. Regarding the age of the granite foot wall at this mine Coleman remarks: "The statement that the coarse granite beneath the Creighton orebody is later than the ore does not agree with my own observations." It is respectfully submitted that this is a misstatement of what appeared in my article. It was stated that the granite is later than the norite hanging wall, not the orebody. Coleman apparently has failed to appreciate the significance of the fact that the granite is younger than the norite. He does not specifically deny this relationship. He remarks: "Even if it were younger [than the ore] no reason can be assigned why granite should not come beneath an already existing orebody." The reason that can be assigned in the case of the Creighton is that the orebody did not exist when the granite was intruded. The orebody was formed after the intrusion of the granite—a fact to which Coleman assents. This being true, it is easy to realize that molten sulphides in the molten norite could not have settled to the bottom of the norite and rested on a granite that was not there.

E. Howe[1] has shown that the norite, at its contact with the Creighton orebody, is brecciated into fragments and blocks and, further, that the sulphides cement the fragments together, as shown in the illustration. The character of this contact, as described by Howe, was confirmed by the writer during the present summer. It is clear that the sulphides were deposited after the norite had solidified. These facts present another serious objection to a belief in gravity segregation. It is only fair to add, however, that Howe thought the sulphides might have been injected in a molten condition as a later intrusive after the norite had solidified.

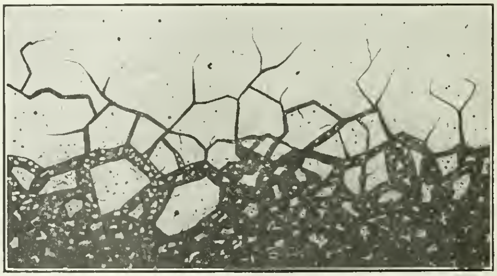


Fig. 1—Diagrammatic drawing illustrating the character of the contact between massive sulphides (black) and norite (white). Creighton, third level, west end of pit. (After E. Howe.) The nature of this contact presents a serious difficulty to a belief in gravity segregation of the sulphides

Some writers have suggested that the presence of "blebs" of sulphides in fresh norite constitutes a reason for believing that the sulphides crystallized directly from the molten norite. This variety of norite has been called "spotted" norite. Similar "blebs," however, occur in granite, greenstone, greywacke, schist and gneiss, and like the "spotted" norite, "there is no hint of a channel through which the sulphides could have arrived at their present position." The granite is perfectly fresh—probably fresher than the norite. It would appear, therefore, that this method of reasoning loses its significance.

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[1] "Economic Geology," September, 1914.

Coleman asks how the origin of the Sultana, Levack, Whistle, Garson and other marginal deposits are to be accounted for in the absence of the "suspicious" granites. I made no suggestion, however, that there was any genetic connection between the granites and the origin of the ores. These deposits were probably formed, like all the other deposits in the area, by solutions circulating along crushed and sheared zones. It is a fact that practically all the orebodies occur along extensive and well-defined lines that have either a northwest-southeast or northeast-southwest direction. These directions constitute lines of shearing and crushing. Some of the deposits in these sheared zones, in the greenstones and sediments, are in part typical fahlbands. It has so happened that the lines of shearing and crushing occur, for the most part, along the contact of the norite and adjacent rocks, thus accounting for the occurrence of the orebodies in this position. It is believed that this explanation of the occurrence of the deposits at or near the edge of the norite is a more rational one than that which suggests that the ores settled by gravity segregation to the edge of the norite.

The theory of gravity segregation at Sudbury is partly based on the plausible supposition that the norite occurs in the form of a sill. The sill-like nature, however, of this intrusive has not been definitely proved. Many of its contacts with adjacent rocks suggest an irregular dike-like form more than a sill-like form.

After all is said, however, the two theories of the origin of the ores—magmatic segregation and deposition from solution—are not, fundamentally, so very far apart. Both have, for instance, a common starting point. That is to say, both agree that the norite and the ore-bearing solutions had a common origin—possibly a deep-seated reservoir of molten rock. The theories merely differ as to how the ores gained their present position. Indeed, Coleman admits that deposition from solution was the dominant factor in the formation of the Worthington and Vermilion deposits. To quote his own words: "Finally there are a few deposits accompanied by little norite . . . such as the Worthington and Vermilion mines, which may have been formed principally through the action of heated water circulating along fissures at distances, sometimes miles, away from the edge of the eruptive sheet."[2] Possibly, therefore, certain writers may come to believe that deposition from solution was the dominant factor in the formation of all the commercial orebodies, including the Creighton.

Coleman refers to my citation of the opponents of magmatic segregation as rather unfortunate. He asserts that "C. W. Dickson, one of the earliest opponents of the theory, called on me some years ago, spent several hours with the microscope over my thin sections of pyrrhotite-norite from Creighton and elsewhere, and could not deny that they favored the magmatic theory." Regarding this statement I am in receipt of a letter from Dickson. "With reference to the Sudbury ores," Dickson writes, "you can if you wish quote me as saying most emphatically that I still am and, since my investigations, always have been firmly convinced that these ores have been mainly depositions from solution. I remember calling on Dr. Coleman several years ago, and we talked about Sudbury ores, and I looked at a few of his slides; but Dr. Coleman is quite in error when he says I came away favoring magmatic segregation. As a matter of fact I spent quite a short time with him, not several hours; and the slides he showed me could not have impressed me greatly, as I have never given up my contention that these ores have been concentrated and deposited in their present formation by means of heated aqueous solutions. To try and twist any remarks I may have made at that time, and of which neither of us can have more than a hazy recollection now, is quite unfair and does not look to me as coming from an unprejudiced mind."

On three occasions in the last eight years it was my privilege to go over the nickel field with Coleman. Nevertheless I should be glad to do so again.

Sudbury, Aug. 20, 1916. CYRIL W. KNIGHT.

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[2] Ontario Bureau of Mines, Vol. 14, Part III, p. 19.

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Cattlemen Menace Prospecting

The discussion published so far in the *Journal* has failed to touch upon a point vitally affecting the whole future of mining—the illegal fencing off of mineral lands. Inasmuch as this constitutes a most effective discouragement to prospecting, it is certainly in order to here briefly present the facts.

Throughout the Southwest, at the present time, the prospector is continually obstructed in his ligitimate travels by the ubiquitous landhog, apparently delighting in the unrestrained fencing off of the public domain. The evil is no longer to be mainly attributed to the big cattle interests, but usually to the smaller kind of man, with the upkeep of only a couple dozen cows or so as his sole excuse for encumbering the earth. Near the mining camps, which of course now afford first-class markets for milk and wood, the evil is especially pronounced. On the outskirts of the camp, say, is a water hole that for generations has befriended the steady stream of prospectors and their jacks. Now comes some milk peddler and locates a mining claim so as to include the water hole. Starting with one claim as a nucleus, he locates three or four more around it in the form of a cross or an H. Then he runs a 5-strand barbed-wire fence around the whole area, including not only that staked as mining claims, but all other that can be included.

If this wire-stringer leaves any gates at all, he is sure to keep them locked or posts "No Admission" signs.

With neither water nor pasture for his beasts nor wood for his fires, the prospector is in a bad way. The only way out is to keep his beasts in town, and anyone with the cash to do that probably is not a true prospector. It is unnecessary to remark upon the restraint from prospecting upon fenced lands, as that is obvious.

To make the situation rankle worse, however, the prospector knows that the lands are not legitimately held for farming purposes, but are very largely fraudulently held by mining-claim locations. If the assessment work is properly done the first year, it rarely is in succeeding years, and evasion by well-known methods is only too easy under existing statutes.

I will venture to say that in the Southwest today, 60% of the unpatented mineral lands are held by fences of wood hawkers and milk peddlers who keep the legitimate prospectors out. At the present rate of encroachment, inside of three years it will be impossible to go anywhere within five miles of a mining camp without cutting wire fences. JAMES A. MCKENNA.

Hanover, N. M., Sept. 11, 1916.

How To Sell a Mine

I have been much interested in reading the article by F. F. Sharpless, in the *Journal* of Aug. 19, 1916, about the way to sell a mine. In the directions given he is without doubt right—when one has a mine to sell. The interesting part of this discussion, it seems to me, is that the question at issue is not so much that of selling a mine as it is interesting capital in the business of mining.

One having a mine to sell is in the same position as any vendor of merchandise. He has so much ore in sight and developed and it is worth so much money, upon which figures of the value of the mine may be predicated. The valuation is a specific matter that may, by process of calculation, be arrived at. I feel that this is the position taken by Mr. Sharpless and, however correct he may be, it does not answer the question of how to sell mining properties, many of which have very little ore in sight, but by systematic development work, based upon favorable geological conditions only, may become properties worth many millions. It is my impression that the origin of the question is as to the means of interesting capital in prospects of merit that may become mines by judicious development.

We all know what Mark Twain said about the prospector: "A liar with a 10-ft. hole in the ground"; but I am wondering if he would really feel like so condemning the prospectors who persistently maintained their contentions of the presence of large deposits of ore—afterward proved to exist—against the scientific knowledge of ore deposits as understood by those skilled in that study. We have instances galore where men of knowledge and learning have repeatedly reported adversely upon properties that afterward became our heaviest producers. In nearly every instance the mines that are our greatest dividend payers owe a debt of gratitude to the pioneer prospectors who persisted in their endeavors and refused to be influenced by the advice of experts on ore deposits.

Not a mine exists today, that was not once a prospect, and many offered little encouragement to the student of ore deposits. In relatively few instances has successful development been due to the presence of the professional student of ore deposits. These men appear in due time and serve a good purpose. Imagine the owner of a partly developed prospect trying to induce capital to join in the development of his property! And yet, if these prospects are not developed we shall soon cease to have mines. Without physical data to measure orebodies presumed to exist, the question is, How are you going to evolve a mathematical calculation that will determine the value of a mine in its early days?

The prospector is interested in advice about how best to accomplish that which will aid him to produce results in the development of his property. He is quite as much interested as the mine owner who has holdings well developed and who is seeking additional capital. Crude as the prospector's ideas of finance may be; wild as his propositions may seem; unlearned in technical expression as he usually is, ignorant, as he often is, as to geology and ore formation—yet this is the man who leads the way, and any advice that will help him in his efforts to finance his undertakings would be welcome to him and an aid to the mining industry.

The exploration of promising prospects is a business in itself, distinct and separate from the development of mines. It is a speculative business, but a field that offers great profits if properly managed. The number of prospects presenting favorable surface indications that finally develop into mines of consequence is such that the proportion of successful ventures may safely be said to be greater than in many lines of trade. The wonder, then, is that more encouragement is not given to the financing of prospecting companies. One cannot forecast with precision the future of such companies; nevertheless, results would be more gratifying if persistence were shown and operations extended over a long period of time.

It frequently happens that mining engineers and geologists in their travels come across promising prospects, not sufficiently developed to appear attractive to their principals because there are no ore reserves to measure, but which might appeal by reason of their surface indications. If they attempted to develop such properties they would subject themselves to criticism by their clients, which naturally makes them hesitate. The consequence is that many favorable prospects are without the support they should have. What remedy there is and what means are available for aiding the pioneer in the development of promising prospects are questions of vital importance to the future welfare of the mining industry.

Many of the going mines have men in the field looking for developed properties. Once in an age one is found that conforms to all of the conditions. In all such investigations the men in the field must, by virtue of precedent and instruction from headquarters, pay respect only to tonnage developed and value thereof, before exhibiting any interest in other factors. Even though the surface evidence is of such character that it presents especially attractive signs of mineral deposition; even though the district be one of considerable area; even though geology may speak in its silent manner and beckon—yet because there are no measurable orebodies the mining engineer must turn his back and leave.

Now and then we read about the great number of mines presented to this or that mining company; and of these only a few are investigated, out of which possibly one or two may be selected to develop. Is it reasonable to believe that this company has passed intelligently on all these properties, or is it more reasonable to assume that the sifting was done with a sieve with too large a mesh?

Wherein lies the trouble? Is it that conservatism is too conservative? Is not now the time for the exploration of prospects, and is it not compatible with reason that profits may be expected from a sorting of the dumps of prospects that have been rejected by those agencies whose methods are so rigid as to condemn to perdition many worthy prospects? John T. Reid.

Lovelock, Nev., Aug. 22, 1916.

Right To Drill Through Lands

Before Judge Crow, of the Circuit Court of St. Clair County, Illinois, the New Staunton Coal Co. applied for an injunction on Aug. 28 to prevent Louis Miller, of Staunton, Ill., from drilling through their coal vein about 100 yd. in advance of the mine workings at their coal mine at Livingston, Ill. After able presentation of both sides, the judge refused the injunction and granted Miller the right to drill through the coal owned by the coal company by reason of his having leased the privilege from the owner of the surface. H. A. Wheeler.

St. Louis, Mo., Sept. 2, 1916.

The Rand's Ore Reserves

By A. Cooper Key*

Ore reserves of producing and developing mines of the Rand at the end of last year reveal a total in the neighborhood of 95,000,000 tons, of which about 25% has a value of between 25s. 6d. and 27s. 6d. per ton, or about the present average yield. The total is subject to the sorting out of waste rock, say 10%, before being sent to the reduction works; it embraces ore partly developed, as well as shaft pillars, etc., and therefore not immediately available for stoping. The tables presented herewith show tonnages and values as at Dec. 31, 1915, and 1914, or at the close of the financial year in certain instances. The Rand has had lately an abundance of native labor, which has enabled development operations to be pushed as much as possible and other work to be done that can only be carried out when the supply of native labor is in excess of requirements for essential mining operations.

One Thousand Less Rock Drills Employed

It is, however, rock drills which produced large developed tonnages, and it is a very distinct feature of recent statistics that the number of rock drills working has shown persistent diminution, a drop of 1,000 machines in the last twelve months. There is nothing to show the distribution of the total number of machines as between development and stoping. Undoubtedly there would be a tendency to employ surplus native labor on development work, and so retain it on the Rand, in order to make the position assured and to provide against the inevitable reduction in the supply. Rock drills would also be taken off stoping work in the narrower orebodies and native labor substituted.

It should be made clear that the two sets of figures are not always comparable; in particular, all the mines of the Johannesburg Consolidated Investment group state their ore reserves in terms of stoping tons and thus come into line with other groups. Hitherto certain of the companies of the group have given their reserves in milling tons. Engineers generally prefer the mining-ton basis, as it can easily be adjusted to milling tons, in accordance with prevailing native labor conditions, sorting ratio and so forth. On the whole the variations at mines with established milling equipments—that is, where increases in reduction plant are not contemplated—are inconsiderable. An exception exists in the East Rand Proprietary, which records a shrinkage of 600,000 tons attributable to low pay ratio; while the Crown Mines aggregate is down only 84,000 tons, explained by a reduction of a couple of inches in the stoping width. But it is distinctly disappointing to find that the ore reserve is only maintained in face of an advance of 50%—that is, from 32,700 ft. to 48,300 ft.—in linear development accomplished. There is this redeeming feature, that the augmented footage produced 637,000 additional payable tons compared with the previous year, whereas the unpayable tonnage developed was almost identical with that of the earlier period. Owing to the alteration in form in which the data are presented, it is not practicable to compare the figures of the Randfontein Central, the third big consolidation of the Rand.

As might be expected, the largest increases are in expanding mines of the far East Rand. Thus the Modder Government Areas, which is doubling its reduction plant, records an increase of 1,211,000 tons (equal to over 50%) and an increase equal to 1.1 dwt. in value and of 8 in. thickness. Some 10,000 ft. developed last year showed 74s. 6d. over 1 ft. of reef thickness. Springs Mines where crushing should begin at the end of the year, has been able to double its tonnage in reserve, the value improving 0.1 dwt. and the thickness by 5 in. Brakpan is distinguished by showing the biggest increase in value, one of 1.15 dwt., which moreover, applies to the huge reserve of three million tons, an advance of 527,000.

THE RAND'S ORE RESERVES IN 1914 AND 1915

Producing Co.	As at December, 1914 *			As at December, 1915 *		
	Tons	Dwt	In.	Tons	Dwt.	In.
Aurora West... ..	614,610	5 26	44	550,044	5 5	42 5
				partial 88,500	5 7	42 5
Bantjes Con.. . .	(b) 800,100	6 1	41	(b) 648,000	6 1	41
Brakpan	2,490,000	6 73	62	3,017,000	7 86	62
City Deep..	(b) 2,510,800	9 7	55	(b) 2,976,800	9 5	57
City and Suburban	758,700	8 5		637,400	9 0	
Con. Langlaagte	(c) 2,220,707	6 9		(c) 2,248,656	6 5	49 24
Cons Main Reef	693,160	7 3	49	855,600	7 53	48 5
Crown Mines .	(b) 10,022,000	6 0	66	(b) 9,938,000	6 25	63 8
Durban Rood Deep	(b) 1,303,400	6 7	47	(b) 1,290,000	6 5	47
East Rand Prop.	5,400,000	6 6	55	4,800,000	6 3	55
Ferreira Deep..	(b) 1,893,100	8 5	68	1,854,100	8 3	70
Geduld Proprietary	1,900,000	7 1	59 5	2,100,000	7 7	59 5
Geldenhuis Deep	(b) 1,613,000	6 4		1,826,800	6 1	57
Ginsberg	278,213	6 7		(c) 278,118	5 67	68
Glencairn. .	440,520	(a)3 3		(c) 117,430	4 1	56
Govt. Areas (Modder)	(c) 2,451,581	5 8	60	(c) 3,665,000	6 9	68
Jupiter	1,273,000	4 5		(g) 1,217,000	4 6	
	partial 161,000	4 1		partial 161,000	4 25	
Knights Central	430,500	5 7	63	406,490	5 8	62 4
Knights Deep.	(c) 2,480,000	4 2		2,627,000	4 25	
	partial 200,000	3 9		partial 174,000	3 9	
Langlaagte Estate..	886,396	5 97	50	1,161,119	6 08	50
	prob. 187,221					
Luipaardsvlei Estate .	660,365	5 5		702,123	5 3	
Main Reef West	526,440	5 7	53	416,280	5 87	51
Meyer & Charlton .	469,839	13 9	55	485,246	12 56	53
				partial 46,566	19 87	47
Modder B.	2,772,540	8 6	55	2,790,740	8 75	56
Modder Deep .	2,450,000	8	69	2,670,000	8 3	73
New Goch .	825,900	5 27	84	668,600	5 51	82
New Heriot	588,315	8 1		536,680	8 2	
New Kleinfontein...	(c) (f) 2,890,731	5 6	58	(c) (f) 2,846,712	5 5	57
New Modderfontein	(b) 6,334,500	8 4	63	6,010,800	8 15	62
				(h) 1,656,000	6 6	
New Primrose	335,463	6 8	.	(c) 265,623	5 5	56
New Unified	371,037	(a)5 5		(c) 399,140	5 7	44
Nourse Mines	(b) 2,473,700	6 4		(b) 2,952,400	5 7	
Princess Estate.	553,000	7 1	28 2	488,000	6 7	29 7
RandfonteinCentral	6,826,644	6 6		(i) 4,449,324	7 4	
				(j) 3,285,153	4 2	5 3
Robinson, Leader & S. Reef .	364,700	10 7		565,100		
Robinson Reclaimable	330,100					
Robinson, Main R	534,300	4 4		418,200		
Rose Deep .	(b)3,957,100	5 5		(b) 3,605,390	5 2	62
Robinson Deep	(c) 1,533,000	5 9		1,513,000	6 0	
	partial 407,000	5 8		partial 365,000	6 1	
Roodepoort United	590,000	5 9	45	720,309	5 9	44
	partial 227,000	5 9	45	partial 148,114	5 17	48
Simmer & Jack	(c) 2,320,000	5 4		2,155,000	5 2	
	partial 348,000	4.6		partial 273,000	4 3	
Simmer Deep	1,429,000	4 3		1,585,000	4 4	
	partial 302,000	4 6		partial 238,000	4 4	
Van Ryn .	1,973,312	6 5	53	1,953,000	6 2	54
Van Ryn Deep	(c) 1,692,349	(a)8 5		(c) 2,044,108	8 4	62
Village Deep..	(b) 2,853,470	6 8	60	(b) 2,631,606	6 6	60
West Rand Cons	1,453,000	6 05	49	1,838,380	6 1	52
	partial 340,000	7		partial 255,793	6 4	
Witwatersrand	(c) 1,221,879	(a)6 6		(c) 1,480,423	6 83	60 4
WitwatersrandDeep	1,707,400	6 2	50	1,673,300	6 02	54 5
Wolhuter	999,400	5 9	53	1,263,320	5 8	53 2
Non-Crushing Co.						
Cinderella Cons	613,000	6 35			unchanged	
	partial 231,000					
Developing Co.:						
Springs Mines. .	553,000	10 3	52	1,125,000	10 4	57

* Or latest date in respective years (a) Estimated recovery value (b) Includes shaft and boundary pillars. (c) Mining tons (d) Payable and unpayable. (e) Milling tons. (f) Includes Apex and Benoni, Kleinfontein Section alone, 1,781,231 tons, 5 47 dwt over 59 ft 6 in. (g) Of the total, 303,000 tons at the Catlin shaft not economically available (h) At circular shaft (i) Payable. (j) Unpayable at present costs

New Modder's reserve outside the circular-shaft section shows a drop of 325,000 tons, the value being $\frac{1}{4}$ dwt. lower. Circular-shaft development is shown for the first time at an approximate total of 1,656,000 tons, which cannot of course be credited to a single year's work. City Deep has brought up its reserve by 460,000 tons, coupled with a slight decrease in value.

Allowing for sorting, Van Ryn Deep's reserve is 100,000 tons to the good, while the present stoping value approximates to the former milling value. At the Geduld Proprietary Mines the reserve has increased 200,000 tons and the value has improved by 0.6 dwt. Modder Deep's value is 0.3 dwt. higher, its total (220,000 tons) more due to greater thickness. Meyer & Charlton is now the only producing mine on the Rand whose reserve is over 10 dwt. in value, that assigned to the complete development being 12.56 dwt., while that partly opened is worth nearly an ounce. Springs, at 10.4 dwt., is second, but this is at present a developing mine. The Robinson's leader and South Reef Reserve used to be valued at over 10 dwt., but values are no longer assigned. City Deep and City Suburban are the only representatives of 9 dwt. grade. Rose Deep's reserve has dropped 352,000 tons, the value being 0.3 dwt. owing to consistently poor development. Nourse mines aggregate has increased 480,000 tons, but the value has seriously deteriorated. Among West Rand concerns, the Consolidated increase of nearly 500,000 tons in two years and the Roodepoort United's 350,000 tons (and 0.6 dwt. in value) are noteworthy.

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*Box 3621, Johannesburg, South Africa.

Breach of Ore-Sales Contracts

By A. L. H. Street*

A suit for damages for breach of a contract for the sale of the output of zinc concentrates at a smelting company's plant, under which it was agreed that average quotation of the *Engineering and Mining Journal* for spelter at East St. Louis during the month of arrival at the buyer's works was to be taken as a basis for settlement, was lately decided in plaintiff's favor. (Jacobsen vs. Tri-Bullion Smelting and Development Co., 233 Federal Reporter, 646.)

In affirming judgment for $5,847.31 in favor of plaintiff, the United States Circuit Court of Appeals, Second Circuit, holds that if plaintiff was unable to procure elsewhere the same kind of ore to take the place of that which defendant failed to deliver under its contract, the damages recoverable for breach of the contract are to be measured with reference to the market value of the best substitute available.

It is also decided in the same case that the fact that plaintiff failed to make a small payment due on a delivery made did not justify defendant in terminating the contract; it appearing that plaintiff customarily had been permitted to make settlements when convenient, and was responsible for its obligations, that the particular payment fell due after defendant announced its repudiation of the contract, and that plaintiff was fairly entitled to retain the payment to offset damages for such breach.

Tolovana Gold Gravels, Alaska

During 1914 and 1915 hundreds of people, attracted by the reported finding of gold in the headwater region of Tolovana River, in central Alaska, rushed into the district, and systematic mining began there during the summer of 1915. Although considerable prospecting was done, only about 10 mines were commercially productive, but these made a gold output to the value of $80,000. Gold-bearing gravels occur in the beds of the present streams, in buried channels and in bench gravels, but most of the gold has been won from the deep channels on Livengood Creek, which have proved to be far richer than either the stream or the bench placers. Some shallow placers have also yielded gold, notably on Olive Creek, but only prospects have been found in the benches.

A report by A. H. Brooks entitled "Preliminary Report on the Tolovana District, Alaska," has been issued recently by the United States Geological Survey, Bulletin 642-G. This report will be distributed on requests addressed to the Director, United States Geological Survey, Washington, D. C.

Arizona Meeting of A. I. M. E.

Editorial Correspondence

(By Telegraph)

The Arizona meeting of the American Institute of Mining Engineers, from all reports so far received as the *Journal* goes to press, is proving one of the best attended and most successful ever held by the Institute.

The party leaving New York on Sept. 14 numbered only 17, but received recruits at Albany, Utica, Chicago and Kansas City, so that over 50 arrived at Chicago. Here they were met at the station by automobiles and taken on a sight-seeing trip to the city parks, followed by a banquet at the Hotel La Salle. The special train leaving Chicago for El Paso carried the private car "Anaconda" of Vice-President Benjamin B. Thayer of the Anaconda Copper Mining Co.

Arrived at El Paso Sunday afternoon, the party was greatly swelled by the addition of the Arizona delegation, whose members welcomed the Eastern delegates to the Southwest. The party was conducted on a trip of inspection to El Paso smelting works under the leadership of Karl Eilers. The entertainment committee, headed by Mr. and Mrs. W. W. Rose and Mr. and Mrs. W. D. Gordon, conducted the delegates on tours about the city and to the National Guard camps at Fort Bliss. The party was characterized by high spirits, and a number of staid Eastern delegates were treated to experiences never before enjoyed. One young lady, a graduate of the chemical engineering course of Boston Tech, visited and apparently enjoyed a spectacular bull fight at Juarez. In the evening the party, now numbering 180 guests, sat down to a Mexican dinner at the Toltec Club, where the menu included the following items: Enchiladas con huevos, tamales de pollo, tortillas, frijoles refritos, nieve neapolitana, queso and café. A Mexican orchestra enlivened the evening by playing Mexican airs.

This train out of El Paso consisted of 14 cars including the club car and stateroom car. The number of delegates ariving at Santa Rita was 105. Here Manager J. M. Sully, his wife and daughter, assisted by many officials of the Chino and Empire Zinc companies, were responsible for a most unique and enjoyable program. While the arrangements showed much thought and work, Mr. Sully modestly disclaims any credit for it,, saying that he had nothing to do with it except to tell his boys to go as far as they liked. The first thing on the program was a trip around the Chino steam-shovel pits. All clambered aboard a special train of bunting-bedecked flat cars and took this most enjoyable trip. The party then split, part descending into the pits for closer inspection of the porphyry ores, going thence to the Fierro iron mine and the new Chino mine crushing plant. The rest journeyed by automobile to the new 100-ton mill and mine of the Empire Zinc Co., at Hanover. The reunion of the parties was celebrated on the return to Santa Rita at noon by a barbecue enlivened with military airs played by the United States cavalry band from Fort Bayard.

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*Attorney at law, 829 Security Building, Minneapolis, Minn.

Leaving Santa Rita by automobiles, the visitors were taken to the Chino mill at Hurley, where it so happened that Manager Daniel C. Jackling was due to arrive the next day to decide important questions pertaining to future new operations. In speaking of this expected arrival, L. D. Ricketts voiced the general feeling concerning the Jackling accomplishments. He said that while Jackling was at first considered somewhat wild in his endeavors, now he has everyone looking for 1½% ore.

FLOTATION PLANT AT CHINO

Construction of a new flotation plant has been started at the Chino concentrator to re-treat all the stored mill tailings. The crushing plant at the mine is being enlarged to double its capacity. For this purpose a great jaw crusher is being built, the opening of which is 5x7 ft. and its weight over 400,000 lb. Other improvements include new boiler units at the power plant, water-cooling towers and a weighing system attached to the conveyor belts for weighing the flotation tailings directly as they come from the Portland filters.

On returning from the Chino mill, as the train came down the track it stopped at a spot brilliantly lighted near a pavilion erected for the occasion, where a dance was held up to the time of departure for Douglas at 10:15 p.m. At both Santa Rita and Hurley the ladies' entertainment commitees did much to add to the pleasure of the visits. At Santa Rita the committee consisted of Mrs. Horace Moses and Mrs. F. J. Anderson. The Hurley committee consisted of Mesdames F. R. Wicks, G. L. Webster, S. B. Riser, J. F. Anton, J. W. McElvany, Newton Holman, F. M. Brown, R. C. Thompson and David Boise.

Upon arrival at Douglas early Tuesday morning the delegates were met by a military band and transported in automobiles to the Copper Queen smeltery, where a thorough inspection was made before going on by train to the Calumet & Arizona smeltery. Here the new acid plant attracted greatest attention. Its walls and roof are finished and the lead chambers are now being installed. A buffet lunch was given under the blast-furnace dust chamber—a significant commentary on the cleanliness of the plant. Enjoyment was added at this point by the military music played by the artillery band. Both the Copper Queen and Calumet & Arizona companies distributed finely illustrated booklets describing their respective plants and giving data concerning production.

The first technical session of the meetings was called to order at 2 o'clock in the Y. M. C. A. gymnasium, with 175 delegates in attendance, the ladies being conspicuous by their absence. They had been urged to attend by President L. D. Ricketts, but had deserted in a body to enjoy the superior attractions of what is humorously referred to by the men as a "tea fight." The session was opened by President Ricketts, who called upon Walter Douglas to preside. Manager J. C. Greenway of the Calumet & Arizona company, made an address of cordial welcome to Arizona, to which President Ricketts of the Institute responded briefly, "passing the buck" as he termed it, to President Thayer of the Anaconda company, a past president of the Institute. The assembly voted a tribute to James Douglas, from whom a telegram had been received and read.

The subject of this first session was the general one of smelting. More copper-smelting plant construction has been witnessed in Arizona during the past five years than in any like period of the world's history. This statement was made by A. G. McGregor, of Warren, Ariz., in an address on the "New Copper-Smelting Plants in Arizona." Mr. McGregor said that in this period five new plants had been constructed whose monthly production ranges from 5,000,000 to 18,000,000 lb of copper. He described new features in plant design and equipment recently developed. Discussion of McGregor's paper brought from L. D. Ricketts a statement that the preventable loss of recoverable copper due to splashes from a converter during blowing and due to dusting in the charging system is 0.70%. E. P. Mathewson expressed himself as impressed by the cleanliness of the plants visited, the skull crackers, the ventilation system, the provisions made for the safety and health of the men, the convenient plant arrangement and modern steelwork construction.

THE BASIC-LINED CONVERTER

A paper entitled "The Basic-Lined Converter in the Southwest" was presented by L. O. Howard. Discussion of this paper brought out the fact that 70,000,000 lb. of copper has been blown with one basic converter lining owing to its excellent grade of material and to the fact that Howard practically lived with it day and night. E. P. Mathewson said that the disadvantage of the Anaconda type of converter was the considerable splashing, unless care is taken in its operation, due to its deeper placement of tuyeres. The disadvantage of the Peirce-Smith type of converter is the difficulty in getting the silica evenly distributed over the bath of matte. He said that with the Anaconda type, if the heat is kept down to reasonable limits by careful operation, the lining will last almost indefinitely. The superintendent of El Paso smeltery said that the company's old 11-ft. Smith type of converter used 11,000 cu.ft. of air, while the new type of 35-ft. Smith converter used 30,000 cu.ft. of air.

At the evening session, Doctor Morse, of the Western Precipitation Co., presided, the session being devoted to the subject of "Leaching." Frederick Laist and Harold W. Aldrich described the 2,000-ton leaching plant at Anaconda, Mont. "Possibilities in the Wet Treatment of Copper Concentrates" was the title of a paper by Lawrence Addicks, while "Leaching Tests at New Cornelia" was discussed by H. W. Morse and H. A. Tobelmann.

This paper brought out considerable discussion in which Mr. Van Arsdale advanced the opposite view regarding anodes. F. N. Flynn, of the Arizona Copper Co., made the important announcement that the company would start leaching raw flotation concentrates without roasting. He commended the Chino process of dissolving copper by sulphuric acid, then precipitating the copper with iron followed by floating the copper.

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"The Modern Hospital," published from St. Louis and Chicago, devotes its August issue to a symposium on welfare work among the industrial corporations of the country. The journal contains many illustrations of welfare features in corporation plants, and many facts that should be of great help to those interested. Among the topics discussed are those of first aid, industrial nursing, lunches and diets

Dewatering Cobalt Lake

The Cobalt Lake Co., Cobalt, Ont., which is a subsidiary of the Canadian Mining Corporation, undertook to dewater Cobalt Lake, with the object of making accessible ore reserves assumed to exist between the stope-backs and the bottom of the lake. As the water supply for several mills near Cobalt Lake and the Town of Cobalt fire service, as well as several other users depended largely on the water of the lake, an alternative supply had to be provided before undertaking the dewatering. According to the annual report of the company, the plant required for the dewatering of the lake consisted of a 20-in. wire-wound wood-stave pipe line, 3,600 ft. in length, through which water was pumped from Cobalt Lake northerly to Farr Creek; a housed pontoon in the deepest part of the north end of Cobalt Lake, containing two centrifugal pumps and motors of 3,500 gal. per min. each, for the purpose of pumping out Cobalt Lake and keeping it dewatered; two wooden flumes, one on either side of the south end of Cobalt Lake, 2,050 and 1,010 ft. long respectively, for the purpose of conveying the mill tailings and diverting surface water to the sump of the pumping station at the north end of the lake.

The water supply system consisted of a pumphouse on the southwest side of Cobalt Lake, containing two centrifugal fire pumps and motors, each of 600 gal. per min. capacity, and 2,800 ft. of pipe line to Cobalt town. A concrete dam was erected at the north end of Short Lake, 290 ft. long and 20 ft. high for storage water for the mills and fire service. A pumphouse was erected at Short Lake, containing pumps and motors of the following capacities for the water supply of the Cobalt Lake Mill, Cobalt Reduction Co. mill and other mills, and for the fire service: Two centrifugal pumps, 700 gal. per min. each; one centrifugal pump 400 gal. per min., and one centrifugal pump 450 gal. per min. In connection with this service, 5,800 ft. of cast-iron pipe and 600 ft. of spiral steel-riveted pipe was used. A housed pontoon at the north end of North Pickerel Lake, containing one centrifugal motor-driven pump of 3,500 gal. per min. capacity, which discharges through 1,270 ft. 16-in. wire-wound wood-stave pipe, and a closed wooden flume, 1,520 ft. long, into Brief Lake, which empties by a gravity ditch 1,600 ft. long, into Short Lake. A housed pontoon was provided at Bass Lake with one 3,500 gal. per min. centrifugal pump, which discharges through 1,260 ft. of 16-in. wire-wound wood-stave pipe to South Pickerel Lake, which is connected naturally with North Pickerel Lake. Included in the work are several minor dams, cutoff walls and trestle work, also a power line and telephone line. The dewatering of the lake commenced on Apr. 26, 1915, and was completed June 5. To keep the lake dry, the pumps have been operated about half time. On Apr. 19 the water service commenced and was in full operation by Apr. 29. The details of operating costs are given in the table herewith:

DETAIL COST OF DEWATERING COBALT LAKE AND KEEPING IT EMPTY, AND OF NEW WATER-SUPPLY AND LAKE DRAINAGE SERVICES

From Apr. 12, 1915, to Dec. 31, 1915

			Power		Operation			Maintenence and Repairs Pipe Lines and Flumes		Power Line			Superintendence and Other	
Water-Supply	Gallons Pumped	Hours Pumping	Kw.-Hr.	Cost	Labor	Material	Total	Labor	Total	Labor	Material	Total	Expenses	Total Cost
Short Lake to Cobalt reduction mill	340,524,000	5,944	293,815	$3,393.79	$987.19	$15.68	$1,002.87	......	......	.....	....	.....	....	$4,396.66
Cobalt Lake mill	187,262,450	5,666	117,010	1,363.11	393.19	6.24	399.43	......	......	.....	....	.....	....	1,762.54
McKinley-Darragh	123,161,000	5,866	111,885	1,379.69	397.84	6.80	404.64	......	......	.....	....	.....	....	1,784.33
Northern Ontario Light and Power Co.	....	....	......	....	46.20	147.47	193.67	......	......	.....	....	.....	$155.46	349.13
T. & N. O. Ry.	....	....	......	....	......	....	....	......	......	.....	....	.....	784.00	784.00
Cobalt fire service	....	....	......	....	......	....	....	......	......	.....	....	.....	....	....
Short Lake station	....	....	......	....	66.74	210.39	277.13	......	......	.....	....	.....	....	277.13
Pickerel Lake to Brief Lake	480,676,000	2,304	167,830	2,179,42	641.91	141 20	783.11	$44.61	$44.61	.....	....	.....	....	3,007.14
Bass Lake to Pickerel Lake	370,619,500	2,877	170,140	2,439.32	803.68	284.17	1,087.85	......	......	.....	....	.....	....	3,527.17
Montreal River to Bass Lake	....	....	......	....	......	....	....	......	......	.....	....	.....	....	....
Sundry service	....	....	......	....	170.99	64.48	235.47	......	......	$74.10	$5.66	$79.76	690.50	1,005.73
Total	....	....	860,680	$10,755 33	$3,507.74	$876.43	$4,384.17	$44.61	$44.61	$74.10	$5.66	$79.76	$1,629.96	$16,893.83
Lake Drainage														
Cobalt Lake pumping plant	946,008,000	2,590	454,700	$6,849.91	$2,486.98	$1,217.15	$3,704.13	......	......	.....	....	.....	....	$10,554.04
Surface drainage	....	....	......	....	......	....	....	$111.65	$111.65	.....	....	.....	....	111.65
Sundry	....	....	......	....	......	....	....	38.39	38.39	.....	....	.....	....	38.39
Total	....	....	454,700	$6,849.91	$2,486.98	$1,217.15	$3,704.13	$150.04	$150 04	.....	....	.....	....	$10,704 08
Grand total	....	....	1,315,380	$17,605.24	$5,994.72	$2,093.58	$8,088.30	$194.65	$194.65	$74.10	$5.66	$79.76	$1,629.96	$27,597.91

The books of the company show for 1915 an expenditure of $56,222 for Cobalt Lake drainage and $15,520 for Cobalt Lake drainage operation.

NEW PATENTS

United States patent specifications listed below may be obtained from the "Engineering and Mining Journal" at 25c. each. British patents are supplied at 40c. each.

FURNACE—Metallurgical Furnace. Utley Wedge, Ardmore, Penn., assignor to The Furnace Patent Co., Philadelphia, Penn. (U. S. No. 1,195,425; Aug. 22, 1916.)

INGOT-DELIVERY CAR. Albert Soderstrom, Homestead, Penn. (U. S. No. 1,195,522; Aug. 22, 1916.)

IRON ALLOY—Process of Producing an Iron Alloy Rich in Phosphorus from Inferior Finery-Slag. Friedrich von Holt, Georgsmarienhütte, near Osnabrück, Germany. (U. S. No. 1,196,185; Aug. 29, 1916.)

LAMP—Acetylene Lamp. John M. Brock, Brooklyn, N. Y. (U. S. No. 1,193,985; Aug. 8, 1916.)

LEACHING—Method of Extracting Metals from Their Ores. Henry B. Slater, Riverside, Calif. (U. S. No. 1,195,616; Aug. 22, 1916.)

MOLDS—Manufacture of Molds for Steel. Charles G. Robinson, Pittsburgh, Penn., assignor to Harry E. Sheldon, Pittsburgh, Penn. (U. S. No. 1,191,473; July 18, 1916.)

REDUCTION—Art of Reducing Metal Ores and Fusing Other Materials. Charles B. Hillhouse, New York, N. Y. (U. S. No. 1,193,783; Aug. 8, 1916.)

ROASTING FURNACE—Securing Rabble Arms to Shafts. Louis R. Kelley, Philadelphia, Penn., assignor to the Furnace Patent Co., Greenwich Point, Philadelphia, Penn. (U. S. No. 1,195,360; Aug. 22, 1916.)

STAMP MILL. Richard Raycraft, Genoa, Nev. (U. S. No. 1,195,855; Aug. 22, 1916.)

STEEL—Method of Producing Steel and High-Phosphorus Slag. Anson W. Allen and Eugene Guy Lilly, Birmingham, Ala. (U. S. No. 1,193,496; Aug. 8, 1916.)

TIN—Improvements in the Electrolytic Refining of Tin. American Smelting and Refining Co., New York, N. Y. (Brit. No. 11,818 of 1915.)

TIN—Process for Removing Iron from Tin Ores. Günzel von Rauschenplat, Steglitz, Germany, assignor to Parilla Ltd., London, England. (U. S. No. 1,196,049; Aug. 29, 1916.)

TITANIC OXIDE—Method of Treating Titanic Oxide. Auguste J. Rossi and Louis E. Barton, Niagara Falls, N. Y., assignors to The Titanium Alloy Manufacturing Co., New York, N. Y. (U. S. No. 1,196,030; Aug. 29, 1916.)

TITANIUM COMPOUND. Auguste J. Rossi and Louis E. Barton, Niagara Falls, N. Y., assignors to The Titanium Alloy Manufacturing Co., New York, N. Y. (U. S. Nos. 1,196,029 and 1,196,031; Aug. 29, 1916.)

Editorials

A Cadmium Myth?

During the last two years, while the spelter market has been so greatly excited, there has been an extraordinary demand for superior spelter and buyers have emphasized the desirability of a minimum content of cadmium. Extremely fine points have been drawn. Certain brands of spelter that in lead and iron content are not inferior to the premier have failed to come into the class of high-grade spelter, owing to the presence of a few hundredths of a per cent. of cadmium, and have therefore been rated as high-grade intermediate, realizing a price far below that of high-grade although far above that of brass special. Producers have striven to supply spelter free or nearly free from cadmium, owing to the demands of buyers. So long as the latter were willing to pay largely for a refinement, it was not for the producer to question whether the refinement was necessary or not. In the minds of manufacturing experts, however, there has long been a doubt whether the objection to cadmium is well founded, and whether indeed it is not mythical.

Many years ago—long before anybody dreamed of the recent extraordinary military demand for spelter—the *Journal* published some editorials on the subject of cadmium in spelter used in brass making, which were based on conferences with and communications from a considerable number of representative brass makers. The conclusion was reached then that a moderate percentage of cadmium—as much as is ever found in any American spelter—was not prejudicial to the use of the metal for brass making. Since the manufacture of cartridge brass has become a major industry we have been told, however, that the spelter for such brass must not contain any cadmium. The latter, it is said, causes the brass to deteriorate in storage, to become porous, likely to split, etc. We should like to know what good evidence there is on this subject. None has come to our attention beyond the mere assertion. As a matter of fact, cartridge brass has been made successfully from spelter containing 0.3 to 0.4% of cadmium. Indeed, when such spelter is used there is no cadmium in the brass, anyhow.

Cartridge brass is ordinarily cast at a temperature considerably above the boiling point of zinc, which is far above the boiling point of cadmium, and the latter element naturally eliminates itself. The most careful analytical work on brass made from spelter containing 0.3 to 0.4% cadmium does not show a trace of cadmium, either qualitatively or quantitatively, in the alloy. If any reliable chemist has facts to the contrary, we should like to hear from him.

Of course, when spelter containing as much as 0.4% of cadmium is used for brass making, the loss in melting is increased by just so much, and the brass maker does not like to pay at spelter price for a metal that he is going to lose inevitably. However, with trifling percentages of the impurity that objection is minimized and, anyway, is not a good reason for the payment of a large premium for the absence of it.

If cadmium can be caused to remain in the brass, which, as previously pointed out, is not the easiest thing to manage, a considerable quantity of it—say 0.75% and upward—has some hardening effect. Furthermore, cadmium and lead occurring together in quantities of that magnitude render the brass somewhat sensitive to heat treatments, on account of the low melting point of alloys that may be formed. Brass of such sorts would have to be made deliberately.

The Zinc Committee of the American Society for Testing Materials is very guarded with respect to its statements regarding cadmium. That committee says: "There is very little doubt but that cadmium in zinc is very injurious for some of the purposes for which it is used, as it renders it harder and much more brittle. There is, however, considerable difference of opinion as to how far these undesirable properties persist in alloys made from zinc containing cadmium. The majority of the brass makers are of the opinion that the high temperature of the brass pots causes so much of the cadmium to volatilize that the residual amount has very little deleterious effect. . . . We have no reliable information at present showing the effect of small amounts of cadmium on the alloys, and the evidence on this point is extremely conflicting."

There is no doubt that even a minute percentage of cadmium is unpermissible in spelter that is to be used for making ornamental castings—"slush castings" as they are called in the factory. Spelter that is practically free from cadmium is also required for galvanizing telegraph and telephone wires that are to withstand sharp bending when making the "lineman's splice," for it has been found that otherwise the coating cracks and peels off the joints. For sheet-zinc rolling also, cadmium in spelter is undesirable, causing such severe cracking that metal containing much of it is not economical. The objectionability of cadmium for those three purposes has been well established. Beyond those nothing has been firmly established. None of the three uses of spelter herein mentioned is a military use. We should like to hear from some military engineers why they are so insistent upon spelter very low in cadmium and what they do with it.

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The Cyaniding of Flotation Concentrates

The problem of cyaniding flotation concentrates has been treated academically a number of times in the technical press, but no one seems to have gone into it thoroughly on an experimental basis. The fact is that up to this time there has been no occasion to regard the matter in other than a theoretical light. It has been realized, of course, that some day the problem will have to be solved, but the real necessity for its solution had not yet appeared.

In the United States the greater portion of ores treated by flotation have been copper, lead and zinc, while few applications to silver or gold ores have been noted, and even in these cases the situation has been close enough to smelting plants so that there would be no difficulty in shipping the material produced—a cheaper and easier process than attempting to cyanide it. Should flotation be adopted, however, by isolated plants situated far from a railroad and a long way from smelting plants, then the problem is different and has to be solved on its merit. Particularly is this the case with the Mexican silver mills, where silver usually exists as a sulphide, the whole ore heretofore having been treated by the cyanide process.

The experiments upon Santa Gertrudis ores, showing that flotation is a decidedly promising process for those ores, will undoubtedly stimulate application of the process at many other Mexican plants. In many cases they are too far from smelting plants to allow of economical shipment, so that the problem of cyaniding the concentrates produced must be solved.

The first problem in cyaniding flotation concentrates—in fact, the only one—will be a decision as to whether contained oils will be detrimental to cyaniding. If they are, they will have to be eliminated by some means, whether by roasting or by washing out with hot water or alkaline solutions. After that, the cyaniding of flotation concentrates becomes the same as the cyaniding of any other concentrates. Such work has been successfully done at many places, and there is no reason to believe it cannot be done with flotation concentrates, once the question of what effect the oil has in the matter is settled.

The Taxation of British Mining Companies

It has previously been suggested that the effect of the super-tax on mining companies with head offices in Great Britain and in other warring countries might result in a change of domicile, particularly for companies in which there are large foreign interests. A case in point has just come to our notice. Aramayo Francke Mines, Ltd., has decided to move its main office from London to Geneva, Switzerland. This company has important mines in Bolivia and produces silver, tin, tungsten, bismuth and copper. As some of the principal shareholders reside in other places than in England, it was felt that the super-tax resulting from the war was hardly justified in its application to these holdings, notwithstanding that the company is a registered British corporation. In making the change in headquarters, various neutral countries were considered, including Spain and Argentina; in the former the laws were found to be unsatisfactory, while Buenos Aires was discarded as being too far from the market for the company's products. Switzerland offered all the advantages of other neutral countries, besides favorable laws, practical political isolation and comparative impregnability.

There may be a sentimental or patriotic objection on the part of British shareholders to removing the headquarters of the company to Switzerland, but as a matter of fact there will be a slight financial benefit to them in this change, inasmuch as the heavy war taxes will not be deducted in Switzerland from the general profits available for dividends, though British holdings will of course still be subject to income tax and dividends will be paid, as heretofore, ex-income tax. It seems unlikely that any companies operating in the warring empires will be able to change their headquarters to elude taxes, as it is probable that such a movement would be prohibited or new regulations enforced to collect the equivalent taxes at the source of production. However, in the case of companies operating in foreign countries and in which there is a considerable foreign interest, there are sound reasons for the change of headquarters.

China as an Exporter of Ores and Metals

The report of exports from China, as given by the Imperial Maritime Customs, shows some interesting things as to how that country is gradually entering the markets of the world with its exports of ores and metal. Most important, in point of value, is tin, the exportation of which in 1915 amounted to 8,825 tons, compared with 7,948 tons in the previous year. Next in importance is antimony. Of the metal there was exported in 1915, 25,746 tons, compared with 21,648 in the previous year. On the other hand, the exportation of ore declined from 5,479 tons in 1914 to 1,843 tons in 1915, this reflecting the increased tendency of the Chinese to smelt their ore at home. China has now become the most important of the world's producers of antimony.

China is making small exports of iron, lead, lead ore and quicksilver, but she imports a great deal more lead than she exports, and she imports a good deal of copper, which she does not export at all. The Chinese imports of iron and steel are chiefly the manufactures thereof. Very interesting is the report respecting zinc. Of zinc ore there was exported 8,126 tons in 1914 and 9,415 tons in 1915; of spelter, 342 tons in 1914 and 2,566 tons in 1915; of all other forms of zinc, 2,175 tons in 1914 and 9,872 tons in 1915. Respecting the last we do not understand what forms of zinc are meant. The fact that China should be exporting any zinc is interesting. Probably it comes from the small native furnaces, the prototypes of the art, that we have mentioned in recent articles. Japan has already become a rather important producer of spelter. China may become so in the not distant future. The enterprise of the leading Chinese mining and metallurgical men is well exemplified by the fact that they produce antimony by better methods than prevail anywhere except at a few works in France.

Some Thoughts About Foreign Investments

Foreign mine owners in Mexico are now threatened with a new danger by Carranza, who proposes to increase to a confiscatory rate taxes on developed mines in certain districts if not put into operation within 60 days, the ostensible purpose being to give employment to idle Mexicans. American companies have appealed to the State Department to protest against the new decree, but what good is going to do? There is not a company owning a mine in Mexico, we venture to say, that would not like to work it if it dared.

In no similar period in the history of the United States has so much legislation been enacted with the possibility of such far-reaching effect on the foreign relations and trade of the country as in the last two weeks, says a contemporary. This legislation is in the Shipping Board law, passed by Congress Aug. 30 and signed by the President on Sept. 7, and in the Omnibus Revenue bill, passed by Congress Sept. 8 and now awaiting the signature of the President.

We believe it is true that the present administration has been making strenuous efforts to extend American trade in foreign countries. Suppose it succeeded in doing so within a year, and then in some country—Bœotia, let us say—anarchy developed—like that in Mexico—would it tell American investors that they went there at their own risk and there be nothing to do about it?

BY THE WAY

A cargo of copper, which was said to be the largest ever shipped here, was brought into this port yesterday by the American steamer "Sherman," on her arrival from Valparaiso, Antofagasta and Cristobal, says the New York *Sun*, Sept. 17, 1916. The shipment, which consisted of refined product, was valued at more than $4,000,000. It weighed 5,500 tons and was shipped in care of the American Smelters Steamship Co.

⁂

The romance of mining, like the glamor of soldiering, is rapidly becoming a thing of the past. On Sept. 14 prohibition was adopted in the Yukon Territory by popular vote, and it is noted with some surprise that the largest majorities in its favor were in the mining districts. The disappearance of the typical miner of the old school, as depicted by Bret Harte and Service, recklessly blowing in his gold dust in the saloons, dancehouses and gambling dens, is doubtless due to the exhaustion of the placer mines and the adoption of modern methods under which the working miners' possibilities of sudden enrichment have vanished.

⁂

Two mining scholarships, said to be the first of the kind in England and worth £60 a year each, are to be established by the Weardale Lead Co. According to the *Financial Times*, the object is to combine university training with a year's practical work, calculated to advance the student in the knowledge of mining engineering. One of the scholarships is at the Royal School of Mines and the other at Armstrong College, Newcastle. The Weardale Lead Co. owns a lease of lead mines and smelting works near Weardale, Durham, and produces about 4,000 tons of pig lead yearly. The lease embraces an area of 80 sq.mi. and is for sixty years from 1883.

⁂

In a crowd of job "rustlers" surrounding a Butte shaft the other day stood a typical Swede. Inwardly concerned as to how he should hold down a job if successful, he was intently observing the details of work about the shaft. In the pursuit of such useful details as might come handy, he followed a trammer as he pushed a car of waste to the dump. The trammer was apparently nervous, for the car under observation escaped his control and went over the dump just as the foreman came along. With characteristic Celtic decision, the boss promptly fired the trammer on the spot and grabbed the first man handy to fill his place. So the Swede suddenly acquired a job, and the foreman headed for the office in blissful confidence. A half-hour later that confidence was rudely jolted by hearing at his elbow in Swedish drawl, "Aye say, boss—you bane got any more dose leedle wagons?" Hasty investigation enlightened the boss that, working true to his one observation, the Swede had loaded all the cars at the shaft one by one and pushed them over the dump.

⁂

The author of an article in the *Journal*, some time ago, made use of the metaphor, "between the devil and the deep sea," but said that a mill operator was "literally" in that position. This called forth a protest from England, in the following form:

"If he was literally there, both devil and deep sea must have been visible. You should have given a photograph—an authentic likeness of Satan would be interesting. Seriously, when I see people misuse the word 'literally' in this way, I, as part owner of the English language, feel as if someone had used my best razor to chop firewood. For there is, literally, no other word which can do the work of 'literally,' and habitual misuse of it threatens to leave us with no word at all to do its work. For instance, in most quarrels 'there are faults on both sides' metaphorically, but at the Menai Straits there are literally 'faults on both sides,' geological faults."

Very true—but, isn't the example a little "faulty"? How many kinds of faults are there, and isn't one just as "literal" as the other? However, "be to her faults a little blind!"

⁂

An ex-mining broker was being bombarded with arguments from a man who had read the article of a prominent economist on conditions after the war, says the *Evening Post*. After the man had finished, the ex-mining broker, little suspected of entertaining thoughts on anything outside his narrow field, replied: "You have omitted the most important economic effect of the war. I mean its effect on character. You will remember that before our Civil War the South was in a backward state, and even the North was not so greatly advanced industrially. But when the armies of the South and North were mobilized, there came into those armies men who had followed a plow or had stood behind a counter in a small shop. These men were rustics; many of them had ability, a few of them had genius; but that ability and that genius had lain dormant, because the men were tied to their daily routine or lacked the courage to start afresh. The war broke violently into this routine; contact with men from other parts of the country tore down provincialism; the men learned of other opportunities; and when the war came to a close these men were compelled to make a fresh start. They did it. They went West. They built up the railroads. They started new enterprises. They had gained the courage, the nerve, which formerly they had lacked. The same thing is happening in Europe. Rustics are fighting side by side with men of the cities; most of the men have traveled farther from home than they have ever been before. They are no longer rustics; they are cosmopolitans. To a backward, largely agricultural country like Russia this means much. I should not be surprised if after the war we were to see in these countries a great moral and intellectual, which must ultimately be a great industrial, awakening. What that will mean for our industry and our foreign trade it is difficult to say, but the effect will not be small."

PERSONALS

Lloyd E. LeDue has gone to Vanadium, Colo., from Arizona.

C. V. Rodes has gone from Joplin, Mo., to Charleston, W. Va.

D. P. Mitchell is expected to arrive in New York in October.

Elwin L. Smith recently at Granby, Mo., is now at Ray, Arizona.

G. H. Cox lately at Rolla, Mo., is now located at Tulsa, Oklahoma.

B. S. Harrold is now at Westover, Va. He was recently at Skagway, Alaska.

Ellard W. Carson is now with the Alpine Quicksilver Mining Co. at Hernandez, Calif.

H. H. Knox is about to sail for England, whence he will go to Siberia on professional work that will occupy him about three months.

Arthur K. Adams, recently of El Paso, Tex., has been appointed geologist for the Andes Copper Co. and has sailed for Chañaral, Chile.

Edwin S. Berry, who has joined Pope Yeatman as a partner, sailed for Peru Sept. 16 in connection with mine examination work in that country.

W. H. Staver has moved his office to 1412 Massachusetts Ave., Washington, D. C. Mr. Staver has been examining mining properties near Silver Plume, Colo.

Fred Hellman, general manager of the Chile Copper Co., has been appointed consulting engineer by the firm of Guggenheim Brothers, succeeding Pope Yeatman.

Samuel D. Nicholson, manager of the Western Mining Co., Leadville, who has been a candidate for the republican nomination for governor of Colorado, was defeated at the state primaries.

Lyon Smith has resigned his position as metallurgist with the Snyder Electric Furnace Co., of Chicago, to become assistant superintendent for the River Smelting and Refining Co., Florence, Colorado.

G. H. Cunningham has resigned his position as superintendent of construction with the Anaconda Copper Mining Co. to become chief engineer for the Electrolytic Zinc Co., of Australia, at Hobart, Tasmania.

Professor Lawrence Martin, of the University of Wisconsin, assisted by F. T. Thwaites, had a class of 22 men doing field work in geology and geography in the Devil's Lake region (Wis.), during the month of August.

W. L. Honnold, the well-known mining engineer, who has been assisting Mr. Hoover in the Belgian relief, has come to New York to succeed Capt. J. F. Lucey as director of the Commission in America. Mr. Honnold is quoted as saying: "If the children of Belgium and northern France are to grow to healthy maturity, they must be provided with more food than is now supplied to them, and to this end the Commission for Relief in Belgium will soon ask the people of the United States to give at least $1,000,000 monthly toward the cost of a special meal which will be served every day in the schools." Just before he sailed for America, Mr. Honnold inspected conditions in the occupied areas and he says that the Commission must increase its activities on behalf of the children, and, particularly, must combat an alarming increase of tubercular troubles among both children and adults.

OBITUARY

Alexander Watson Black died at his home in Pittsburgh, Sept. 17, aged 69 years. He was born and educated in Pittsburgh and was actively engaged in steel manufacturing until his retirement from business a few years ago. He was for 20 years with the Park Brothers Steel Co., being general manager for a large part of the time. He was one of the organizers of the Pittsburgh Crucible Steel Co., and for some years a director. He was a member of the Pittsburgh Club and was connected with several charitable organizations.

John A. Beekman, for many years connected with the Lidgerwood Manufacturing Co., died at his home in Plainfield, N. J., Sept. 11, aged 73 years. Mr. Beekman was born at Somerville, N. J. About 1870 he engaged in the manufacture of rotary engines, pumps, etc., being a member of the firm of John A. Lighthall, Beekman & Co., with works at Imlay St., Brooklyn, N. Y. This company was absorbed by the Lidgerwood Manufacturing Co. in 1873, Mr. Beekman assuming charge of the works of that company. He was the inventor of many improvements in hoisting engine design. Mr. Beekman gradually withdrew from active participation in business about 10 years ago, devoting his later years to outdoor pleasures, becoming an enthusiastic motorist and golfer, being a member of several golf clubs, and a familiar figure on the golf course at Pinehurst, N. C., where he spent his winters. For many years Mr. Beekman had been a member of the American Society of Mechanical Engineers. His death is keenly felt by his surviving family, and by many of the men with whom he was formerly associated.

SOCIETIES

National Safety Council—The annual meeting and congress will take place in Detroit Oct. 17 to 20. We have received a copy of the program—40 pages long—and containing the names of 140 speakers. The development of the Council's work has indicated the need for intensive study of the problems of various industries, so that the main feature of the meeting this year is Sectional conferences. For instance, the Mining Section will meet Oct. 18 and 19, with H. M. Wilson of Pittsburgh as chairman and H. M. Wolflin of the Bureau of Mines as secretary.

Institute of Metals—At the annual meeting in London, Sept. 20, Sir George T. Beilby presided and the following papers were read and discussed: (1) "The Allotropy of Silver." By Dr. W. D. Helderman, Utrecht University, Holland. (2) Note on "Cadmium in Spelter." By W. R. Ingalls, New York. (3) "The Annealing of Arsenical Brass containing 61 and 62.5% of copper. A Study of the Structure and Properties Developed by Varying the Rate of Cooling within the Transformation Range." By C. H. Mathewson and E. M. Thalheimer, Yale University, U. S. (4) "The Development of the Spelter Industry." By Ernest A. Smith, Sheffield, England.

INDUSTRIAL NEWS

From Sept. 5 the offices of the Pacific Tank and Pipe Co., the National Mill and Lumber Co. and the Mercantile Box Co. are again at the old location, No. 318 Market St., San Francisco.

The **Brennan Engineering Co.**, Chicago announces that the business has been incorporated under the name of the Brennan Wahl Co., consulting engineers. Daniel A. Brennan is president; Andrew G. Schneider, vice-president; Henry R. Wahl, secretary-treasurer.

Hammond Iron Works, Warren, Penn., has made an arrangement with Wonham, Bates and Good, 17 Battery Place, New York, by which the latter represent the Hammond Iron Works in Cuba, Argentina, Brazil and British Columbia. The Hammond Iron Works manufactures steel tanks and general steel plate work.

TRADE CATALOGS

Jaw Crushers. Traylor Engineering & Mfg. Co., Allentown, Penn. Bulletin J-1. Pp. 22; 7x9½ in.;, illustrated.

Pelton-Doble Centrifugal Pumps. The Pelton Water Wheel Co., San Francisco,. Calif. Bulletin No. 9. Pp. 8; 6x9 in.; illustrated.

Welding and Cutting Equipment. Searchlight Co., 415 Karpen Building, Chicago, Ill. Catalog No. 12. Pp. 32; 6x9 in.; illustrated.

Grinding Machinery. Colorado Iron Works Co., Denver, Colo. Pamphlet No. 31. Pp. 32; 6x9 in. Describes ball and tube mills, grinding pans, etc.

"Ironclad-Exide" Battery for Storage Battery Mine and Industrial Locomotives. The Electric Storage Battery Co., Philadelphia, Penn. Bulletin No. 159. Pp. 8; 8x10½ in.; illustrated.

Burd Piston Ring Directory. Burd High Compression Ring Co., Rockford, Ill. 1916 Edition of piston ring sizes for automobiles, trucks, tractors, engines, etc. Pp. 180; 4½x6½ in.; illustrated.

"Better Electric Motors." S. K. F. Ball Bearing Co., Hartford, Conn. This is the title of a pamphlet which describes the application of S. K. F. bearings to electrical machinery. Pp. 62; 6x9 in.; illustrated.

Fuel Oil Appliances. W. S. Rockwell Co., 50 Church St., New York. Bulletin No. 31. Pp. 28; 8½x11 in. This contains considerable information on the burning and handling of fuel oil which ought to be useful to those interested.

Editorial Correspondence

SAN FRANCISCO—Sept. 13

Gold Dredging Is Active in all the California fields and a number of the established companies are adding to their gold fleets. Construction on Yuba No. 16 is to be started this month and Pacific No. 5, a Guggenheim boat, near Smartsville, has been launched and construction is going forward. The Guggenheim interests are prospecting some ground on the north fork of the American River, near Auburn. The situation on middle fork of the American River, near Auburn, where a Guggenheim dredge and the Poverty Flat dredge are operating, is worth looking into again. At Chico a Guggenheim dredge and the Wade dredge are operating. At Oroville, the Natomas Co. has started prospecting the tailings with a view of ascertaining whether it will be worth while to redredge a part of the Oroville field. At Natoma, old No. I, which is being rebuilt, is nearly ready for commission; No. 4 which was reconstructed with two tailing stackers has been improved and is now successfully doing the work of reclamation; a number of Natomas dredges are being equipped with Neill jigs in accordance with the installation on No. 7; this boat turned over a while ago but has since been righted.

BUTTE—Sept. 14

Anaconda's New Zinc Plant at Great Falls was sufficiently completed to place the first section of the electrolytic refinery in operation on Sept. 11. Construction was begun last December and could have been completed in August, but for delay in delivery of machinery and steel. When completed the plant will have a capacity of 70,000,000 lb. of zinc annually and will have cost about $2,000,000.

Supply of Labor Is More Plentiful, with the advent of cold weather. The usual rush of men into Butte has begun. Every day the line of "rustlers" at the various mines is lengthening and more men are seeking jobs at present than at any time for months. Many of the rustlers are old-time miners who during summer work in the hayfields for the sake of being out in the open. These men, as a rule, get their places back. But among the applicants are hundreds of men who have never been in a mine and have drifted into Butte, attracted by the prevailing high wages and in the hope of finding employment in the mines. As there are plenty of men in Butte for the work now being done, the influx of job seekers has swelled the number of unemployed and unemployable in Butte to a high point.

The Mine Experiment-Station Site for the Northwest still remains undecided. While no definite announcement has been made as to the final location of the station, Butte is among the sites under consideration, offering as it does besides local advantages, the laboratory facilities and other equipment at the School of Mines as well as the aid of the students. Those in charge of the station would find these advantages of great assistance in carrying on the work contemplated by this department of the government. Moreover, the many interesting problems to be solved every day in the normal operations of the Butte mines and the reduction works at Anaconda and Great Falls, would present a constant stimulus for most interesting research work. While Butte is too busy with its own multitudinous tasks to make a formal campaign to obtain the station, if selected as the site, it wil give its hearty support to those in charge of the station.

Barnes-King Prospects are again interesting stockholders who have had a long period of gloom. Officers of the Barnes-King Development Co. are well satisfied with conditions at the properties and the showing made in the new mines, but the passing of the dividend and the decreased earnings shown by the monthly statements are not so encouraging to stockholders. The last report shows that the estimated value of the bullion produced in August was $330,000 from 2,511 tons of ore, the North Moccasin mine yielding $15,000 from 1,713 tons and the Piegan-Gloster and Shannon mines $18,000 from 1,300 tons of ore. There has been no improvement in the bottom workings of the North Moccasin, where the vein has been narrow and of low grade for several weeks, but it is stated that the showing in the upper workings is better than a month ago. The winze from the 500-ft. level of the Gloster was unwatered and the 498 ft. of old workings at the bottom—300 ft. below the 500-ft. level—were cleaned up and sampled, but the appearances were not encouraging. The west drift on the 400 was driven 111 ft. during the month, and for the last 30 ft. the ore assayed $8 per ton for a width of $4\frac{1}{2}$ ft. The rope tramway at the Shannon mine is in operation and a good production from the property may now be expected, according to the official statement. The wagon road from the Woodrow Wilson mine to the county road, a distance of 3 mi., has been completed and shipments of ore from that property began on Sept. 1. Nothing is being done at the old Barnes-King mine, which adjoins that of the North Moccasin in the Kendall district.

DENVER—Sept. 12

Specimen Identification will be continued at the Colorado School of Mines, but free assaying was discontinued on Sept 1. A year ago there was established a fund providing for a department for testing and identifying specimens sent in by prospectors. During the first year more than 5,000 samples and specimens were thus classified or assayed. The duties of the department became so great that most of the fund has been exhausted and no assaying is now being done, although specimens will be identified and statements will be written concerning the probable commercial value of each sample submitted.

Tungsten Mining continues a prominent industry in Boulder County although it does not possess the glamor it had a year ago. A prominent assayer in Boulder, however, reports that his office still does a heavy business in tungsten assays. This indicates that prospectors and leasers are paying closer attention to the grade of ore they select for shipment and have become economical, instead of profligate, as formerly, in saving and seeking only high grades. The Degge-Clark tungsten mill in Boulder Cañon is operating at capacity although this and the other mills do not turn out as large quantities of concentrates since they have been operating on lower grade ores.

Safety Rules for the Cripple Creek District have been published by Mine Inspector M. J. McCarthy. The list is a long one and includes, among other requirements, the following: Winzes and raises must have at least two compartments; hoisting conveyances must not be filled to overflowing; wooden buildings must never be erected over mine mouths; ventilation must be ample; safety clutches, detaching hooks and automatic engine-stops must be installed; worked-out stopes parallel to working stopes must be filled with waste; landings at not to exceed 20 ft. apart must be placed in all ladderways; bulkheads and chain ladders must be provided in bottoms of all shafts and winzes during sinking; solid doors instead of guard rails must be erected at shaft collars and at shaft stations.

LEADVILLE, COLO.—Sept. 15

Another Gold Dredge is to be installed near Leadville. John R. Champion, former superintendent of the Yak Mining, Milling and Tunnel Co., has completed plans for the operation of a dredge in the mouth of Iowa Gulch. Prospect shafts of from 10 to 15 ft. in depth are reported to have indicated values of 45c. to $1.50 a yard. The problem of securing sufficient water to float the boat is now delaying the enterprise, but Mr. Champion has stated that this will be taken care of in some way within the coming month. The Champion dredge will be the second to enter Lake County. The boat now being operated by the Derry Ranch Gold Dredging Co. on Box Creek has proved to be a remarkable success, and the gravel at the mouth of Iowa Gulch is claimed to be equal to that being dredged on the old Derry ranch.

Sluicing in California Gulch at Leadville is again in progress but the objective is quite different from the one that caused the settlement of this district a half century ago. Today, zinc and lead minerals are sought and gold is no longer uppermost in the thought of Leadville's residents. A small group of Leadville men, headed by Dr. Max Raabe, a practicing dentist, has been testing the alluvials in California Gulch, practically within the city's limits and enough of the ground has been handled to prove that it can be made the basis for successful commercial operations—upon a relatively small scale to be true. These men have a long lease upon a fairly large tract of this gulch extending from below the site of the dismantled Union smeltery up to the big trestle of the Colorado Midland R.R. Beside proving the value of the loose ground by test pits spaced 50 ft. apart, several carloads of concentrate have been recovered by the simplest kind of apparatus. A small sluice supplies creek water for a small two-compartment jig into which is fed the alluvial material without any sorting or screening. The efficiency is low, the concentrates averaging only about 20% zinc and 6% lead. Experiments are being made to increase the capacity of the project as well as to improve the recovery. It is believed that the installation of simple, standard types of concentrators and some devices for breaking up the compacted gravel, sand and minerals will be sufficient. Within a short time, it is expected that a steady production of 40% zinc concentrates will be the result of this project. Three different types of jigs have been tried, each machine driven by a small gasoline engine. The minerals—sphalerite and galena—unquestionably came down the gulch from the mills near the portal of the Yak tunnel. Interesting facts concerning this "tertiary" enrichment are that the sulphide minerals are not on bedrock and, despite their exposure to weather, are practically unoxidized.

Empire Zinc Co. on Oct. 1 will take over the active operation of the large area of mining property purchased last summer from the Small Hopes-Boreel Mining Co., including the Robert Emmet, McCormick, Ranchero, and Gonabrod claims in Stray Horse Gulch. This tract is in one of the promising sections of the district; since the draining of the territory was recently completed through the Wolftone shaft by the Empire Zinc Co. and the Western Mining Co., it offers unlimited possibilities for deep mining. At present the Robert Emmet is shipping 100 tons of high-grade zinc-lead ore daily. It is stated that the orebodies now open in this property are the largest in the district with the possible exception of the Garbutt. The Empire Zinc Co., which is under the local management of Charles Bargler, has erected a new surface plant and installed new electric-hoisting machinery at the McCormick shaft. A request has just been made of the Denver & Rio Grande Ry. to lay 600 ft. of standard-gage track to the McCormick to handle the large tonnage of ore that is to be shipped beginning early next month. After all preparations have been completed it is reported that the Emmet and McCormick will ship a combined tonnage exceeding that of any property in the district.

SALT LAKE CITY—Sept. 15

Utah Coal Mines are at present receiving more orders than at any time in three years, according to production reports being received by J. E. Pettit, state coal-mine inspector. Difficulty is experienced by some of the mines in getting enough cars to move their output. Prices of coal recently submitted by Salt Lake dealers to the board of education were: Lump, $5.75; nut, $5.25; screened slack, $3; dust, $2.50.

The Cottonwoods and American Fork are receiving more attention from the United States Geological Survey. F. S. Ransome, geologist in charge of the Economic Branch of the Survey, is in Alta supervising and working out some of the more difficult geology with B. S. Butler, who has been on the ground for some time. A thorough report with detailed work on some of the complicated structural features of the district will be welcomed by the Utah mining men.

New High Records by Utah Copper Co. were attained during August, both in the mining and milling departments. On one day 45,275 tons of ore were mined and loaded on the cars. The Magna and Arthur mills, which were built to handle 12,000 and 8,000 tons respectively, handled in one day 40,300 tons or about twice their rated capacity. The average tonnage milled during the month was 36,000 tons daily, and the ore and overburden handled averaged 67,000 tons a day for the month.

Bondholders' Reorganization Plan for Ohio Copper has been sent to stockholders by the bondholders' protective committee, 43 Exchange Place, New York. A substantial cash royalty has been accumulated, and the bondholders now find themselves in a position to reorganize and readjust the affairs of the company. The plan of reorganization adopted by the bondholders, June 8, 1916, provides that the bondholders in exchange for their bonds and coupons will receive bonds and stock of the new company to be organized as follows. Seventy-five per cent. of the principal in new bonds and 25% of the principal in new stock. The bondholders of the Bingham Central Ry. Co. shall be given the privilege of participating on the basis of 46½% of the principal of their bonds. Stockholders of the Ohio Copper Co. or Bingham Central Ry. Co. are given a right to subscribe at par, and accrued interest, for an aggregate of at least $250,000 in bonds of the new company and with the bonds will receive a bonus of 1½ shares of stock of the new company, par value $1, for each dollar of bonds so subscribed and allotted. The bonds will be registered 6% income bonds, which may become convertible into stock at par at such time as the committee shall determine. At least 25% of the net income of the new company shall be applied annually in payment of the principal of the bonds outstanding. Any stockholder who desires to avail himself of the privilege of subscribing for these new bonds may exercise his privilege by depositing his stock indorsed in blank with the secretary of the committee, H. G. Catrow, and at the same time paying in cash 10% of the face amount of bonds subscribed for. If the committee is unable to carry out the plan it will return to any deposting stockholders any certificate delivered to it together with the cash received from such stockholders, with interest at rate which shall have been allowed thereon by its bank of deposit. The right to accept the plan expires Sept. 30, 1916. Stockholders in New York are endeavoring to get together and start action in behalf of the minority stockholders. The majority stockholders are also the majority bondholders. Stockholders in Salt Lake met Sept. 14, over 50,000 shares being represented. An outline of the troubles of the company as issued by the North American Liquidation Co., behind the move of the stockholders, was read, and the meeting asked for suggestions as to what action should be taken. A committee consisting of George Baglin, J. R. Whitney, and W. M. Havenor, was appointed. This committee met later and chose Frank B. Cook as the representative of local stockholders. The committee will urge all local stockholders to coöperate on whatever plan of action is decided on. Stockholders' meetings are to be held today in both New York and Boston.

JOPLIN—Sept. 16

Record Ore Sales from the veteran Oronogo camp were claimed during the week by the Oronogo Mutual Co. It sold a total of more than one million pounds of blende and galena, all of which had been made by one mill in two weeks' run.

Rivalry in Ore Hoisting between two mines of the Kenefick Zinc Corporation, the Coyote and Airedale, resulted in the establishment of a new record here last week. The mines are on adjoining tracts, and when the Airedale recently hoisted 890 cans (1,250 lb. each) with a 72-hp. electric hoist, the Coyote workers began speeding up and two days later pulled 890 cans. On Thursday last the miners at the Airedale set out to beat this record and from 7:30 a.m. to 4 p.m.—with a half-hour off for lunch, a strict 8-hr. day—raised 1,017 of the 1,250 lb. cans. The tub hooker, Roxie Fisher, missed but two cans out of this number and upset three, and one shoveler loaded 83 of the cans and another 82. The company took notice of the performance by a special luncheon for the men on Saturday afternoon.

DULUTH, MINN.—Sept. 16

The Largest Iron-Ore Cargo from Ashland, Wis., was sent out on Sept. 8 when the steamer "M. A. Ford" cleared with 12,861 tons. The 1916 tonnage of iron ore, thus far, exceeds the total 1915 shipments from the Ashland docks.

Peat Fields in Northwestern Minnesota are to be the subject of an exhaustive examination, conducted by State experts in coöperation with local authorities. Senator D. P. O'Neill of Thief River Falls is to be in charge of the investigations.

Universal Portland Cement Co.'s Plant will be in full operation within two weeks. Three of the four kilns are now operating and the daily output of the plant is 3,000 bbl. Electrostatic precipitators are being installed to prevent the escape of the cement dust.

Fatality Rate for Iron Miners in Itasca County, Minnesota, is reported upon by the mine inspector for the year ended June 30, 1916; there was but one fatal accident for each 1,067,000 tons of iron ore shipped from the county, which includes the western end of the Mesabi Range.

Collapse of Cuyuna Range Strike was officially completed at a recent meeting of the Industrial Workers of the World at Crosby, Minn., when it was unanimously decided to call off the strike. The miners had called it off some time prior, as all mines in the district are operating regularly. There is, however, a shortage of miners due to so many having left the district during the strike troubles.

TORONTO—Sept. 15

The Dominion Royal Commission, inquiring into the resources of the British Colonies, visited Cobalt on Sept. 7, the party including Sir Edgar Bowring, Sir George Foster, W. Lorimer, Joseph Tatlow and others, accompanied by Thomas W. Gibson, Deputy Minister of Mines for Ontario. They were officially welcomed by Mayor McKinnon, and were met by a committee of mine managers who furnished them with the information required. After visiting several of the principal mines they left for Porcupine, whence they will proceed to British Columbia.

The Mining News

ARIZONA

Cochise County

SHATTUCK-ARIZONA (Bisbee)—Shipping about 600 tons daily, of which 50 tons are lead ore and the remainder copper. Development in Copper Rock claim on 800 level has added considerably to sulphide-ore tonnage, about 75 tons of 5% copper ore being mined daily from this ground.

Gila County

MIAMI MOTHER LODE COPPER (Miami)—Development is being undertaken at this property, about 8 mi. west of Miami; comprises about 980 acres between Inspiration Needles and Five Point Mountain. Several shallow shafts; principal work on the Cracker Jim which is 142 ft. deep, with some lateral work. William Schaefer in charge.

CHRISTMAS (Christmas)—This copper mine, which is only 8 mi. from the Hayden smeltery, has not been acquired by the American Smelting and Refining Co., as mentioned on p. 514 of the "Journal" of Sept. 16. It is merely operated by the Smelting company under an agreement and is still owned by the Gila Copper Sulphide Co. S. H. Sherman is superintendent.

Maricopa County

NORTH MARICOPA GOLD (Phoenix)—Reopening old Union mine under direction of Herbert Strickland. Evans shaft is being unwatered with a view of developing Evans vein and crosscutting to old Union vein.

Mohave County

FIRST PLACER LEASE in Oatman district has started operations on Warner group. Men are making better than wages but are having difficulty in separating pyrite from the gold and are sinking a shaft for water.

TOM REED (Oatman)—Strike in Aztec claim on 400-ft. level is reported.

GOLD DUST (Oatman)—New mill being tried out, including new centrifugal separator.

HIDDEN TREASURE (Chloride)— Another strike of high-grade ore made in this property.

OATMAN AMALGAMATED (Oatman)—Driving crosscuts east and west in low-grade material at 300-ft. level.

KEYSTONE (Chloride)—Excavations about completed for new mill. Sinking continues, a 12-ft. vein having been cut near the 300-ft. level.

OATMAN NORTH STAR (Oatman)—Work has been resumed after five weeks shutdown, due to lack of funds. R. R. Moore, superintendent.

Yavapai County

NEW STATE (Prescott)—Air compressor and drills being added. W. S. Wilhelm, manager.

GOLD BLOSSOM (Prescott)—Will sink 200-ft. shaft to 500-ft. point. Air compressor and hoist being installed. F. A. Johnson, in charge.

STODDARD MILLING (Stoddard)—Made initial shipments of concentrates to Humboldt smeltery on Aug. 23. Treats ores of Stoddard and Copper Queen mines.

CALUMET & JEROME (Jerome)—This property, about 1 mi. south of Jerome, is to be further developed by Boston and New York men. Workings include 100-ft. shaft and a 1,000-ft. tunnel.

UNITED VERDE CONSOLIDATED COPPER (Jerome)—This company, which recently acquired the Mahurin property, 4 mi. southwest of Camp Verde, has also taken over the United Verde Junior group of six claims surrounded by the Green Monster, Verde Combination, Decatur and News groups.

CALIFORNIA

Amador County

MOST AMADOR COUNTY GOLD MINES CLOSED on Sept 19 by failure of underground men to report for work, by order of United Federation because mine operators declined to discuss uniform scale.

Nevada County

ADVANCE OF 25C. PER DAY in wages was announced for Oct. 1 by principal mines in Grass Valley, including North Star, Empire Mines, Brunswick, Golden Center, Allison Ranch, Sultana and Union Hill.

Sierra County

GRAY EAGLE (Downieville)—Heavier power machinery being installed, stamp mill being moved to obviate long tram, and work resumed on oreshoot in shaft. Sidney C. Love in charge.

SIXTEEN-TO-ONE (Alleghany)—Under agreement with Twenty-One mine, work resumed in litigated ground, under direction of experts of both companies, to determine ownership of veins in dispute.

HERKIMER (Downieville)—Channel, sought for years struck 900 ft. from tunnel mouth; gravel yielding $6 to $8 per carload. Under bond to Gustav De Bretteville, of San Francisco. A. E. Cary, foreman.

ROCK CREEK (Downieville)—This gravel mine has opened extension of rich Bald Mountain channel. Strike made in 65-ft. raise near face of 1,000 tunnel at west rim, with 8,000 ft. of channel to be worked; gold steadily growing coarser and more plentiful. W. F. Copeland in charge.

Tulare County

INTERNATIONAL MAGNESITE (Porterville)—This San Diego company has purchased property of California Magnesite Co. here and will complete the calcining plant.

COLORADO

Arapahoe County

OIL AT AURORA was struck in well 3,130 ft. deep. Amount as yet uncertain and small.

Clear Creek County

GEM ELECTRIC CO. (Idaho Springs)—Purchased at sheriff's sale all property of Boston-Colorado Power Co. and will continue to operate plants.

CAPITAL (Georgetown)—Rich gold quartz opened in stope above main tunnel level. Copper-lead ore of stope being extracted. Quartz hanging-wall considered worthless until accidentally broken into and found to contain free gold. Side of stope 12 ft. high and 40 ft. long of shipping grade. Stope will be drawn and quartz mined.

Dolores County

RICO-ARGENTINE (Rico)—New compressor building being constructed.

RICO MILLING CO. (Rico)—Force of 25 men employed on development with satisfactory results. New equipment to be installed to hasten development.

Gilpin County

RARE ORES CO. (Rollinsville)—New mill now treating 50 tons per day will be increased to 75 tons daily.

HAMILTON & CO. (Central City)—Milling ore now being treated. Recent ore shipment returned $75 per ton.

Lake County

M. E. C. (Leadville)—Satisfactory progress in sinking this shaft at head of East 8th St.

GARBUTT (Leadville)—Manager John Cortellini has planned a 250-ton cyanide plant for the large orebody opened in this Breece Hill property.

FORTUNE (Leadville)—New lease for two years granted on portion of mine below Yak tunnel; royalties between 15 and 50% for $10 to $100 ore. Some ore developed.

ALLEGHENY (Leadville)—Recently leased by W. E. Bowden. Shaft, being retimbered to 500 ft., will be sunk 300 ft. and new electric hoist installed. Adjoins the McCormick.

PROGRESSIVE (Leadville)—Warren F. Page, who is opening this old Fryer Hill property, has cleaned out and repaired shaft to 280 ft. Old workings being reopened. Diamond drilling may be undertaken if no large orebodies are found exposed.

ALLRIGHT (Leadville)—Lessees on this Poverty Flat property opened large body of iron-manganese ore recently. Ore said to assay 25% manganese, 30% iron and is low in silica and phosphorus. Will be shipped to Pueblo steel plant. Discovery stimulated development in this part of district. A second discovery of iron-manganese ore was made on 250-ft. level of Jason mine. Ore is lower grade than that of Allright, but shoot is of large size; stope opened to over 19 ft. in width in places.

Ouray County

WAHNAKAH (Ouray)—Developing in milling-grade ore. Results in mill satisfactory.

KENO (Ironton)—Lessees opened shoot of shipping ore. Owned by Ouray Smelting and Refining Co.

OURAY TUNGSTEN MINING CO. (Ouray)—Incorporated to work Dunsmore group of tungsten claims, south of town. Tunnel being driven to cut vein at depth of 100 ft.

Park County

BLACK BARNETT (Alma)—This Buckskin Gulch property will be reopened.

GOLD WAVE (Alma)—Peterson interest in this property sold to Hyndman Bros., of Fairplay.

HOCK HOCKING (Alma)—Purchased machinery of old Morning Star mill on Mt. Bross; installing same in new building at tunnel portal on south side of Mosquito Gulch. Mine development satisfactory.

Summit County

RILLA (Breckenridge)—Contract let to drive east and west on Witch Hazel vein. Much low-grade ore developed in this vein. Equipped with rock drills and electrically driven compressor.

PIONEER CONSOLIDATED (Breckenridge)—Power line of Colorado Power Co. will be extended from Jessie mine to ground recently purchased, and mine equipment installed for extensive development.

Teller County

PORTLAND (Victor)—Mill at Independence being remodeled and extended.

LAST DOLLAR (Victor)—Charles Walden has leased this Bull Hill mine and is improving the equipment

QUEEN BESS (Cripple Creek)—Shipment of 27 tons from this Tenderfoot Hill property recently netted $2,100 to lessee operating through 750-ft. level of Molly Katherine shaft

IDAHO

Shoshone County

OPTION ON DOUGLAS MINE, in Pine Creek section, held by Anaconda Copper Mining Co. reported extended for six months, though developments are proving satisfactory.

GOLD HUNTER (Mullan)—Faulted orebody picked up on 1,200-ft. level.

SILVER CABLE (Mullan)—Engineers of the Anaconda company, which has an option on this property, have completed their examination.

FEDERAL MINING AND SMELTING (Wallace) — Net profits for quarter ended July 31 were $268,287 after charging off $64,007 for depreciation; shipped 38,972 tons of concentrates and crude ore as against 31,844 tons in previous quarter when profits were $290,891. Strike reported in extension of No. 6 tunnel of Morning mine near Mullan; discovery is north of Morning vein and is regarded as new vein; shoot 20 ft. wide and high in zinc. Developments at Iron Mountain mines unsatisfactory and operations suspended.

IDORA (Wallace)—This company's mill in the Beaver Creek section, used jointly by the Idora and Tuscumbia mines, will be operated two 10-hr. shifts as ore is accumulating faster than it can be handled in 12 hr. Mill was turned over to Tuscumbia leasers for two weeks on Sept. 11 to clean up accumulation of ore. Increased development has followed decision of Oregon-Washington Railroad and Navigation Co. to build branch railroad up Beaver Creek to connect with Ray-Jefferson mill. E. L. Latta, superintendent of Idora and Charles E. Mallette, secretary and manager.

MICHIGAN

Copper

VICTORIA (Victoria)—Copper-bearing rock encountered on 29th level west of shaft.

LAKE (Lake)—Force being added to and production will be increased during coming month.

MASS CONSOLIDATED (Mass)—Mining selectively about 12 ft. of the 100-ft. Butler lode and obtaining rock averaging about 15 lb. of copper per ton; decidedly profitable under present conditions.

LAKE MILLING, SMELTING AND REFINING (Point Mills)—Now running five stampheads, two on Allouez rock, two on Isle Royale and the fifth on Superior and Hancock Consolidated.

CALUMET & HECLA (Calumet)—Production of Calumet & Hecla and subsidiaries for August was as follows: Calumet & Hecla 6,603,418 lb.; Ahmeek, 2,173,439; Allouez, 870,758; Centennial, 207,486; Isle Royale, 1,199,162; La Salle, 109,032; Osceola, 1,625,498; Superior, 192,463; Tamarack, 513,441; White Pine, 426,152 lb. copper First unit of C. & H. leaching plant is running satisfactorily, and it is expected in about two months to be treating 2,000 tons daily. This would give an annual production of 10,000,000 lb. of copper at a cost below that of the average Lake mine.

Iron

AT QUINNESEC, the St. Clair company is drilling the old McKenna homestead. Some shallow drilling done there years ago.

CASTILE (Wakefield)—Two 500-gal. high-lift motor-driven pumps purchased; will pump against head of 1,250 ft.

OHIO (Michigamme)—Mine will work all winter—first time in years. Double present working force will be required.

FORBES (Iron River)—Much water entered workings during recent heavy rain. One miner drowned; water collected in a pit and broke through.

CHAMPION (Beacon)—Some of ore will be shipped from stockpile this fall. Mine idle several years. About 150,000 tons on surface. Track being put in shape.

HOLMES (Ishpeming)—Shaft will soon be bottomed. Headframe almost completed. Headframe will be 145 ft. high. Both hard and sofe hematites will be mined so there are pockets and chutes on two sides. Mining will start in winter. Shipments to be made next year.

MINNESOTA

Mesabi Range

LEONIDAS (Eveleth)—Mine working one shift. Closed several months. Deepest property on the range.

GENOA (Sparta)—This property flooded when strike started. All water is now removed and operations resumed.

FRANTZ (Buhl)—St. Clair Exploration Co. working two drills for Consumers Mining Co. Property idle since 1906. Some ore is known to exist.

ST. JAMES (Aurora)—Operations resumed here; was first mine closed when strike started. Two shifts are working. Over 250 men employed; wages $2.90 per day.

HULL-RUST (Hibbing)—Shipping a larger tonnage during present season than ever before and will set new record for the range. Nine steam shovels working in pit. Shipments in 1913 were 3,400,000 tons.

KERR (Hibbing)—This open-pit property, upon which stripping was finished a few weeks ago, has shipped its first ore. The pit is ½ mi. long and about 600 ft. wide; orebody rich with shallow overburden. Two shovels in pit at present.

GRANT (Buhl)—Mine started shipping steadily Sept. 13. A Jones & Laughlin property stripped by Butler Brothers. Its shipments have had big effect on state, lease records—172,000 tons of ore having been produced from state mines in one week.

SNYDER (Nashwauk)—This property, adjoining the Harrison, is being opened as a separate operation by Butler Brothers. A big Bucyrus shovel of 370 tons weight is stripping property. The development of this mine, together with other important work, is making Nashwauk one of the large mining centers of the Mesabi Range.

MISSOURI

Joplin District

BABCOCK (Joplin)—Completed shaft sinking after penetrating 24 ft. of good ore.

MERCHANTS (Miami)—Will start shaft on lease north of city; just completed fifth drill hole; 14 ft. good ore.

LUCKY 'LEVEN (Springfield)—Incorporated for $200,000 to develop 20-acre lease in Oklahoma section of field.

ANDREW (Galena)—New mill, completed on Martin land, will start during coming week. Drilled 18 holes showing ore from 55 to 120 ft.

PIOKEE (Picher, Okla.)—Spending $10,000 drilling lease adjoining Picher mines. Twenty-one holes down so far, ore in almost all, with assays from 5 to 23% blende.

JONES (Joplin)—Small company from Pittsburg, Kan., operating only coal mine in district on Mexico-Joplin land, north of Joplin. Have 5-ft. vein of soft coal at 30 ft.

EMPIRE ZINC (Galena)—The 6x15-ft. three-compartment shaft (largest in district) is down 90 ft. In broken ground; expect hard ground in another 10 ft. Shaft will go to 280 ft.

SUNNY SOUTH (Joplin)—New mill built at Thoms Station by Bilger & Montgomery has started. Mining at 140 ft., soft, timbering ground. Test at custom mill averaged 4%.

BELCHIC & McDONALD (Saginaw)—Drilling on 40-acre lease of St. Paul Mining Co.'s land where lead was mined 40 years ago. Three holes now completed show calamine from 75 to 100 ft.

SCOTT, PHELPS & SCOTT (Aurora)—Planning installation of first oil engines in Aurora camp at property north of town where shaft is now being sunk to 275 ft. Framework for mill being cut from timber near tract.

Southeastern Missouri

MISSOURI COBALT CO. (Fredericktown) — Old buildings being razed to make room for new plant.

ST. JOSEPH LEAD CO. (Herculaneum) — Extensive improvements contemplated during coming year. William Allen Smith, manager.

MONTANA

Lewis and Clark County

HIGH-GRADE COPPER ORE struck in Looby mine, Grass Valley district, west of Fort Harrison, near Helena. Under lease and bond to Cruse company which will sink to 200 ft.

SCRATCH GRAVEL (Helena)—Shaft now down 500 ft., the greatest depth yet attained in Scratch Gravel district. At shaft bottom, vein is 6 ft. wide with 10-in. pay streak. Four carloads of ore shipped to smelters in August netted $14,000.

Mineral County

INTERMOUNTAIN (Iron Mountain)—Initial dividend of ½c. per share announced for Oct. 20. Shipped five cars, valued at $8,500, to British Columbia Copper Co.'s Greenwood smeltery in August.

Silver Bow County

NORTH BUTTE (Butte)—W. J. Stone, station tender at Speculator, fatally injured Sept. 11, being struck on head by a piece of timber while standing at the 400-ft. station.

BUTTE-DETROIT (Butte)—Will resume operations on large scale at Ophir mine. New machinery being installed and mill is being remodeled. Mine is in southern section of district and was large producer of rich silver ore. New company plans to exploit mine chiefly for its zinc ores.

NEVADA

Esmeralda County

GRANDMA CONSOLIDATED (Goldfield)—Heavier hoisting equipment now installed at new three-compartment shaft. Sinking resumed.

REA COPPER CLAIMS (Goldfield)—Shaft now down 300 ft.; crosscutting for vein. Lateral work at this level to determine plans for future development.

LOS ANGELES SULPHUR CO. (Goldfield)—Shipped three cars per week; sulphur content about 80%. A few days' delay occasioned recently by deposit catching fire. Property is two miles from Cuprite.

ATLANTA MINES CO. (Goldfield)—Footwall crosscut on 1,750-ft. level has cut vein, believed to be extension of one worked on 1,500-ft. level, Grizzly Bear. Encouraging assays obtained and drifting started.

GOLDFIELD CONSOLIDATED (Goldfield)—After about 3 weeks trial run, management announces recent conversion of plant to flotation treatment not entirely satisfactory under present conditions. Will revert to former cyanide treatment pending placing of additional settling and filtering capacity. In July, net realization was $30,016 from 26,700 tons; operating cost $5.62.

Humboldt County

LOVELOCK QUICKSILVER MINES CO. (Lovelock)—New furnace about completed; 200 tons ore on dump awaiting treatment.

SEVEN TROUGHS COALITION (Seven Troughs) — Completely unwatered. Little damage resulted from flooding of workings. Expect to resume production during month.

Lander County

PLUMAS-GOODWIN (Battle Mountain)—This group, 12 mi. southeast in Galena district, purchased by Breitung & Co., Ltd., 11 Pine St., New York, who will undertake further development.

Nye County

TONOPAH ORE PRODUCTION for week ended Sept. 9 was 8,134 tons valued at $172,292 compared with 9,872 tons for week previous. Producers were: Tonopah Belmont, 2,445 tons; Tonopah Extension, 2,200; Tonopah Mining, 1,500; West End, 765; Jim Butler, 700; Rescue-Eula, 206; Halifax, 161; miscellaneous, 157 tons.

EARLY BIRD (Manhattan)—D. McFarland has joined James H. Nelson in lease and will soon make shipment.

WALL (Manhattan)—Wittenburg & Mushett and Tonopah men have leased this group near the Manhattan Summit.

ORIGINAL MANHATTAN (Manhattan)—Ray & Kryder, lessees, are developing considerable tonnage of low-grade ore and are considering a mill.

MUSTANG (Manhattan)—Train & Chase lease has reached incline depth of 225 ft., in rich ore. Another milling of high-grade ore will be made soon.

REORGANIZED WHITE CAPS (Manhattan)—Mill tests indicate 90% extraction at cost of $3.75 per ton. Roaster ordered. Mine showings continue favorable.

TONOPAH EXTENSION (Tonopah)—Quarterly dividend of 15c. per share declared. Sinking of Victor shaft resumed with 1,800-ft. level as the objective.

UNION AMALGAMATED (Manhattan)—Recent developments satisfactory, especially in the old Bath lease where oreshoot is opened from 250-ft. level to the 500.

WITTENBURG & MUSHETT (Manhattan)—In Big Pine, orebody reported found having been faulted easterly about 70 ft. Mill is again operating, after extensive overhauling.

WEST END (Tonopah)—Plans to reopen and deepen old Ohio-Tonopah shaft for further development of western area. Shaft is on California claim about due south of Extension No. 2 shaft; present depth 750 ft.

TONOPAH BELMONT (Tonopah)—Quarterly dividend of 12½c. per share amounts to approximately $187,500. Relinquished bond on Bull Moose property, near Beatty, where crew of about 10 men have been engaged in development for last six months.

UTAH

Beaver County

PALOMA (Milford)—Development in progress on 400 level, and in sinking shaft. Fifteen men working.

BONNEVILLE (Milford)—Development of property 12 mi. east of Milford undertaken by C. A. Cline. Copper-bearing rock opened.

BEAVER COMBINATION (Milford)—Recently started work from 200-ft. shaft sunk by Dan Ferguson. Electric hoist and compressor installed. Twelve men working. Property north of Moscow.

Box Elder County

TUNGSTEN ORE being developed and mined at Bovine by Ogden men.

Juab County

TINTIC SHIPMENTS for the week ended Sept. 8 were 181 cars, by 21 shippers.

EUREKA HILL (Eureka)—Machinery from old mill sold to Salt Lake machinery firm; included 600-hp. engine, crushers, stamps, etc.

IRON BLOSSOM (Silver City)—Working in north end where new copper ore is being developed on 1,200 level. Notice received that smelters will accept only limited tonnage of siliceous ore.

EAGLE & BLUE BELL (Eureka)—Station at 1,875-ft. level completed; drifting into orebody cut in sinking. Shipping about 50 tons daily coming from three different places. Ore showing in 25-ft. sump below 1,875-ft. level.

Salt Lake County

MICHIGAN-UTAH (Alta)—Two cars daily being shipped.

SECRET MINING & MILLING (Alta)—Contract let for 200 ft. of work on lower tunnel. Now in 75 ft.

EMMA COPPER (Alta)—Two diamond drills being used to prospect for continuation of faulted orebodies of old Emma.

REED'S PEAK (Salt Lake City)—Block of ground on tunnel level leased to L. G. Schwalenburg. Property near head of Big Cottonwood.

BIG COTTONWOOD CONSOLIDATED (Salt Lake City)—Main tunnel in 630 ft. and daily progress of 5 ft. being made. New bunkhouse and building for machinery completed. J. E. Johnson, manager.

Summit County

PARK CITY SHIPMENTS for the week ended Sept. 8 amounted to 2,571,110 lb. by seven shippers.

PARK CITY MINES (Park City)—Connections made on 700 level with raise from 900. Six inches of ore running well in gold and silver found. Shipment expected soon.

THREE KINGS (Park City)—Sinking below 500 shows increase in mineralization. Winze down 70 ft., and fissure widened from 18 in. to 4 ft. Small air hoist recently installed at winze; objective is contact of limestone with underlying Ontario quartzite.

JUDGE MINING & SMELTING (Park City)—Good progress being made in construction of zinc plant at Deer Valley. Wedge furnaces being erected. Material for leaching tanks, crushing machinery, etc., beginning to arrive. Expects plant to be treating 35 to 40 tons daily by first of year, producing about 15 tons of spelter.

Tooele County

TUNGSTEN ORE being shipped from Deep Creek region, reached from Wendover on Western Pacific R.R. The Seminole controlled by Wilson brothers of Salt Lake City has made shipment. Tungsten occurs as scheelite.

WASHINGTON

Stevens County

COLUMBIA COPPER (Turk)—Ore is being taken by auto truck to Great Northern Ry. for shipment to Consolidated Mining and Smelting Co.'s plant at Trail, B. C.

WISCONSIN

Zinc-Lead District

TIFFANY ZINC (Platteville)—Foundations laid for 150-ton mill at Potosi.

OLIVER (Shullsburg)—Shipments of zinc concentrates from Mulcahy mine begun, first consignment of three cars going to Cherryvale, Kan.

WISCONSIN ZINC (Platteville)—Extensive drilling has proved strong orebody on Copeland lease at Shullsburg; formerly operated by the Lake Superior Mining Co.

UTT-THORNE (Platteville)—Lawrence mill at Cuba City was destroyed by fire; Utt-Thorne, owners, will buy low-grade ore and continue operating roasting plant at Benton.

CANADA

British Columbia

BUTTE ENGINEERS are examining the Tasso mines on the west coast of the Queen Charlotte Islands. Mines are owned by James E. Corlett, of Seattle, but worked at present by Thomas E. Young, of Victoria.

GRANBY CONSOLIDATED (Vancouver)—Has optioned the Swede and the Last Chance groups on Queen Charlotte Islands, near Lockport and has commenced diamond drilling. O. B. Smith and E. J. Conway, of the Granby company also looked over the Ikeda mine at the south end of the Islands.

STANDARD SILVER-LEAD (Silverton)—Strike in upper tunnel on Alpha claim more important than first anticipated, may be one of best orebodies developed in mine. Monthly dividend of $50,000 declared for October, making $500,000 so far this year.

Ontario

COSTELLO (Goodfish Lake)—Prospect shaft being sunk.

LA BELLE KIRKLAND (Kirkland Lake)—Will diamond-drill property.

PORCUPINE CROWN (Timmins)—Struck an important new vein at 800 ft.

PLATT (Porcupine)—Under option to the Coniagas, of Cobalt; will be diamond-drilled.

LAKE SHORE (Kirkland Lake)—Will issue 150,000 shares of treasury stock to provide funds for mill.

INTERNATIONAL NICKEL (Port Colborne)—New refining works will cover 23 acres; cost estimated at over $3,000,000.

CROWN RESERVE (Cobalt)—Vein running 5 to 7 in. opened on 700-ft. level, stated to carry 5,000 oz. to the ton.

WEST DOME (South Porcupine)—Ordered $35,000 worth of new machinery. Three new veins indicated by diamond drilling.

TRETHEWEY (Cobalt)—Shareholders' meeting to consider sale of mine to Northern Customs Concentrator postponed to Sept. 29.

ANKERITE (Porcupine)—Under option to Coniagas, of Cobalt; has granted six months' extension. New contract let for further diamond drilling.

DOME LAKE (South Porcupine)—Increasing capacity of mill to 200 tons a day. No announcement made of developed tonnage. Stock has been fluctuating widely.

NIPISSING (Cobalt)—During August ore was mined of estimated value of $203,898 and bullion from Nipissing and customs ore shipped of estimated net value of $226,341.

MILLER LAKE O'BRIEN (Gowganda)—Has made most striking discovery in northern Ontario; new vein on 350-ft. level in one place shows 39 in. of 3,000-oz. silver ore.

McKANE (Kirkland Lake)—Vein encountered in crosscutting on 300-ft. level shows 31 ft. of ore, being largest orebody so far found in Kirkland Lake district. Runs about $12 per ton.

BEAVER (Cobalt)—In developing lower contact, 242 ft. of crosscutting has been done at 1,600-ft. level, encountering 2 small veins similar in character to those cut above the diabase sill.

LORRAIN CONSOLIDATED (South Lorrain)—Julius Cohen, engineer in charge, reports shaft put down 40 ft. since mine reopened. Vein has left shaft dipping to south about 5 from vertical.

LITTLE NIPISSING (Cobalt)—At this property now being operated by a Detroit syndicate, the workings have been dewatered below the 100-ft. level. Inspection of old stopes shows considerable low-grade ore.

McINTYRE (Schumacher)—New machinery has been ordered, including 500-hp. compressor, electric hoists and crushing and hauling equipment. An electric sub-station is to be built on north side of Pearl Lake.

BUFFALO (Cobalt)—The 600-ton flotation will placed in operation. About 100 tons of ore from mine will be treated daily and 500 tons of tailings. There are accumulated tailings amounting to 300,000 tons, the silver content of which is estimated at 1,600,000 oz.

DOME EXTENSION (South Porcupine)—Under option to Dome. Suspended drilling operations in deep hole designed to cut extension of main Dome orebodies. The hole turned in strike and dip, and capacity of machine was reached before ore was cut.

BOLIVIA

ARAMAYO FRANCKE MINES, LTD. (Chorolque)—Tin production at Chorolque has been decreasing and tunnels are being driven at greater depth in hopes of finding sulphides; good tungsten ore, however, has been developed in this section. In Tasna, good results obtained in workings of bismuth and tungsten. In the Chocaya section expectations have been fully realized in production both of silver and tin; option on this group for £275,000 to an American syndicate, that contemplated purchasing the neighboring Oploca company also, lapsed on the failure of the latter negotiations, and was not renewed.

BRITISH GUIANA

GOLD EXPORTS for the half year ended July 1 were 15,966 oz. fine or $330,022 in value; a decrease of $212,772 from 1915. The exports of diamonds were 6,695 carats, valued at $51,964; an increase of 6,224 carats over last year

The Market Report

Metal Markets

NEW YORK—Sept. 20

A very large business was done both in copper and in lead and in the latter there was a sharp advance in price. The spelter market became dull and toward the closed showed signs of a reactionary tendency.

Copper, Tin, Lead and Zinc

Copper—Again a very large business was done, the sales of which we had reports amounting to about 60 million pounds, which was larger than in the previous week. The business was done in large blocks, and to the major extent was with domestic brassmakers and sheet-rollers, whose product, however, is largely destined ultimately for export. It is noteworthy that the producers and agencies who were the largest sellers in the previous week were the smallest sellers this week, and vice versa. Such changes from week to week reflect more or less ability to make deliveries, etc. There was a fair volume of business in copper for delivery in 1916, but the largest business was for delivery in the first quarter of 1917, and some sales of round lots were made for delivery during the first half of 1917 and during the second quarter of 1917, several agencies taking such business. There was a wide range of prices, according to the delivery, sales for early delivery being reported at 27¾@28¼c., while contracts for late deliveries were accepted on the basis of 25¾c., net cash, New York, a large volume of business being reported at about that figure. The average realized on all the business of which we had reports was about 26¾c., and we quote the market for the week at 26½@27c., which does not reflect weakness as compared with the previous week, but simply that the major market had become for a later delivery on the average.

The important foreign business, to which we referred last week, was still pending at the time of our going to press, but there was understood to be a possibility of its consummation on Thursday, and at the same time an expectation that it might be further delayed.

Copper Sheets are nominal at 37.5c. per lb. for hot rolled and 38.5c. for cold rolled. Copper wire is 32@32½c. per lb. for large lots at mill.

Copper Exports from Baltimore for the week included 224,043 lb. copper and 26,228 lb. brass to England; 269 tons brass to Italy; 3,000,000 lb. copper to Russia.

Copper Exports from the port of New York, as reported at the Custom House for the month up to Sept. 20 were 16,310 gross tons.

Visible Stocks of Copper in Europe on Sept. 15 are reported as follows: Great Britain, 4,484; France, 2,634; afloat from Chile, 1,550; afloat from Australia, 3,000; total, 11,668 gross tons, or 26,136,320 lb. This is an increase of 154 tons over the Sept. 1 report.

Tin—There was scarcely any change in the price of this metal during the week. For the first three days the market was practically idle. On Sept. 18 and 19 a small business in future was done, the market for near-by tin continuing dull.

Supplies of Banka and Billiton tin in August were 1,164 gross tons. For the year 1916 they are estimated at 17,740 tons. The stock in the hands of the Netherlands Trading Co. on Aug. 31 was 936 tons.

Lead—As we forecasted last week, the A. S. & R. Co. was forced to advance its price, which it did by raising to 6.75c., New York, on Sept. 15. Independent producers immediately asked and realized more, and the A. S. & R. Co. advanced again on Sept. 19 to 7c., while independent producers had sold at 6.90c. on the morning of that day. The St. Louis market was also very strong, there being a stiff demand for chemical lead, which at certain times during the week sold on even terms with the New York market.

Spelter—Considerable business was done in the early part of the week, including some for export, but then the market flattened out, previous experiences being repeated, viz., a disappearance of buyers after the price has risen to 9c. On Sept. 20 business was done in considerable volume at a lower price than had prevailed previously, and the market exhibited a distinctly softer tendency.

Exports from Baltimore for the week included 403,116 lb. spelter to England.

Spelter Exports from New York as reported at the Custom House for the month up to Sept. 20 were 6,750 gross tons.

Zinc Sheets are in steady demand and business is fair. Quotations are unchanged at $15 per 100 lb., f.o.b. Peru, Ill., less 8% discount.

Other Metals

NEW YORK—Sept. 20

Aluminum—Demand continues good while supplies are not heavy. It is difficult to fill large orders for any early delivery. Prices are strong at 61@63c. per lb. for No. 1 ingots, New York.

Antimony—This market was dull and somewhat weaker. Producers reported that it required considerable skill to land orders. There was a wide range of prices. We quote 11@12½c.

Quicksilver—There was a fair business at unchanged price, $75, New York. San Francisco reports, by telegraph, $75@77½, market steady.

Nickel—Demand is good both from domestic and export business. Prices are firm and unchanged at 45@50c. per lb. for ordinary forms, according to size of order. A premium of 5c. per lb. is charged for electrolytic nickel.

Imports at Baltimore for the week included 475 tons nickel ore from Noumea, New Caledonia.

Minor Metals—Current quotations for **Bismuth** are $3.15@3.30 per lb., New York—**Cadmium** is quoted at $1.30@1.50 per lb.—**Cerium**, electrolytic, is sold at $8@9 per lb.—**Cobalt Metal** is quoted at $1.25 per lb.—**Magnesium** is steady, with sales at $3.75@4 per lb. for 99% pure.—**Selenium** is from $3 up to $5 per lb., according to size of order.

Gold, Silver and Platinum

Gold—Further arrival of $10,000,000 gold from Ottawa is reported this week. Making a total of $307,000,000 received on British account since May 1. More is reported coming.

Gold output of the Kolar goldfield in Mysore, India, for August is reported at 45,361 oz.; for the eight months ended Aug. 31 it was 357,238 oz., or $7,384,110; a decrease of 13,968 oz. from last year.

Platinum—This market was unchanged at $85. Producers report an increasing demand from jewelry manufacturers.

Platinum production in Russia in 1915 is estimated by a recent report at 215 poods—or 103,200 oz.—a decrease of 83 poods from 1914. Platinum production of Colombia is estimated at 19,000 oz., against 17,500 oz. in the preceding year.

Silver—The market continues steady with fair inquiry from the other side—sufficient to absorb the moderate offering going forward weekly. The opinion is expressed by London authorities that: "In view of probable continuance of coinage orders and encouraged by the favorable monsoon, indicating a possible demand for the bazaars, we see no reason to expect any setback at present, and even higher prices may be seen."

Mexican dollars were quoted in New York Sept. 14 at 52⅝@55⅝c.; Sept. 15 at 52⅝@55⅝c.; Sept. 16 at 52¾@55½c.; Sept. 18 at 53@56c.; Sept. 19 at 52⅞@55⅛c.; Sept. 20 at 52¾@55c. per peso.

Zinc and Lead Ore Markets

Joplin, Mo., Sept. 16—Price quotations per 2,000 lb.: Blende, high, $65.70; 60% zinc, premium ore, $65; medium grades, $65@60; low, $55. Calamine, per ton 40% zinc, $45@30. Average selling price, all grades of zinc, $57.43 per ton. Lead base price $70@65 per ton 80% metal contents. High price, $71.90. Average selling price, all grades of lead ore, $67.60 per ton.

Shipments of the week: Blende, 8,509 tons; calamine, 181 tons; lead, 1,103 tons. Value, all ores, the week, $573,600; the year to date, $27,105,230.

During the past week the railroads requisitioned some coal shipments, but tonight reports indicate a settlement of wage scale in the Kansas coal fields, ending the probability of a strike further injuring the zinc mining industry. The shipment of the week is the largest since April, and with but a slight increase in output will lower the reserve stock. Further heavy buying for next week's delivery greatly enhances prospects for a winter ore market better than during the past summer.

Platteville, Wis., Sept. 16—Quotations for the district are according to the following figures: Base price per 2,000-lb. ton for material assaying 60% zinc is $56 for premium ore down to $50 for medium grade. For material assaying 80% lead the base price per 2,000-lb. ton is $71. Shipments for the week were 2,798 tons of zinc ore, 28 tons of lead ore, and 570 tons of sulphur ore. For the year to date, the figures are, 87,467 tons of zinc ore, 3,059 tons of lead ore, and 20,790 tons of sulphur ore. Shipped during the week to separating plants, 4,523 tons of zinc ore.

SILVER AND STERLING EXCHANGE

		Silver				Silver	
Sept.	Sterling Exchange	New York, Cents	London, Pence	Sept.	Sterling, Exchange	New York, Cents	London, Pence
14	4.7575	68¼	32½	18	4.7575	68¾	32 11/16
15	4.7575	68	32⅜	19	4.7575	68¾	32⅝
16	4.7575	68¼	32½	20	4.7575	68⅝	32⅝

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine.

DAILY PRICES OF METALS IN NEW YORK

	Copper	Tin	Lead		Zinc
Sept.	Electrolytic	Spot.	N. Y.	St. L.	St. L.
14	26½ @27	38¾	6.65 @6.75	6.55 @6.60	9.00 @9.25
15	26½ @27	38⅝	6.70 @6.80	6.55 @6.65	9.00 @9.25
16	26½ @27	38½	6.75 @6.85	6.65 @6.85	9.00 @9.25
18	26½ @27	38½	6.75 @6.90	6.65 @6.85	9.00 @9.25
19	26½ @27	38½	6.90 @7.00	6.85 @6.95	9.00 @9.25
20	26½ @27	38⅝	7.00	6.90 @6.95	8.87½ @9.12½

The quotations herein are our appraisal of the average markets for copper, lead, spelter and tin based on wholesale contracts for the ordinary deliveries of the trade as made by producers and agencies; and represent, to the best of our judgment, the prevailing values of the metals, reduced to basis of New York, cash, except where St. Louis is basing point.

The quotations for electrolytic copper are for cakes, ingots and wirebars. Electrolytic copper is commonly sold at prices including delivery to the consumers and is subject to discounts, etc. The price quoted for copper on "regular terms" (r.t.) is the gross price including freight to the buyer's works and is subject to a discount for cash. The difference between the price delivered and the New York cash equivalent is at present about 0.25c. on domestic business. The price of electrolytic cathodes is 0.05 to 0.10c. below that of electrolytic. Quotations for lead represent wholesale transactions in the open market for good ordinary brands. Quotations for spelter are for ordinary Prime Western brands. Only St. Louis price is given, St. Louis being basing market. We quote New York price at 17c. per 100 lb. above St. Louis.

Some current freight rates on metals per 100 lb. are: St. Louis-New York 17c.; St. Louis-Chicago, 6.3c.; St. Louis-Pittsburgh, 13.1 cents.

LONDON

	Copper			Tin		Lead	Zinc
	Standard		Electrolytic				
Sept.	Spot	3 Mos.		Spot	3 Mos.	Spot	Spot
14	117	113	133	170½	171½	30¼	54
15	116	112	134½	170¼	171¼	30½	54
16	.		. . . .		. .	. .	.
18	116	112	135½	170¾	171½	30½	55
19	116	112	135½	171½	172	30¾	56
20	116½	113	135½	172¼	173	30¾	56

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2,240 lb. Copper quotations for electrolytic are subject to 3% discount. For convenience in comparison of London prices, in pounds sterling per 2,240 lb., with American prices in cents per pound the following approximate ratios are given, reckoning exchange at 4.80. £15 = 3.21c.; £20 = 4.29c.; £30 = 6.43c.; £40 = 8.57c.; £60 = 12.85c. Variations, £1 = 0.21⅜ cents.

OTHER ORES

Manganese Ore Exports from British India in the quarter ended June 30, 1916, were: United States, 12,326 gross tons; Italy, 7,300; France, 12,570; Great Britain, 121,013; total, 153,209 tons. In the corresponding quarter of 1915 the exports were 56,072 tons.

Imports at Baltimore for the week included 23,250 tons manganese ore from Brazil.

Pyrites production in the Urals in Russia in 1915 was 39,100 gross tons. The pyrites deposits are situated not far from Ekaterinburg.

Tungsten Ore—The market was dull and a trifle weaker. We quote $16½@17 per unit.

Antimony Ore—Unchanged at $1@1.10 per unit.

Iron Trade Review

NEW YORK—Sept. 20

While domestic orders have not increased to any great extent, there is much inquiry for material for next year's delivery, both for home consumption and for export.

With cooler weather the mills are doing better work and are gaining back the ground lost last month. They are, as a rule, still far behind their orders, and could hardly come out even in six or eight months, even if no more orders should be received. Under these circumstances premiums on any early deliveries needed must be expected.

Export demand is strong and steady, both for semi-finished and finished steel. In home buying structural steel is rather slow again, but plates and shapes for shipbuilding are in very strong demand.

The heaviest item of business in the past week is in the placing of orders for 500 miles of line pipe by the Standard Oil Co., and of 150 miles by Oklahoma companies. This will require a large tonnage of plates, still further increasing the demand.

The Interstate Commerce Commission this week is hearing protests from manufacturers against the proposed increase of rates on iron and steel to seaboard points. This increase would do away with the special rates made on export goods and would make export material pay local rates to the seaboard. The larger increases proposed are to points west of Pittsburgh.

The pig-iron market is active and strong. There have been large transactions in basic pig both in the East and the West. Foundry iron also is in good demand. Both Northern and Southern furnaces report large sales and higher prices.

The Thomas Iron Co., Hokendauqua, Penn., has received an offer of $3,500,000 for its property—consisting of blast furnaces and iron ore property—from a Philadelphia syndicate said to be made up of large steel interests. The offer was referred to a committee. The Thomas Iron Co. is one of the oldest and largest makers of merchant iron.

Exports of Iron and Steel and their products from the United States for the seven months ended July 31 are reported as follows, the first line giving the tonnage of those products reported by weight; the second line the value of machinery and the third line the total value of all exports:

	1915	1916	Changes
Tonnage exports, tons.	1,676,485	3,116,234	I 1,439,749
Machinery, value..	$67,959,822	$123,406,983	I $55,447,161
Total value.	174,940,645	442,240,120	I 267,244,475

The exports far exceeded those of any previous year. The increase in the total value of exports was 152% this year. Imports of articles reported by weight for the seven months were 124,636 tons in 1915 and 145,309 in 1916; increase, 20,673 tons.

Exports from Baltimore for the week included 1,107 tons steel scrap, 2,911 tons steel billets and 34 tons wire to Italy; 848,960 lb. pig iron and 1,621,330 lb. steel billets to France; 1,311,640 lb. pig iron, 317,517 lb. steel pipe, 604,800 lb. wire, 681,722 lb. nails, 15,627,094 lb. steel billets, rods, blooms and bars to Great Britain.

PITTSBURGH—Sept. 19

Steel production has been increased somewhat, with more favorable weather, and most of the mills expect to make new tonnage records in October, a month always marked by favorable weather for outputs. The mills have fallen farther behind in shipments, with the curtailed output of July and August and at the best will have to break many promises made for delivery this year. The Carnegie Steel Co. expects to make 1,000,000 tons of ingots next month, which would constitute a new record. Some new open-hearths are being completed at Farrell and Clairton, with a new mixer at the latter plant.

The steel market continues to present an appearance of quietness. In some branches, as in sheets and tinplates, the mills have not opened their books for next year, while they are filled for this year. In rails they are filled for practically all of next year. In other lines they are filled as far ahead as they usually sell, and thus there is not much disposition to buy or sell. Nevertheless the total of obligations on mill books does not seem to diminish materially. Steel prices are very strong all along the line and may even be said to show a slight advancing tendency in general. Woven wire fence has been advanced 1½ points to 60% off, an advance of about $2.40 per ton. Predictions are made that the tinplate price for next year will be $5.50, against $3.60 for the past season, but some observers do not expect more than $5 per box.

Pig Iron—Sales of basic have hitherto been confined to this year's delivery, but in the past few days there has been a considerable tonnage, 25,000 to 50,000 tons, sold for first half 1917, generally at $18.25, Valley, representing an advance of 25c. For the furnaces to sell for an additional half-year at only 25c. advance, however, does not bear out predictions lately made of a large advance for pig iron, and one buyer is understood to have secured iron at only a few cents above $18, Valley. The buying of foundry iron continues, with furnaces showing a slight disposition to quote higher prices. Export demand continues for bessemer, while some export inquiry is now in the market for basic. We quote basic up 25c., other quotations unchanged: Bessemer, $21@21.50; basic, $18.25@18.50; foundry and malleable, $18.50@18.75; forge, $18@18.25, f.o.b. Valley furnaces, 95c. higher delivered Pittsburgh.

Steel—It is now understood that the Carnegie Steel Co.'s price for fourth-quarter on quarterly adjustment sheet-bar contracts will be $2 higher than for third-quarter, when the nominal price was $40, with various adjustments with special customers down to $35. In the open market there are only occasional offerings, and the market is considered almost nominal at $45@50 for billets of sheet bars, bessemer or openhearth. A Cleveland mill was recently offering steel for first half 1917 at $46, mill, but is understood to be out of the market now. Rods are $55@60 per ton.

FERROALLOYS

Exports from Baltimore for the week included 485 tons ferromanganese and 650 tons spiegeleisen to Italy—an unusual item.

Ferrosilicon—Bessemer ferrosilicon varies from $30 for 9% up to $41 for 16%, all per ton at furnace. High grade, 50%, is $86@89 at furnace. Several contracts are reported placed at these prices for the first half of next year.

Spiegeleisen is unchanged, ordinary 20% being quoted at $40@45 per ton at furnace; 25 to 30% is held at $55@65, according to grade and size of order.

Ferromanganese—British makers have taken cognizance of offerings of contract ferromanganese by domestic makers at $165 and thereabouts and are meeting the competition. Even this figure is understood to have been shaded slightly in one or two cases. We quote prompt and contract at $165@170 per ton.

Imports of ferromanganese in July were 5,341 gross tons in 1915, and 40,162 in 1916; increase 31,821 tons.

Imports at Baltimore for the week included 3,275 tons ferromanganese from Middlesboro, England.

IRON ORE

A few belated buyers of Lake Superior ore have made their appearance and quotations have been made them of $5.20 per ton for Old Range bessemer, an advance of 75c.; and of $4.20 for non-bessemer, an advance of 50c. over this season's price.

Wild tonnage has been chartered for the balance of the season at rates varying from 85c. to $1 per ton from the head of the Lakes.

The decision of the Interstate Commerce Commission on iron-ore rates from Lake Erie ports to furnaces is a complex one and will involve many changes. It will not take effect until Apr. 1, 1917, so that it will not affect the work of this season.

The commission's new project is that every ore rate shall be divided into three parts, each part representing a detail of the service. At present rates are stated so as to include the whole service of taking the ore from the rail of the vessel to the trestle of the furnace company. The proposal, approved by the commission, is that the unified service shall be treated as three distinct operations, for each of which a charge is to be made. The first is to be a flat rate of 6c. per gross ton for unloading from ship to car. The second is for the rail haul from the dock to the furnace plant inclosure and the third is to cover the placing of the car on the unloading trestle.

Dock ore at present bears a rate of from 8c. to 10c. greater than direct ore. The rate on dock ore is also to be stated so as to show its components. The railroads which own the unloading devices are to charge 16c. for taking the ore out of the ship and depositing it in a stock pile and 10c. for taking it from the stock pile to the car. That means a net increase of 16c. in dock ore that now pays 10c. more than direct ore and of 18c. in the case of ore that costs 8c. more than direct ore.

The groupings of Lake ports as points of origin and of furnace towns as groups of destination are also to be changed. The destination groups and distances are to be as follows: Youngstown to include furnace points from 50 to 74 mi. from the lake; Leetonia, 75 to 99 mi.; Midland, 100 to 124 mi.; Pittsburgh-Wheeling, 125 to 159 mi.; and Monessen-Johnstown, 160 to 199 mi.

COKE

Alabama coke trade has been active, with shipments to Texas and the Pacific Coast and some to Mexico. Standard furnace coke is quoted at $3.25@3.50 at ovens; foundry coke, $4.25 per ton.

Coke production in the Connellsville region week ended Sept. 9 is reported by the "Courier" at 381,374 net tons; shipments, 381,21[illegible] tons. Production was cut down by the Labor Day holiday.

Connellsville—Despite the advent of cooler weather which was expected to improve labor conditions, coke has grown scarcer. Several sales of spot of a brand not generally regarded as standard have been made at $2.85, and as high as $3 is reported in one instance. The scarcity is of coke-making labor, there being a sufficient supply of miners, and indeed, there are now shipments of nearly 100,000 tons a week of raw coal from the strictly Connellsville region, chiefly for byproduct coking. Consumers are beginning to show some interest in first-half contracts, on which operators' views range from $2.75 to $3, or much above what furnaces expected to pay. We quote: Spot furnace, $2.85@3; contract, $2.75; spot and contract foundry, $3.25@3.50 per ton at ovens.

New South Wales Coal Production for two years past is reported as follows, in gross tons:

	1914	1915	Changes
Coal mined .	10,390,622	9,449,008	D 941,614
Coal exported .	5,868,033	4,668,394	D 1,199,639
Coke made	304,800	417,753	I 112,953
Oil shale mined	50,049	15,474	D. 34,575

The number of persons employed in coal mining in 1915 was 17,959 on the average.

SAULT STE. MARIE CANALS

The total tonnage of freight passing through the Sault Ste. Marie canals for the season up to Sept. 1 was: East bound, 44,121,701; west bound, 11,427,272; total, 55,548,972 net tons, an increase of 18,141,822 tons over 1915. Of the total traffic 4,145 vessels carrying 10,850,100 tons passed through the Canadian Canal; 11,261 vessels carrying 44,698,873 tons through the United States Canal. The total number of vessel passages was 15,406, showing an average cargo of 3,606 tons.

Mineral freights included in the totals were, in net tons except salt, which is given in barrels:

	1915	1916	Changes
Anthracite..	1,274,174	1,305,594	I 31,420
Bituminous coal	6,552,627	9,158,100	I. 2,605,473
Iron ore	25,962,787	37,867,562	I. 11,904,775
Pig and m'f'd iron .	118,360	116,272	D. 2,088
Copper ...	79,254	61,709	D. 17,545
Salt, bbl	393,853	465,455	I 71,602

The total freight tonnage in August was 11,031,262 tons. For the season iron ore was 68.2% and coal 18.8% of the total freight.

NEW YORK—Sept. 20

The general market is steady and the demand for heavy chemicals is reported good, with prices generally steady and a good undertone.

Arsenic—Offerings are not large but supplies are pretty well taken up, and prices are steady and unchanged. Spot arsenic is quoted at $6@6.25 per 100 lb., according to size of order.

Copper Sulphate—Actual business is rather quiet just now, but prices are well held, though a little easier. Standard makes are $10.50@10.75 per 100 lb., according to size of order.

Nitrate of Soda—Reports from the west coast of South America are that freights are slightly lower, though vessels are not at all plentiful. Business here is fair, but prices are slightly easier at $2.95 per 100 lb. for both spot and futures.

Sulphur—The market continues strong with a heavy demand. High freight rates are still a factor. Quotations are $35 per ton, New York, for spot and $30 for futures.

Exports of sulphur from Japan for two years are reported as below, in pounds:

To	1914	1915	Changes
Australia ...	52,204,636	65,356,168	I 11,151,[illegible]
India	2,111,053	10,521,868	I 8,413,8[illegible]
Russia	734,815	11,819,997	I. 11,085,[illegible]
Canada	3,975,658	11,586,128	I. 7,61[illegible]
United States	41,600,098	60,655,332	I. 19,0[illegible]
Total	100,626,260	157,912,793	I. 57,[illegible]

The production of sulphur was much restricted in 1914, but the year 1915 showed a large increase and the first half of 1916 showed [illegible] greater gain.

Sulphuric Acid—Demand is good and prices steady at $1 per 100 lb. for 60-deg. and $1.5[illegible] per 100 lb. for 66-deg. acid. Some concessions are said to have been made on [illegible] contracts for future delivery.

Assessments

Company	Delinq.	Sale	Amt.
Alta Silver, Nev.	Sept 1	Sept. 25	$0.03
Aodes, Nev.	Oct. 11	Nov. 1	0.02
Beaver Gold, Utah	Aug. 19	Sept. 16	0.01
Beaver Mines, Utah	Sept 30	Oct. 21	0.0025
Blue Star, Ida.	Sept 25	Oct. 21	0.02
Bull Valley, Utah	Oct. 10	Oct. 31	0.004
Cash Boy, Nev.	Sept 1	Oct. 15	0.01
Coal Creek, Ida	Aug 25	Sept. 26	0.005
Colonial, Ida.	Aug 26	Oct. 10	0.001
Con. Virginia, Nev.	Sept 29	Oct. 20	0.05
Crown Point, Utah	Sept 26	Oct. 10	0.005
Eagle Mountain, Ida	Oct 2	Nov. 4	0.001
Exchequer, Nev	Sept. 5	Sept. 26	0.03
Friend, Ida.	Aug 26	Sept. 16	0.002
Great Bend, Nev.	Aug 15	Sept. 20	0.01
Great Western, Nev	Sept 26	Oct. 18	0.01
Idaho-Nevada, Ida	Sept 14	Oct. 14	0.002
Jacket-C.Point-Belcher, Nev	Aug 14	Sept. 7	0.05
Leonora, Utah.	Sept 27	Oct. 16	0.005
Old Veteran, Ida	Sept 9	Oct. 7	0.002
Paloma, Utah	Aug 21	Sept 9	0.01
Phedora, Ida	Aug 29	Sept. 29	0.001
Rio Grande Grubstake, Nev	Sept. 22	Oct. 31	0.002
Royal Copper, Ida	Sept. 2	Oct. 2	0.001
Sandstorm Kendall, Nev	Aug 22	Sept. 26	0.01
Santaquin Chief, Utah	Sept. 11	Sept. 21	0.0025
Santaquin King, Utah	Sept. 11	Sept. 21	0.0025
Sells, Utah	Sept 21	Oct 7	0.06
Sierra Nevada, Nev	Oct 12	Nov. 2	0.10
Silver Pick, Nev.	Sept. 25	Oct. 30	0.01
Smuggler, Utah	Sept 20	Oct. 18	0.005
Spearhead, Nev.	Oct 2	Nov. 2	0.01
Springfield Tunnel, Calif	Aug 15		0.05
Syndicate, Utah	Sept. 18	Oct. 14	0.0015
Tarbox, Mont.	Sept. 28	Oct. 28	0.005
Tonopah-Bonanza, Nev	Sept. 19	Oct. 16	0.01
Tyler, Ida.	Sept. 12	Oct. 12	0.0015
Umatilla, Nev	Sept. 18	Oct 24	0.0025
Uvada, Nev.	Oct 9	Oct. 26	0.02
West Toledo, Utah	Sept. 12	Oct. 3	0.01
Whale, Utah	Sept. 5	Sept. 25	0.05
Wonderful, Ida.	Aug. 30	Sept 20	0.001

Stock Quotations

SAN FRANCISCO Sept. 19 Name of Comp.	Bid.
Alta	05
Andes	10
Best & Belcher	06
Bullion	01
Caledonia	35
Challenge Con.	07
Confidence	15
Cons. Imperial	01
Con. Virginia	10
Gould & Curry	03
Hale & Norcross	10
Jacket-Cr. Pt.	06
Mexican	16
Occidental	70
Ophir	22
Overman	06
Savage	13
Seg Belcher	03
Sierra Nevada	32
Union Con.	69
Utah Con	01
Belmont	4.25
Jim Butler	90
MacNamara	05
Midway	21
Mont.-Tonopah	21
North Star	16
Rescue Eula	23
West End Con.	72
Atlanta	09
Blue Bell	‡01
Booth	11
C.O.D. Con	02
Comb. Frac	06
D'field B.B.	02
D'field Daisy	02
Jumbo Extension	34
Round Mountain	37
Sandstorm Kendall	03
Silver Pick	17
Central Eureka	07
Argo	07
Ariz. Central	15
Big Jim	1.21½
Lazy Boy	10
Oatman No. Star	‡10
Tom Reed	2.00
United Eastern	3.75
United Western	08

LONDON	Sept. 6
Alaska-Mexican	£1 6s 3d
Alaska Tre'dwell	5 7 6
Burma Corp	3 15 0
Cam & Motor	0 11 6
Camp Bird	0 8 0
El Oro	0 10 0
Esperanza	0 12 0
Mexico Mines	3 15 0
Nechi, pfd	0 13 0
Oroville	0 16 9
Santa Gert'dis	0 12 0
Tomboy	1 2 0

SALT LAKE Sept. 19 Name of Comp.	Bid
Alta Con	25¼
Black Jack	07
Cardiff	7.00
Colorado Mining	16
Crown Point	04½
Daly-Judge	8.00
Emma Cop	1.25
Gold Chain	17
Grand Central	62
Iron Blossom	1.47½
Lower Mammoth	05
May Day	07¾
Opohongo	01
Prince Con	1.35
Seven Troughs	03
Silver King Coal'n	3.00
Silver King Con.	3.55
Sioux Con	11
So. Hecla	1.90
Uncle Sam	03
Wilbert	06
Yankee	16

COLO. SPRINGS	Sept. 19
Acacia	03
Cresson	6.48
Doctor Jack Pot	08½
Elkton Con	17
El Paso	44
Findlay	03½
Gold Sovereign	05
Golden Cycle	2.25½
Granite	74½
Isabella	21½
Jack Pot	05¾
Jerry Johnson	04
Mary McKinney	30
Portland	1.71
Vindicator	1.99

TORONTO	Sept. 19
Adanac	‡25
Bailey	09
Chambers Ferland	21
Coniagas	4.70
La Rose	59
Peterson Lake	22
Right of Way	05½
Seneca Superior	25
T. & Hudson Bay	60.00
Temiskaming	63
Wettlaufer-Lor	11
Dome Exten	36
Dome Lake	56
Foley O'Brien	60
Hollinger	7.00
Jupiter	30
McIntyre	1.44
Newray	.65
Porcu. Crown	71
Vipond	39
West Dome	37

N. Y. EXCH. Sept. 19 Name of Comp.	Clg.
Alaska Gold M	14
Alaska Juneau	7¼
Am.Sm.&Ref.,com	107¾
Am. Sm. & Ref., pf.	114¾
Am. Sm. Sec., pf. A	95
Am. Sm. Sec., pf. B	85
Am. Zinc	42½
Am. Zinc, pf	78½
Anaconda	90¾
Batopilas Min	1¾
Bethlehem Steel	559
Bethlehem Steel, pf.	129
Butte & Superior.	64¼
Chile Cop	20
Chino	53½
Colo. Fuel & Iron.	54¼
Crucible Steel	94½
Dome Mines	24¼
Federal M. & S.	21
Federal M. & S., pf.	43⅛
Great Nor., ore ctf	42¼
Greene Cananea.	49½
Homestake.	133
Inspiration Con.	61
International Nickel	48¾
Kennecott	52¾
Lackawanna Steel.	85
Miami Copper	37½
Nat'l Lead, com.	70¼
National Lead, pf.	‡110
Nev. Consol	21¼
Ontario Min	7
Quicksilver	3
Quicksilver, pf	5
Ray Con	24¾
Republic I&S, com.	67
Republic I&S, pf.	110
Sloss-Sheffield	57½
Tennessee Copper	25¾
Utah Copper	86
U. S. Steel, com.	108¼
U. S. Steel, pf.	120¾
Va. Iron C. & C.	54

N. Y. CURB	Sept. 19
Beaver Con.	43½
Buffalo Mines	85
Butte & N. Y.	1¾
Butte C. & Z.	6¾
Caledonia	64
Can. Cop. Corpn	1 9/16
Cashboy	.06
Cerro de Pasco	39¼
Con. Ariz. Sm.	1½
Con. Coppermines	2½
Con. Nev.-Utah.	5/16
Crystal Cop.	1¼
First Nat. Cop.	5¾
Florence	76
Goldfield Con.	74
Goldfield Merger.	07½
Granite	20
Hecla Min	5 3/16
Howe Sound	5
Jerome Verde	2 3/16
Joplin Ore & Spel	50
Kerr Lake	4¼
Magma	17½
Majestic	¾
McKinley-Dar-Sa	65
Mother Lode	38½
Nevada Hills	22
N. Y. & Hond	15¾
Nipissing Mines	8¾
Oro	03
Ray Hercules	3½
Rochester Mines	50
St. Joseph Lead	16¾
Standard S. L.	1½
Stewart	25
Success	38
Tonopah	5¾
Tonopah Ex.	5¾
Tribullion	¾
United Zinc	5½
White Knob, pf.	1¾
White Oaks	5½
Yukon Gold	2

BOSTON EXCH Sept. 19 Name of Comp.	Bid
Adventure	3½
Ahmeek	105
Algomah	1½
Allouez	66
Ariz. Com., ctfs.	12¾
Bonanza	28
Butte-Ballaklava	¾
Calumet & Ariz.	71½
Calumet & Hecla	555
Centennial	18
Copper Range	64
Daly West	2¾
East Butte	15¾
Franklin	8½
Granby	87¾
Hancock	13
Helvetia	25
Indiana	[illegible]
Island Cr'k, com.	43
Island Cr'k, pfd.	90
Isle Royale	30¼
Keweenaw	6
Lake	13
La Salle	1¾
Mason Valley	3¼
Mass	14½
Mayflower	2¾
Michigan	3½
Mohawk	89¾
New Arcadian	7
New Idria	14¼
North Butte	20¼
North Lake	2
Ojibway	1½
Old Colony	1¼
Old Dominion	67
Osceola	91
Quincy	89½
St. Mary's M. L.	87
Santa Fe	2¼
Shannon	9¼
Shattuck-Ariz.	30
So. Lake	5¾
So. Utah	23
Superior	18¾
Superior & Bost.	5½
Tamarack	‡37¼
Trinity	6¾
Tuolumne	50
U. S. Smelting	73¾
U. S. Smelt'g, pf.	52
Utah Apex	4
Utah Con	13¼
Utah Metal	‡7½
Victoria	3¼
Winona	5
Wolverine	‡48
Wyandot	1½

BOSTON CURB	Sept. 18
Bingham Mines	9¾
Boston Ely	1¼
Boston & Mont.	88
Butte & Lon'n Dev	.58
Calaveras	6
Calumet-Corbin	.03½
Chief Con.	1 15/16
Cortez	35
Crown Reserve	57
Davis-Daly	1 15/16
Eagle & Blue Bell	1 13/16
Houghton Copper	1¾
Iron Cap Cop., pf	5½
Mexican Metals	36
Mines of America	2½
Mojave Tungsten	4¼
Nat. Zinc & Lead	1 1/16
Nevada-Douglas	1 7/16
New Baltic	2
New Cornelia	16½
Ohio Copper	28
Oneco	85
Raven Copper	‡07
Rex Cons	27
Rilla	16
United Verde Ext	39½

‡Last Quotations.

Monthly Average Prices of Metals

SILVER

Month	New York 1914	New York 1915	New York 1916	London 1914	London 1915	London 1916
January	56.572	48.855	56.775	26.553	22.731	26.960
February	57.506	48.477	56.755	26.573	22.753	26.975
March	58.067	50.241	57.935	26.788	23.708	27.597
April	58.519	50.250	64.415	26.958	23.709	30.662
May	58.175	49.915	74.269	26.704	23.570	35.477
June	56.471	49.034	65.024	25.948	23.267	31.060
July	54.678	47.519	62.940	25.219	22.597	30.000
August	54.344	47.163	66.083	25.979	22.780	31.498
September	53.290	48.680		24.260	23.591	
October	50.654	49.385		23.199	23.925	
November	49.082	51.714		22.703	25.094	
December	49.375	54.971		22.900	26.373	
Year	54.811	49.684		25.314	23.675	

New York quotations cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

COPPER

Month	New York Electrolytic 1915	New York Electrolytic 1916	London Standard 1915	London Standard 1916	London Electrolytic 1915	London Electrolytic 1916
Jan	13.641	24.008	60.756	88.083	65.719	116.167
Feb.	14.394	26.440	63.494	102.667	*	133.167
Mar.	14.787	26.310	66.152	107.714	*	136.000
April.	16.811	27.895	75.096	124.319	*	137.389
May	18.506	28.625	77.600	135.457	*	152.522
June.	19.477	26.601	82.574	112.432	95.333	137.455
July.	18.796	23.865	76.011	95.119	91.409	125.500
Aug.	16.941	26.120	68.673	110.283	82.333	126.304
Sept.	17.502		68.915		85.250	
Oct.	17.686		72.601		88.000	
Nov.	18.627		77.744		93.273	
Dec	20.133		80.773		100.43	
Year.	17.275		72.532			

TIN

Month	New York 1915	New York 1916	London 1915	London 1916
January	34.260	41.825	156.550	175.548
February	37.415	42.717	176.925	181.107
March	48.426	50.741	180.141	193.609
April	47.884	51.230	166.225	199.736
May	38.790	49.125	162.675	196.511
June	40.288	42.231	167.636	179.466
July.	37.423	38.510	167.080	168.357
August	34.389	38.565	151.440	169.870
September	33.125		152.625	
October	33.080		151.554	
November.	39.224		167.670	
December	38.779		167.000	
Av. year	38.590		163.960	

LEAD

Month	New York 1915	New York 1916	St. Louis 1915	St. Louis 1916	London 1915	London 1916
January	3.729	5.921	3.548	5.826	18.606	31.167
February	3.827	6.246	3.718	6.164	19.122	31.988
March	4.053	7.136	3.997	7.375	21.883	34.440
April	4.221	7.630	4.142	7.655	21.094	34.368
May	4.274	7.463	4.182	7.332	20.347	32.967
June	5.932	6.936	5.836	6.749	25.170	31.011
July	5.659	6.352	5.531	6.185	24.611	28.137
August	4.656	6.244	4.520	6.088	21.946	29.734
September	4.610		4.490		23.151	
October	4.600		4.499		23.994	
November	5.155		5.078		26.278	
December	5.355		5.266		28.807	
Year	4.673		4.567		22.917	

SPELTER

Month	New York 1915	New York 1916	St. Louis 1915	St. Louis 1916	London 1915	London 1916
Jan.	6.386	16.915	6.211	16.745	30.844	89.810
Feb.	8.436	18.420	8.255	18.260	39.819	97.762
Mar.	8.541	16.846	8.360	16.676	44.141	95.048
April	10.012	16.695	9.837	16.525	49.888	99.056
May	14.781	14.276	14.610	14.106	68.100	94.217
June	21.208	11.752	21.038	11.582	100.614	68.591
July	19.026	8.925	18.856	8.755	97.250	50.760
Aug.	12.781	8.730	12.611	8.560	67.786	51.587
Sept	13.440		13.270		67.841	
Oct	12.800		12.596		66.536	
Nov	15.962		15.792		88.409	
Dec	15.391		15.221		89.400	
Year	13.230		13.054		67.553	

New York and St. Louis quotations, cents per pound. London, pounds sterling per long ton. * Not reported.

PIG IRON IN PITTSBURGH

Month	Bessemer‡ 1915	Bessemer‡ 1916	Basic‡ 1915	Basic‡ 1916	No. 2 Foundry 1915	No. 2 Foundry 1916
January	$14.59	$21.60	$13.45	$18.78	$13.90	$19.70
February	14.55	21.16	13.45	18.93	13.90	19.51
March	14.55	21.81	13.45	19.20	13.95	19.45
April	14.55	21.65	13.45	18.95	13.95	19.45
May	14.61	21.78	13.60	19.11	13.83	19.58
June	14.70	21.95	13.67	18.95	13.77	19.34
July	14.94	21.95	13.91	18.95	13.68	19.20
August	16.01	21.95	15.31	18.95	14.75	19.25
September	16.86		15.95		15.70	
October	16.95		15.96		15.80	
November	17.57		16.17		17.20	
December	19.97		18.44		18.95	
Year	$15.82		$14.76		$14.95	

‡As reported by W. P. Snyder & Co.

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The Lakeview Mine, Utah

By Douglas W. Jessup*

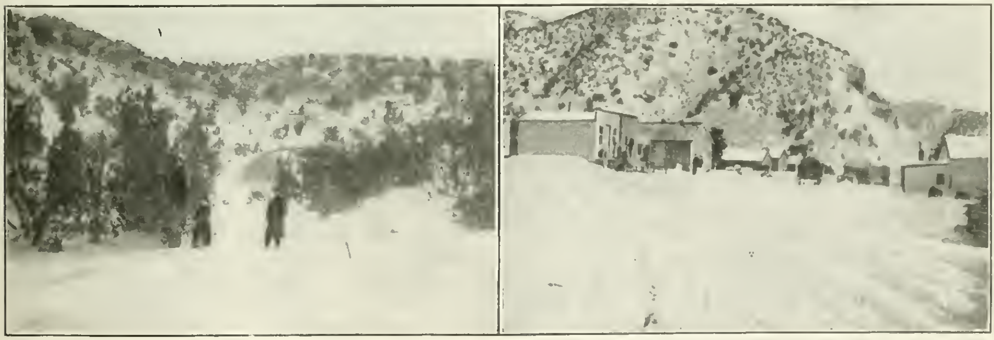
SYNOPSIS—The Lakeview mine is in a district not formerly known to be well mineralized. It promises to be one of the largest zinc producers of the West. It has been self-supporting, no money has been invested for development, and dividends have been paid. Other mines have come into existence in neighboring ground, stimulated by Lakeview's success.

The last year has seen the growth and development of the Lakeview mine, a property that gives promise of being one of the large zinc producers of the West. Not only has the mine been self-supporting from the grass roots, but after less than 6 months of operation, the first dividend was paid. Being a newly discovered orebody and in a district formerly supposed to contain but little mineral, the property as well as the district has commanded a great deal of attention and interest. In a report to the company, the manager, S. S. Arentz, supplied a large portion of the following data:

The property is 3½ mi. north of Saline, Boxelder County, Utah. The elevation is about 5,200 ft. and is 1,000 ft. above the level of Great Salt Lake. The shortest distance to the lake is less than one mile. The lower portion of the property contains the Lakeview townsite and is part of a former shore of the lake. The higher portion is more rugged and is partly covered with a growth of stubby cedar trees. The climate is semiarid; there is no running water and the vegetation is limited.

No mining of importance was done previous to the locations of the Lakeview Mining Co. The first discovery of mineral was made in 1907 on a thin seam of copper ore lying in a quartzite contact 1½ mi. northwest of Saline. Only a few pounds of ore was mined, and no shipments were made. In 1909 a company of Ogden men located two groups of placer claims covering a bed of marble-limestone and containing a large portion of the present mining company's property. Only assessment work was done, no marble being sent to market. In December, 1914, workmen walking up a wash leading to the outcropping limestone beds discovered boulders of lead-zinc carbonate and traced them to the outcrop of ore found in a contact between the so-called Middle Limestone bed and the Lakeview shale. Four claims were located, a few opencuts and holes were made in the outcrop, and a small quantity of ore was mined for shipment.

On Mar. 9, 1915, the Lakeview Mining Co. was incorporated. No stock was sold, all expenditures made by the original owners were returned to them and from May 1, less than 60 days of operating, the property was self-supporting.



VIEWS OF THE LAKEVIEW MINE AND THE TOWNSITE IN WINTER

The basal geological formation of the district in Archæn schist, which is overlain by a great series of massive quartzites, several thousand feet in thickness. The quartzite outcrops from along the shores of the lake, ¾ mi. west of the Lakeview mine, to the western edge of the property and to the base of the mountain. Overlying the quartzite is approximately 500 ft. of metamorphic shales, limestones and quartzites in thin beds, very dark in color and ranging from a green to a black. Resting upon these beds is 50 ft. of deeply stained limestone with outcrops of ore carrying from a trace to 31½% zinc. This is followed by 10 ft. of shaly limestone, then limestone shales capped by 50 ft. of marble-limestone on which the original placer claims were located. A bed of shale 75 ft. wide, rests above the limestone, and this is followed by the middle bed, or ore-bearing limestone, 70 ft. in thickness. Overlying is another bed of shale from 50 to 75 ft. thick, and above this, running back for a distance of about 4 mi. to the east side of Promontory Point, is a series of thick limestone beds separated in places by marl and shale. The quartzite is pre-Cambrian, the limestones and shales range from Cambrian to Carboniferous.

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*Mining engineer, Midvale, Utah.

The general strike of the beds is north 40° west with an easterly dip of 30° to 40°. The strike and dip bear the same regularity for three miles on the southern extremity of Promontory Point. On the Lakeview Mining Co.'s property, three cañons, bearing southwest to northeast, give a clear-cut exposure of the various beds and permit development by means of adits that expose the ore contact in the middle bed along its course. No fault displacements of any moment are noticeable to the east of the property, although numerous fissures indicate mineralization at depth.

The Middle Bed and Its Ore Deposits

All ore developed in the Lakeview property is found in the Middle-Bed limestone, and prospecting has developed ore for a distance of 4,500 ft. as measured along the outcrop. The outcrops are not conspicuous—in fact, just the reverse—and for this reason the district up to this time has been overlooked by the prospector in his search for minerals.

The ore occurs in a contact or bedding plane between a shale hanging and a limestone foot wall. It is found in chimneys, shoots and kidneys. The strike is north 40° west, the dip is 35° to the northeast and the rake of the oreshoots is to the north. The ore makes out into the soluble limestone along north and south fissures, sometimes as far as the shale beneath the middle-bed limestone. These north and south fissures are numerous; they are so close together that ore will make almost continuously along the bedding. The fissures show displacements in the main workings of from a few inches to one of 12 ft. They dip westerly. The faults are normal and show no displacement of the beds along the strike.

The metal content of the orebodies is principally lead and zinc. There is less than an ounce of silver and no copper or gold. The zinc occurs as smithsonite, or zinc carbonate, varying in color from white to dark brown. The lead, occurring in lesser quantities, is found as cerrusite, or lead carbonate, constituting about one-sixth of the ore. Barite, which occurs in large quantities and lies in contact with the hanging wall, is known as the ore indicator or lead. The lead ores are also found in contact with the hanging wall and the barite; the zinc ores underlie the lead and are in contact with the foot wall, often extending in the foot wall for several feet. The ores occur as regular replacement bodies, ranging from a narrow seam to bodies 30 ft. in width.

The carbonate ores have probably been produced by the solvent action of the mineral sulphates, formed by the oxidation of the sulphide minerals, and the solutions coming in contact with the limestone have precipitated the ores as carbonates. The district has undergone heavy weathering and erosion, and as the water level is at least 500 ft. below the surface, the ore is well oxidized. Near the surface the ore solutions have spread in the broken limestone, making deposits of a larger nature and intermixed with pieces of wall rock. A great deal of this is second-class ore and requires sorting. At a lower depth the solutions, being more confined, have made deposits of a better grade.

The original orebodies have been altered and leached. The soluble ores have been redeposited, probably at a lower depth. The open watercourses found in the contact indicate original ore channels from which the ore has been leached. While the orebodies found at a lower depth are more compact and of better grade, still they are not in as great quantity as the bodies nearer the surface. At water level the orebodies are often at their maximum size, this being due to the solvent action of the acid solutions upon the limestone forming large chambers favorable to the deposition of ores in quantity. So it may be reasonable to assume that when water level has been reached, orebodies of large size may be developed. Judging from the surface deposits, there seems to be a progressive decrease in zinc content with a consequent increase of lead content from the top toward the bottom of the ore channels. As this is contrary to the general formation of ore deposits, further developments will be awaited with interest.

It is a question whether the ore is confined at depth to the main contact. The Skyline tunnel was driven 75 ft. in ore and on the lower contact between the Middle-Bed limestone and the underlying shale. Here the ore channel reverses and dips to the southwest instead of northeast. The solutions may have followed up through this lower contact or may have migrated from the upper main ore contact. The spelter fissure, at the north end of the property, lies in the middle of the limestone bed; this is also true of the lead fissures in the Buckley tunnel toward the southern end of the property, but in both cases the ore seems to trend toward the main contact, perhaps following cross-fissures, to be deposited in a broken zone paralleling the main contact.

An igneous dike appears about 2,000 ft. northeast of the mine and above Grand View gulch. It is 4 ft. wide and can be traced for 150 ft. in a heavy bedded limestone. The dike is dioritic and undoubtedly has some bearing on the ore deposits. At the bottom of an incline sunk in the No. 1 tunnel, decomposed porphyry was encountered stained with copper, the first appearance of copper on the property.

Development of the Property

On the south side of the ridge, separating Lakeview gulch from Volunteer gulch, the property has been developed by six production and one development tunnels; on the north side of the ridge by three production and three minor tunnels. On the south side of Lakeview gulch and on the north slope of what is known as South Mountain, leasers have driven two tunnels and developed a 12-ft. body of lead ore. There are also several opencuts and minor workings along the contact. The tunnels are all driven along the main ore contact, between the Middle-Bed limestone and the overlying shale, with the exception of the first 1,000 ft. of No. 1 tunnel. A minor tunnel, called the Skyline, has developed the fissure of ore spoken of, in the lower contact.

The tunnels vary in length from 100 to 1,050 ft. The No. 1, or main production tunnel, is at an incline depth of 880 ft. below the top of the mountain ridge. The Complex, or lowest tunnel, is at an incline depth of 95 ft. below No. 1 tunnel. This tunnel is being rapidly pushed forward to develop the ore channels at depth and is now over 800 ft. in length. When completed, it will be used as the main working tunnel. Owing to the contour of the ground, this is the lowest tunnel obtainable and future deep development must be gained by sinking. From the Complex tunnel the ore above will be mined by overhand stoping, dropped into chutes to the tunnel level and hauled out by means of a mule train. The mined stopes will be filled with any waste or second-class ore extracted. Development below the tunnel level will be carried on by sinking a two-compartment inclined shaft on the contact, from which various tunnels and drifts will be driven to prospect and develop the ore channels. This incline will be extended to the surface to avoid the installation of an underground hoisting system. At the mouth of the tunnel will be placed the remainder of the surface equipment, including the ore and sorting bins, blacksmith shop, proposed narrow-gage railroad terminus and other buildings. The mine contains over 11,000 ft. of workings, of which leasers have done 3,500 ft. Most of these workings are in ore.

THE LOWER TRAIN BIN OF THE LAKEVIEW MINE

There are 13 distinct ore channels or shoots more or less connected with one another, seven of which are quite pronounced. The various tunnels extend along the ore contact and intersect each channel. The ore between the levels is mined both by sinking and raising from one level to the other. Selective mining is practiced: either the lead or zinc ore is mined alone, or the high-grade zinc is mined separately from the low-grade. This requires careful mining and constant assaying. At times it is quite difficult to distinguish between the various kinds and grades of ore; a kidney of high-grade may be embedded in a kidney of low-grade ore, and there may be but little visible distinction between them.

The ore, being soft, is easily mined; a large amount of it is extracted by the use of the pick and shovel only. The harder ground requires hand steel, and a limited number of jackhamers are used. These are employed for drifting in the Complex tunnel and do satisfactory work. The broken ore is shoveled or loaded from the chutes into 16-cu.ft. mine cars, then trammed to the mouth of the tunnel and sent down surface chutes or pipes to the No. 1 tunnel level. Here it is dumped over a ½-in. mesh screen on the sorting floor; the fines are sent to the upper-tram bin of 80 tons capacity; the coarse is hand-sorted and joins the fines; the sorted waste goes to the second-class dump. From the upper-tram bin, the ore is carried down a 600-ft. gravity tram to an 80-ton ore bin. From this bin the ore is loaded for wagon haulage to the depot. The tram is a three-rail track with a one-car pass, gravity operating, and is fitted with a 4x5-ft. winding drum and band brake. The tramcars hold about 2,800 lb. of ore and are self-dumping. Three ore sorters are employed on the sorting floor. They stand on a platform built beneath the true floor and so avoid the excessive bending over. About one-sixth of the ore is waste and one-fourth is screening. The grade of ore is raised or lowered according to the price of zinc and the nature of the contract.

The ground stands exceptionally well; the stopes are not large, and but little timbering is required. A few stulls are used, and occasionally two posts and cap are necessary to hold up a loose piece of hanging wall. Rails of 8-lb. weight are used for track. The hand windlass is employed for hoisting from the inclines, the dumping platform being built above the track level from which the ore is dumped into the cars with a minimum amount of lifting. Owing to the high price of metals, the mining operations have been forced to produce ore in the quickest and best way possible and development of the property has not been carried on as it would be in normal times. The zinc ores have been mined almost to the exclusion of the lead ores, but now, with the drop in zinc prices, more attention will be paid to the production of lead.

HANDLING THE LOW-GRADE ORES

The mine contains a large tonnage of ore carrying from 10 to 20% zinc as a carbonate and a lesser tonnage of mixed lead and zinc ores. This ore is of easy access. The dumps all carry high zinc content, ranging from 5 to 20%. Experiments are in view to separate the zinc from the lead by wet concentration and also by sulphidizing flotation. Calcining the ore has been considered, the zinc carbonate being roasted to zinc oxide with a loss in weight and a consequent increase in zinc content.

On the dump of No. 1 level are the tramway ore bin, sorting floor and blacksmith shop. The shop contains a distillate-driven compressor, also the necessary tools and equipment for sharpening steel, handling pipe, etc. The Lakeview townsite is about 1,000 ft. below the mine workings, just south of the ore bins and on a bench of a former lake shore. The buildings consist of a main office, boarding house, assay office, general store, pool hall, four bunkhouses, several dwellings, boarder tents, etc.

The road from the railroad station Saline to the mine is 3½ mi. long. Though somewhat dusty, it is in fair condition and of an even grade until a point 2,000 ft. from the mine is reached, when a 13% grade is encountered. Ore haulage is done by four-horse teams, wagon and trailer. Over 12 tons of ore is hauled per load at a cost of $1.25 per ton. A motor truck formerly employed for haulage was abandoned, the muddy condition of the roads in winter causing its withdrawal. A stock company has been incorporated to build a narrow-gage railroad from Promontory Point to the mine, a distance of 5½ mi., gage to be 24 in. The ruling grade will be 2%, with a maximum grade of 2½%. The road is expected to be in operation by next spring.

The power is all obtained from crude distillate costing 9c. per gal. Electric power can be obtained from Ogden, a distance of 20 mi.

There is no running water upon the property. At present all water is hauled from Ogden and delivered at the mine for 75c. a barrel. It is stored in a concrete cistern, built below the ground, and holding three tankloads. Two larger water tanks are being installed. A well is being driven 2,000 ft. west of the mine, and it is at a vertical depth of 150 ft.; water is expected at 250 ft., but the equipment is for 1,000 ft. The strata dip to the northeast and away from the well, which is about 600 ft. above the lake level, and only surface water can be expected.

The company is sinking a water shaft in the wash of Lakeview gulch and near the mine. The shaft has a hoisting compartment and manway. Its depth is 121 ft., of which 60 ft. is in wash. It will reach the main ore contact at a depth of 250 ft., and both ore and water are expected. There are several fresh-water springs near the lake shore, but the water is brackish. Piping water from the Maple Leaf Springs, 3 mi. northeast from the mine, has been considered.

Leasers Working on Property

A large portion of the property has been given out to leasers. They pay a certain royalty to the company regardless of the metal content of the ore, and they do a required amount of development work. The Western Zinc Co., or W. H. Clark lease, has leased the north and south extensions of the property, a portion of ground between the upper tunnels, and a block on the north side of the ridge below the No. 5, or upper, tunnel. This section has produced a large tonnage of ore averaging 33% zinc, which was mined from three tunnels. The ore was handled by outside chutes, dropped to a 25-ton ore bin and hauled by wagon to Saline, the railroad station. On the southern side of Lakeview gulch this company has developed a 12-ft. body of ore assaying 20% lead. Over 1,200 tons has been shipped. This body of ore has been developed by means of two tunnels known as the Buckley tunnels Nos. 1 and 2. The ore does not lie in the limestone-shale contact, but it is about 25 ft. away and in the limestone. The Clark lease has also shipped lead and zinc ores from surface workings near the No. 1 tunnel and developed a part of the lower, or Complex, tunnel. The operators have their own equipment, boarding house, etc.

The Volunteer Lakeview Co. has subleased one claim from the Lakeview Co. The claim has been developed by an incline shaft sunk in the ore contact. It is 156 ft. deep and pitches 33° to the north. Drifts at the 50-ft. and bottom levels, and two raises in the ore, have blocked considerable ore carrying from 5 to 20% zinc. This company also owns two claims adjoining the Lakeview property on the northwest. No ore has been shipped as yet, but a shipment is ready in the bin.

The Spelter lease contains the northern section of the Lakeview property. The operators have drifted in a body of zinc ore lying in the middle-bed limestone. One vein is about 40 ft. from the true shale hanging wall. There are several drifts, winzes and raises following oreshoots and water courses. The ore seems widely disseminated in the broken limestone and is of lower grade. No shipments have been made.

The Grandview Mining Co. adjoins the Lakeview on the north and northeast, with five unpatented claims. The workings consist of three minor tunnels, one 65-ft. incline and one 75-ft. vertical shaft. They all lie in a contact between a shale hanging and a limestone foot wall. Only ore of lower grade has been developed. The Cedar Ridge has seven unpatented claims adjoining the Lakeview on the northeast. The operators have prospected a shoot of zinc ore carrying from 10 to 20% zinc. The ore lies in the limestone and has been developed by one tunnel with two winzes. The Jay Hawk, also on the northeast, has five unpatented claims. There is but one short tunnel with two inclines sunk in mineralized limestone. A few hundred pounds of galena has been mined. This is the only discovery of galena in the district. The Promontory Development Co. and the Farr Lease are two properties at the extreme south of the Lakeview ore contact. They have small amounts of lead ore.

Shipping Ores from the Lakeview Property

The Lakeview Mining Co. and its leasers include the only ones in the district to have developed ore of shipping grade, in quantity. By careful mining and sorting some of the adjoining properties may be able to ship an occasional carload of ore. The higher grades seem to lie in the Middle-Bed or Lakeview contact and in that section of the contact between the Volunteer gulch and the territory just south of the Lakeview gulch.

From Apr. 15, 1915, when the first ore shipment was made, to Aug. 1, 1916, the company shipped over 10,000 tons of ore with a zinc content of 30% and over 500 tons of 20% lead ore. Company leasers have shipped over 3,000 tons of ore averaging 33% zinc, and 1,200 tons of ore carrying 20% lead. It has lately been decided to extend the operations of these leasers and give them more territory.

Dividends amounting to $150,000 have been paid to the stockholders, the property has been well equipped, mine buildings and cottages have been built and other surface equipment, amounting to a probable expenditure of $30,000. There is a large cash balance in the treasury. For every three dollars divided the company has attempted to place one dollar in the treasury for future development of the property.

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Rhodesian Mineral Production

The total mineral production of Southern Rhodesia in 1915, according to *United States Commerce Reports*, was greater than that of 1914, which in turn was in excess of the output of 1913, which constituted the previous record. The yield of gold for the year was 915,029 oz., an increase of 60,548 oz. of fine gold. Among the 16 gold-producing countries of the British Empire, Rhodesia ranks fourth, being only slightly under Canada. The value of other minerals declared in Southern Rhodesia for the period under review was $2,802,646, as compared with $1,173,537 in 1914. The principal increases in mineral production other than gold were in copper and chrome ore, largely used in the manufacture of shells and other war materials.

The following table shows the quantities of principal minerals produced in Southern Rhodesia during 1914 and 1915:

Mineral	1914	1915
Gold, oz.	854,481	915,029
Silver, oz.	150,793	185,233
Coal, tons	349,459	409,763
Chrome iron, tons	48,207	60,581
Asbestos, tons	487	2,010

The copper production for the period Jan. 1-Sept. 30, 1915, totaled 2,591 tons. Dividends amounting to $2,732,138 were declared by Rhodesian mining companies during 1915, an increase of $357,152 on the amount declared in 1914. This sum does not include the profits made by local syndicates and individuals, which are said to have been substantial.

The copper production in the Transvaal shows a large increase over that of any preceding year. This is accounted for by the development of the mines at Messina, which are now turning out large quantities of this metal. The sales of copper in 1915 amounted in value to $1,988,778, a gain of $429,907 over the previous year. The copper output for 1916 promises to be larger than ever before, owing to increased development.

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Mining Congress Meeting

The nineteenth annual session of the American Mining Congress, which meets in Chicago during the week beginning Nov. 13, promises to be marked by features of exceptional interest.

The addresses of welcome by Governor Edward F. Dunne of Illinois, Mayor W. H. Thompson of Chicago and President J. W. O'Leary of the Chicago Association of Commerce will be responded to by representatives of each mining state giving a carefully prepared three-minute resolution setting forth that state's most important mining issue. This expresion of opinion will have a guiding influence upon the work of the Resolutions Committee.

The general meeting to consider the subject of "Safety" will be addressed by Van. H. Manning, director of the United States Bureau of Mines, on the subject of "The Past and Future of Mine Safety Work."

At the Wednesday meeting to consider the subject of "Efficiency in Mining," Col. George Pope of Hartford, Conn., president of the National Manufacturers' Association, will make the principal address, to which Secretary of Labor Wilson is expected to reply. Honorable E. N. Hurley, chairman of the Federal Trade Commission, will also address this meeting.

The subject for Thursday will be "Conservation." Among the speakers on this subject will be Senator Phelan of California, and Hennen Jennings, of Washington, D. C.

The Zinc and Lead Section of the Congress will convene in its own meeting room at 2 p.m. Tuesday, with S. D. Nicholson, of Denver, Colo., as chairman. "Tariff for Revenue Related to a Compensating Duty on Lead and Zinc Ores" will be the title of the principal address, delivered by Otto Ruhl, of Joplin, Mo. J. H. Troutman, of the Empire Zinc Co., Denver, Colo., will address the meeting on the subject of the "Importance of Zinc in Preparedness." Other addresses will be made by W. B. Shackleford, R. M. Henderson, C. E. Siebenthal, F. G. Cottrell, Edward H. Nutter and H. C. George.

The Precious Metals Section of the Congress will meet in a room by itself on Tuesday, Nov. 14, at 2 p.m., with Irving T. Snyder, of Cripple Creek, presiding. Senator John F. Shafroth of Colorado will address the assembly on "The Future of Silver." Waldemar Lindgren will speak on "The World's Gold Supply and its Sufficiency for Business Needs." Thomas B. Stearns of Denver, president of the Denver Civic Association, will speak on "The Best Industry of the Rocky Mountains West." and W. R. Allen, of Butte, Mont., on "How to Protect the Small Investors in Metalliferous Mines."

On Thursday, with D. W. Brunton, of Denver, presiding, the committee on Revision of Mineral Land Laws is to report through its chairman, E. B. Kirby. Congressman M. D. Foster, of Illinois, chairman of the House Committee on Mines and Mining, will address this meeting on the subject of the "Foster Bill." Horace V. Winchell, of Minneapolis, is also to speak on this topic. The discussion promises to be warm and interesting.

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Foreign Trade in Copper

Exports of copper from the United States in July are reported by the Department of Commerce as below, in pounds:

Ore and concentrates, contents	244,615
Unrefined, blister copper, etc	4,492,264
Refined, bars, etc	66,923,416
Old and scrap	55,463
Plates and sheets	688,900
Wire	4,606,193
Total copper	77 010,851

The weight of ore exported in July was 5,076 tons; of concentrates, 380 tons.

Imports of copper into the United States in July are reported by the Department of Commerce as below, in pounds:

Ore and concentrates, contents	13,413,073
Matte, contents	878,512
Unrefined, etc., in bars, pigs, etc	27,027,316
Old, etc., for remanufacture	484,271
Composition, copper chief value	17,624
Total copper, lb	41,820,796

Actual tonnage of copper-bearing material imported in July was 38,779 tons ore, 8,742 tons concentrates and 1,358 tons matte

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Scope of Extralateral Rights

By A. L. H. Street*

The Nevada Supreme Court has solved three important legal questions relating to mining rights under Section 2,322 of the United States Revised Statutes, which gives to locators the exclusive right to "all the surface included within the lines of their locations and of all veins, lodes and ledges throughout their entire depth, the top or apex of which lies inside of such surface lines . . . although such veins, lodes or ledges may so far depart from the perpendicular in their course as to extend outside the vertical side lines of such surface locations." The decision appears in the case of Jim Butler Tonopah Mining Co. vs. West End Consolidated Mining Co., 158 Pacific Reporter, 876, and the rules laid down are as follows:

Where a patented location is in the form of a parallelogram, except for the exclusion, for conflict, of a triangular piece at one corner, the remainder of what would have been the end line but for such exclusion is to be regarded as the end line for the purpose of determining the claimant's extralateral rights.

Under the statute quoted, extralateral rights may be claimed in opposite directions on a vein in the form of a single anticlinal fold.

The crest of a vein in the form of an anticlinal fold is the apex within the meaning of the law, a terminal edge not being essential to the existence of an apex.

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*Attorney at law, 829 Security Building, Minneapolis, Minn.

Potash Plant at Searles Lake

Machinery is now being forwarded to a mill site near the patented land of the Pacific Coast Borax Co. at Searles Lake, Calif., where a commercial unit for the production of potash is expected to be in operation by Jan. 1, 1917, under the joint management of the Solvay Process Co. and the Pacific Coast Borax Co. Mention was made in the *Journal* of July 15, 1916, of the selection of the mill site, drilling of fresh-water wells and other preliminary work. Early this year the Borax company shipped two tank cars of Searles Lake brine to its Alameda works, where the method of potash recovery developed by the Solvay chemists was checked in a practical way by the technical staffs of both companies.

The output of the first commercial unit will be 40 tons per day of potassium chloride. During the first few weeks, only a 60 to 70% product will be made, but it is expected that the purity of the product will be brought up to 85 or 90% for the subsequent commercial output. It is planned to erect a second unit as soon as the first is completed and in running order. While no attempt will be made, during the period of present high prices for potash salts, to market the other salts contained in the Searles Lake brine, eventually, there will be an important output of sodium borate and soda ash as by-products from the potash plant.

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Second National Exposition of Chemical Industries

The Second National Exposition of Chemical Industries opened at the Grand Central Palace, New York City, Monday afternoon, Sept. 25. There are about 200 exhibits in the hall, bearing testimony to the great advances made in the chemical industry in this country, particularly since the outbreak of the European War. The exhibits comprise what is probably the largest chemical demonstration ever made in this country and certainly show a remarkable development since last year. A large number of distinguished chemists and business men interested in industrial chemistry attended the opening ceremonies, and the American Chemical Society is holding its 53rd annual meeting simultaneously with the exposition, in order to obtain the benefit of the added interest and technical information that they can secure at the same time.

Among the novel exhibits is one of glassware, the expansion under heat of which is so small that it can be safely used for culinary purposes. Glassware of this sort, used particularly for laboratory purposes, was formerly imported from Germany, and the lack of it was so strongly felt that domestic companies were stimulated to begin its manufacture, which has, it seems, now been attended by complete success.

Another of the interesting exhibits is that of Thomas A. Edison, who, before the European War, imported many of his chemicals from Germany. From the outbreak of the war he immediately began to make plans to produce some of his most necessary materials and has succeeded in making them commercially. E. I. du Pont de Nemours & Co. are also supplying a special line of chemicals and intermediates upon a large scale.

Perhaps one of the most interesting exhibits at the exposition, at any rate to miners, is the series of moving pictures that forms a part of the United States Bureau of Mines exhibit. There are 11 films, which, in general, show how raw products are procured, how iron ore is mined, how cement is manufactured, the process of zinc mining, milling and smelting, and the mining and extraction of radium from carnotite ore.

Many of the exhibitors are well known to the mining profession, and among them may be mentioned the Dorr Co., Sweetland Filter Press Co., Kelly Filter Press Co., Abbe Engineering Co., Hardinge Conical Mill Co., Eimer & Amend, Foote Mineral Co., Huff Electrostatic Separating Co., Mine and Smelter Supply Co., Raritan Copper Works, Roessler & Hasslacher Chemical Co., Ruggles-Coles Engineering Co., and the Westinghouse interests. The American Institute of Mining Engineers and the United States Bureau of Mines are also well represented. A particularly attractive exhibit is that of "Anaconda Electric" zinc, shown by the Raritan Copper Works. Altogether the exhibit is a notable one, and anyone attending it will be well repaid for the time spent by the interesting and valuable information gained about the chemical industries of the United States.

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Shannon Copper Co.

The report of the Shannon Copper Co. for the first half of 1916 shows a total production of 4,376,199 lb. of copper, which cost 17.2c. per lb. to produce. The average selling price was 27.363c. per lb., leaving a profit of 10.163c. The property was operated for five months only, being closed in January on account of the strike. Production and profits are shown in the following table:

PRODUCTION AND PROFITS OF THE SHANNON COPPER CO.

	Production, Lb.	Profits
February	667,000	$66,698.80
March	678,000	63,447.94
April	977,000	109,180.83
May	1,067,000	126,627.28
June	987,000	82,441.55
	4,376,000	$448,396.40

Deducting $14,176, expenses in January while the property was not running, leaves a balance of $434,220 net profit. Current assets on June 30, 1916, in excess of current liabilities amounted to $991,407, exclusive of the $388,000 of Shannon Arizona Railway Co.'s first mortgage bonds in the company's treasury on June 30, 1916.

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Information on Alloys

The American Institute of Metals has communicated to its members a request made by Dr. G. K. Burgess, chief of the Division of Metallurgy, Bureau of Standards, Washington, D. C., that at the fall meeting of the Advisory Committee, representatives of the Institute have available as much information on the properties of various alloys as possible. Dr. Burgess' idea is to make the bureau a clearing house for such information in order to accumulate reliable experience tables.

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Bismuth from Peru is exported in the form of concentrates, according to a recent consular report. The production in the last four years has varied from 24 to 81 tons, all of it exported. The principal mine is the San Gregorio in the Cerro de Pasco district. Its production is limited as it has been controlled by the trust which formerly included the Saxon State mine administration at Freiburg, the Deutsche Gold- und Silberscheide Anstalt at Frankfurt and Johnson, Mathey & Co. at Liverpool. This trust has been broken up by the war, but Johnson, Mathey & Co. continue to control the mine and limit shipments, which could be much increased.

Electrolytic Precipitation from Cyanide Solutions

By G. H. Clevenger*

SYNOPSIS—A discussion of the possibilities of electrolysis as a precipitant in cyanide process. While previous attempts have been partly successful, the great area of cathode surface required and the difficulty of providing proper solution agitation have been serious obstacles.

Some time ago I presented a paper[1] upon this subject to the American Electrochemical Society. This paper was confined to practice, up to that time, as carried on under plant conditions, there being no attempt to discuss the data presented or to suggest possible points of improvement for new installations. The case would therefore be somewhat better for electrolytic precipitation plants than this paper would indicate if designed, built and operated upon sound electrochemical principles and with proper cognizance of previous experience.

The accompanying table, compiled under my direction from data collected from all available sources, gives the essential features of electrolytic precipitation as previously practiced. In general, the lower percentage of precipitation of the gold and silver as compared with chemical methods of precipitation is to be noted. In the case of the Butters installations this was intentional, as all the solution used for final washes was passed through zinc after leaving the electrolytic boxes since, with the equipment used, this was found more economical than to attempt complete precipitation by electrolysis.

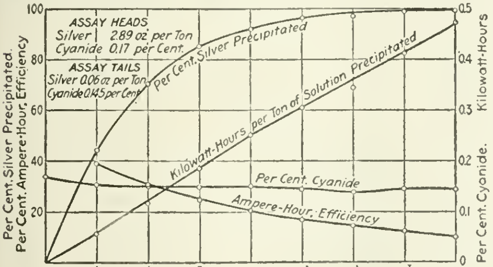

FIG. 1. PRECIPITATION FROM FRESH CYANIDE SOLUTION

It is a well-known fact that as the proportion of metal in solution decreases, the difficulties of precipitation increase. Thus it may require as great an electrode surface, as long a time and as great a consumption of power to precipitate the last 10% of the gold and silver as the first 90%. This is illustrated by the curves shown in Figs. 1 and 2, which embody the results of small-scale experiments in which the solution was agitated throughout electrolysis by means of a small wooden propeller driven by an electric motor. Fig. 1 shows the results upon a fresh cyanide solution containing silver. The loss of cyanide during precipitation is apparent. Since most of this took place at the beginning of the test, it is possible that there was a mistake in the original titration. Fig. 2 shows the results upon Tonopah Extension mill solution of very nearly the same silver content. In this case a gradual increase in the cyanide strength up to the end of the test is to be noted. This is to be expected of a mill solution containing zinc and sulphocyanate.

The Rapidity of Electrolytic Precipitation

It has been pointed out on many occasions that metals in solution can be precipitated by electrolysis only as fast as they are brought in contact with the electrodes. When it is remembered that it is only the thin film of solution in contact with the cathode from which precipitation is taking place, the necessity for agitation or rapid movement of the solution in order that the thin film of impoverished solution may be rapidly removed and replaced by solution containing the metal is apparent. This becomes of greater importance as the metal content of the solution decreases. In none of the previous installations for electrolytic precipitation was proper provision made for the rapid movement of the solution necessary if the best results are to be attained. Invariably the practice was to allow the solution to pass gently by gravity flow through the compartments in which the electrodes were suspended. This feature of the process much resembled the gentle flow of solution through the boxes used for zinc-shaving precipitation. Agitation could be accomplished by mechanical stirring gear or by circulating the solution by means of centrifugal pumps. The latter proposal perhaps has the advantage, although with such a system care would have to be exercised that the solution was properly distributed. The lack of proper agitation in some of the older plants sometimes manifested itself by the formation of insoluble silver cyanide at the anode. With proper agitation this would never occur so long as free cyanide was present. The necessity for proper movement or agitation of the solution cannot be too strongly emphasized.

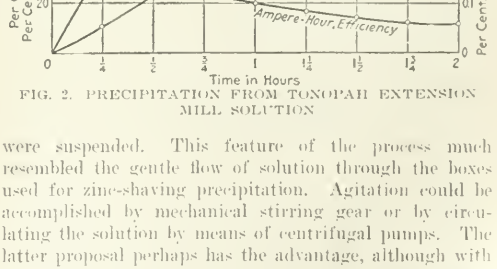

FIG. 2. PRECIPITATION FROM TONOPAH EXTENSION MILL SOLUTION

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*Associate professor of metallurgy, Leland Stanford, Jr., University, Palo Alto, Calif.

[1] "The Electrolytic Precipitation of Gold, Silver and Copper from Cyanide Solutions"; by G. H. Clevenger. "Trans. Amer. Electrochem. Soc.," Vol. XXVIII, pp. 263, 306.

It will be noted that of the plants tabulated those using the Siemens-Halske process invariably used an iron anode. The iron anode has the disadvantage of rather rapid disintegration unless the current density be very low. This results in the formation of either prussian blue or ferric hydroxide, the former being particularly objectionable. The other plants cited used the peroxidized-lead anode. With high current density this is an improvement, as there are no troublesome iron compounds to deal with, the anode has a reasonable life and, when finally discarded, has a salvage value for the lead and other metals[2] that it may contain. The anodes have ever been a source of weakness in electrolytic precipitation. It is therefore not surprising that other materials have been experimented with, but unfortunately some of the more recent proposals have not been tried upon a working scale. Hard carbon was early tried upon a large scale by von Gernet, but, as pointed out by him, it was abandoned because in the course of time it formed compounds with the cyanide and disintegrated. Acheson graphite has also been tried upon a working scale, and though this material gives splendid results with certain electrolytes, it does not seem to be suitable for cyanide solutions. In time it behaves somewhat like carbon, and after a sufficiently long time it becomes disintegrated and mushy. This disadvantage, together with the fact that it has no salvage value, indicates that as anode material it is not so good as lead. High-silicon cast iron, which has proven so satisfactory in the chemical industries for resisting the corrosion of acids, has been suggested as an anode material. In the absence of large-scale, continued tests, definite statements regarding it cannot be made, but I am inclined to think that it would not prove so satisfactory in alkaline solutions.

TABLE SHOWING THE ELECTROLYTIC PRECIPITATION OF

System	Location of Plant	Tons of Solution Precipitated per 24 Hr.	Oz. per Ton Gold	Oz. per Ton Silver	% Copper	% Cyanide	Points Alkalinity	Anode	Cathode	Sq.Ft. of Surface per Ton of Solution Precipitated per 24 Hr. Anode	Sq.Ft. of Surface per Ton of Solution Precipitated per 24 Hr. Cathode	Distance Between Electrodes, In.	Voltage Across Anodes and Cathodes
Siemens-Halske	von Gernet's General data	100	0.25	Trace	None	. .	. .	Iron	Lead foil	100	100	1½	4 to 8
Siemens-Halske	Croesus, Rand, S. Africa...	50	0.100	Trace	None	0.05 to 0.15	. . .	Iron	Lead foil	64.8	153.6	1½	.
Siemens-Halske	May Consolidated (sand) Rand, S. Africa	300	0.25	Trace	None	0.02 to 0.08	.	Iron	Lead foil	46.1	‡	1½	. . . .
Siemens-Halske	May Consolidated (slime) Rand, S. Africa. . .	320	0.05	Trace	None	0.08	. . .	Iron	Lead foil	52.8	‡	1½	. . . .
Siemens-Halske	Lancaster West Rand, S. Africa .	154	0.194	Trace	None	0.03 to 0.10	. . .	Iron	Lead foil	59.9	‡	1½	. . . .
Siemens-Halske	Ferreira (slime) Rand, S. Africa.		0.035	Trace	None	0.017	.	Iron	Lead foil	.	.	1½	. . . .
Butters-Andreoli	Minas Prietas (sand) Mexico	216	0.147	3.51	*	0.0792		Peroxidized lead	Tin plate	29.3	27.7	3⅜	3
Butters-Andreoli	Minas Prietas (slime) Mexico	480	0.055	1.45	*	0.0409	.	Peroxidized lead	Tin plate	26.4	24.9	3⅜	2.6
Butters-Andreoli	San Sebastian, Salvador	150	0.79	Trace	0.075	0.118		Peroxidized lead	Sheet lead	48.9	46.9	2½	4 to 4.5
Butters-Andreoli	Virginia City (Comstock Tailing) Nevada.. .	474 to 668	0.033	0.78	†	0.046	6	Peroxidized lead	Tin plate	30.6 to 21.7	30.3 to 21.7	3¼	3.1
Butters-Andreoli	Virginia City (Comstock Tailing & Tonopah, Ore)....	432	0.055	3.15	†	0.18	10	Peroxidized lead	Tin plate	33.6	33.6	3¼	3.1 to 3.2
Butters-Andreoli	El Rayo, Mexico. .	200	0.30	5.00	0.12	0.15	100	Peroxidized lead	Sheet copper	9.7	9.3	2½	. . . . .
Siemens-Halske	Reliance Mill, Nelson, B. C...	150	0.06	Trace	None	0.01 to 0.05	13	Iron	Sheet lead	70	70	1½	4 to 5

* Ratio of copper to silver about ½ to 1. † Ratio of copper to silver about 3 to 1. ‡ Cathode surface assumed to be the same as the anode surface.

Fused iron oxide or magnetite electrodes were developed in connection with the caustic-soda industry in Germany. They have been experimented with as an insoluble anode material in various electrolytic industries in this country. The large electrolytic precipitation plant for copper at the Chuquicamata mine in Chile was originally equipped with these anodes. More recently, a large number of them have been replaced by high-silicon iron on account of the difficulty of obtaining the magnetite electrodes, but it must be borne in mind that precipitation of copper is here carried on in a sulphuric-acid solution. My own experience with this material in an experimental way leads me to believe that it would not be advantageous for use in cyanide work, as its original cost is rather high, it is very brittle, and under this condition of use it probably would not have an indefinite life, as has been sometimes claimed, and furthermore, when discarded, it would have no salvage value. In order to save weight and give a reasonable surface, the magnetite electrodes are cast hollow and provision for electrical connection is made by plating copper or some other metal on the inner surface of the electrode. The electrical connection is soldered or connected by some other suitable means to this metallic sheet. This makes an ideal electrical connection, but unfortunately constitutes a point of weakness. The fused iron oxide, being very brittle, almost invariably contains microscopic cracks, which extend from the surface in to the metallic contact. The solution undergoing electrolysis finds its way through these cracks, when it is but a matter of a short time before the metallic coating is destroyed. Furthermore, the electrodes are fragile and require careful handling. Passive iron is an interesting possibility, but since its properties are probably due to a thin coating, it seems probable that once this coating is broken or destroyed, the electrode would present no advantage over an ordinary iron electrode. However, a large-scale test of this material would be very interesting and might prove it suitable for this purpose. Various other anode materials have been experimented with, applied in various ways, but so far with no very promising results.

PEROXIDIZED LEAD AS ANODE MATERIAL

On the whole then, so far as now known, peroxidized lead is the most satisfactory anode material. Under ordinary conditions, when properly prepared, such electrodes have a life of approximately one year, and at the end of this period they have a certain salvage value for the lead and other valuable metals that they may then contain. They may be either shipped or treated locally.

The cathodes commonly used have been sheet lead, tin plate, and occasionally aluminum. The use of aluminum, although it has advantages when a nonadherent deposit is desired, may be dismissed on the score of expense, as well as on account of its tendency to disintegrate in an alkaline solution when the current is off. Sheet lead, on account of its fragile nature, is not satisfactory for a nonadherent deposit which necessitates brushing and scraping the cathodes. Tin plate has the advantages of being cheap and of having the necessary strength to resist the operation of brushing or scraping. From the electrochemical standpoint, iron is not the best metal to use as a cathode, but a certain amount of disadvantage in this direction can be tolerated for the sake of overcoming mechanical difficulties. The recent proposal of a paper cathode looks good, but so far as I am aware it has not been tried upon a working scale. The question of cathodes then seems to resolve itself into the proposition of using tin plate with a nonadherent deposit and thin sheet lead, or possibly paper, with an adherent deposit.

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[2] After long-continued use, the lead anodes contain more or less gold and silver as a result of reactions which cause premature precipitation of these metals at the anode.

GOLD, SILVER AND COPPER FROM CYANIDE MILL SOLUTIONS

Current Density at Cathode (Amperes) per Sq.Ft.	per Sq.M.	Percentage Precipitated by Electrolysis Gold	Silver	Copper	Cyanide Regenerated, Gain in %	Nature of Deposit	Metals in Deposit	% Current Efficiency	Life of Anodes	Kilowatt Hours Per Ton of Solution Precipitated	Per Lb. Metal Deposited	Remarks
0.03 to 0.06	0.323 to 0.646	85 to 95	.	..	Showed a loss	Adherent plating	Gold	1.48 to 0.740	**	0.288 to 1.15	16.8 to 67.1	Electrolytic precipitation exclusively
0.04	0.431	100	...	..	Showed a loss	Adherent plating	Gold	0.29	††	.... .		Electrolytic precipitation exclusively
0.04	0.431	85	....	.	Showed a loss	Adherent plating	Gold	2.03	††	.....	.... .	Electrolytic precipitation exclusively
0.04	0.431	90			Showed a loss	Adherent plating	Gold	0.37	††	.....	.....	Electrolytic precipitation exclusively
0.04	0.431	77.4			Showed a loss	Adherent plating	Gold	1.10	††	.....	...	Electrolytic precipitation exclusively
0.04	0.431	82			Showed a loss	Adherent plating	Gold		††	..	..	Electrolytic precipitation exclusively
0.55	5.92	91	91.7	.	0.0146	Flocculent and slightly adherent	Gold, Silver and copper	7.01 to 16.48	Over 12 months	1.1	3.67	Electrolytic precipitation exclusively
0.30	3.23	88	89.6		0.0118	Flocculent and slightly adherent	Gold, silver and copper	7.01 to 16.48	Over 12 months	4.6	40.2	Electrolytic precipitation exclusively
1.00	10.76	80 to 90		36.0	0.036	Adherent plating	Gold, copper and likely zinc	18.93§ and 12.47	8 to 12 months	4.5 to 5.07	7.52 and 12.67	Electrolytic precipitation followed by zinc
0.245	2.64	70	71.8	..	0.02	Flocculent and slightly adherent	Gold, silver, copper and likely zinc	27.15 to 38.26	12 months			Electrolytic precipitation followed by zinc
0.245	2.64	63.6	71.4		No gain or loss	Flocculent and slightly adherent	Gold, silver, copper and likely zinc		12 months	6.17 to 6.37	39.75 to 41.0	Electrolytic precipitation followed by zinc
1.20	12.92	65	65	20	0.075	Flocculent and slightly adherent	Gold, silver, copper and likely zinc	77.95	Short	.		Original plan; zinc precipitation preceded electrolytic precipitation; later, order was reversed
0.02 to 0.03	0.215 to 0.323	Over 90			No gain or loss	Adherent plating	Gold	0.68 to 0.45		0.19	46.1	Electrolytic precipitation exclusively

§ May-1906. June-1906 ** In a plant treating 100 tons per month, 1,080 pounds of iron were consumed (von Gernet) †† 0.33 to 0.67 pounds of iron consumed per ton.

One serious objection to electrolytic precipitation has been the large electrode surface required, which necessitates large and unwieldy units. The compactness of the equipment for zinc- or aluminum-dust precipitation, or even that for zinc-shaving precipitation, as compared with the old type of electrolytic unit, is apparent. The question naturally arises whether it is possible to cut down the electrode surface required per ton of solution precipitated. While much may be accomplished in this direction, yet there is a certain limit beyond which it is not feasible to go. With efficient agitation it is reasonable to assume that the current density could be considerably increased and a reasonable efficiency still be maintained. It must, however, be borne in mind that the solutions to be dealt with in cyanide practice contain a comparatively small proportion of dissolved salts. Therefore the solutions to be precipitated are poor electrical conductors. The only way to mitigate this difficulty appears to be to carry in the solution a certain proportion of some cheap inert salt which will serve to increase the conductivity. This practice would not be without its complications, for it would mean increased cost and the possibility of interference through unwelcome chemical reactions. Notwithstanding these disadvantages, this idea seems to be worthy of a trial. Since there is a rather severe limitation upon the conductivity of the solution, the only other ways that the current density can be increased are either to increase the voltage or to space the electrodes closer together. Increasing the voltage has several serious disadvantages. It causes certain undesired reactions to take place, which result in a lowered efficiency; it increases the liability of short-circuits, and furthermore, it greatly increases the power consumption. This is best emphasized by the old saying that "amperes bring money," while "volts cost money." While in all electrochemical work the voltage should be reduced as far as possible, there is a certain minimum voltage below which it is impossible to go if the reaction is to proceed. This places the lower limit upon the voltage, while the considerations just mentioned tend to impose the upper limit. The Gibbs-Helmholtz[*] equation for calculating the electromotive force required for a chemical reaction to take place in an electrolytic cell is

$$e = 0.0000434\,\frac{W}{n} + \frac{Tde}{dT}$$

in which

e = E.m.f. in volts necessary in order that the desired reaction may go on;

W — The total energy of the reaction in gram-calories per gram-atom of metal deposited;

n — Valence of the deposited metal;

T — Temperature in absolute degrees Centigrade;

$\frac{de}{dT}$ = Temperature coefficient of the e.m.f. at the temperature T.

For all practical purposes $\frac{Tde}{dT}$ may be neglected. The equation then becomes Thomson's rule:

$$e = 0.0000434\,\frac{W}{n}$$

As regards the spacing of the electrodes, the limitation placed upon this is the liability of short-circuiting. In the commercial plants formerly operated it has not seemed practicable to space the electrodes much closer than 1½ in. However, I am of the opinion that with a carefully worked-out design and care in operation closer spacing could be used. The particular difficulty with short-circuiting comes about through the tendency of the electrodes, while in use, to warp and buckle. One possibility that suggests itself would be to have two units, one for the precipitation of say 80 or 90% of the metal, and the other which would take only the amount of solution from the first unit that it would be necessary to completely precipitate for final washes. This second unit could be especially constructed so as to give much closer spacing of the electrodes. These two units would comprise an electrolytic precipitation equipment for operation along the lines of a complete and partial precipitation circuit such as has proved so advantageous with zinc-dust precipitation. The two-unit plan is not unknown in actual plant operation.

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[*] See the paper on "Electrometallurgy," by Dr. E. F. Roeber, Volume on "Metallurgy," "Transactions of the International Engineering Congress."

Much has been said regarding the regeneration of cyanide when electrolytic precipitation is used. My own experience is that with anything like complete precipitation little gain in cyanide strength can be hoped for. With partial precipitation, there would be rendered available a portion of the cyanide liberated through the decomposition of the potassium-silver cyanide, as well as through the decomposition at the anode of the sulphocyanate. In this connection it is well to bear in mind that electrolytic precipitation is the only known method of precipitation that breaks down this salt and renders available the cyanide that it contains. With judicious use of electrolytic precipitation, I am of the opinion that the cyanide balance sheet would show up fully as well as with either aluminum or zinc precipitation. There is, however, a chance that this would not be the case on account of the fact that the solutions resulting from electrolytic precipitation would be more subject to atmospheric decomposition than would the solutions from zinc precipitation, in this respect being much the same as solutions resulting from aluminum precipitation. In the case of an ore which produced much sulphocyanate, the gain from the reduction of the sulphocyanate might easily more than counteract this tendency. The best results as regards cyanide regeneration of course would be obtained with proper agitation.

In the past, byproducts have been a great bugbear with electrolytic precipitation. Much of this difficulty can be overcome, but in my opinion byproducts with the best practice would be more in evidence than under the present methods of precipitation. Whether the old general plan of containing box, providing for agitation in the compartments containing the electrodes and employing a continuous flow of solution would yield the best results, or an entirely new system, in which many electrodes were suspended in a few large tanks where the solution would be precipitated in charges, I am not prepared to say. On the whole, electrolytic precipitation, used either alone or in combination with a chemical precipitant, would prove most advantageous on silver or silver-gold ores where there was a considerable bulk of metal to precipitate and where there was a decided tendency for the formation of sulphocyanate. With ores containing much copper it is a necessity.

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The Silica (Quartz) Sold in 1915 for pottery, tile, glazes, paints, wood-filler, wood-polish, abrasive soaps, fine filters, and other uses, as reported to the U. S. Geological Survey, amounted to 243,340 short tons, valued at $1,270,835. This product was obtained from quartz veins, pegmatites, quartzites, sandstones, sand, tripoli, and diatomaceous earth in Arizona, California, Connecticut, Illinois, Maine, Maryland, Massachusetts, Michigan, Missouri, Nevada, New Hampshire, New York, North Carolina, Oregon, Pennsylvania, Tennessee, Virginia and Wisconsin.

Tin Production in Siam

The tin output of Siam, according to a consular report, comes principally from the State of Puket, which is a Malay state, but is owned by Siam. It includes the provinces of Takuapa, Pangnga, Renong, Trang, and others to the west of the main watershed of the Malay Peninsula. A recent report says that present tin operations in Takuapa are in the hands of the Chinese. The output from the district has for the last few years slightly exceeded 500 tons annually, but it has declined since the commencement of the war. During the year ended March 31, 1915, 497 tons of metallic tin were recovered, while the amount for the succeeding nine months was 252 tons.

Some years ago a Danish company obtained a concession at Pong, some 500 acres in extent, for mining purposes. A subsidiary company was formed in London to work this area and others at Huey Yawt in Monthon Puket and at Nong Pet near Ronphibun in the adjoining Monthon of Nakon Sritamarat. This company expected its bucket dredge to arrive at the end of April, 1916, but, owing to difficulties of transport between Takuapa and Pong, it will not be possible to commence mining operations before April, 1917. The ground is said to average 1 lb. of tin oxide to the cubic yard, this being considered a satisfactory metal content.

Pangnga, like Takuapa, is mainly devoted to the production of tin, of which over 800 tons have been recovered during each of the last two years. For the nine months ended Dec. 31 last, over 950 tons of metallic tin were produced, a considerable increase thus being shown.

Taimuang, some 40 miles from the town of Pangnga, is peopled almost entirely by Chinese, who are engaged in mining operations. The output of tin from the Muang of Pangnga is likely to increase in the future, while that from Taimuang is expected to remain stationary for the next three years, after which a rapid decline is anticipated.

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Rights of Mining Engineers

By A. L. H. STREET*

The Federal Bankruptcy Act provides that in the distribution of a bankrupt's assets priority shall be given to claims of "workmen, clerks and servants" for unpaid wages, and a mining engineer who had been employed at an annual salary of $4,000 by a mining firm that became bankrupt claimed the benefit of the statute. The United States District Court for the District of Massachusetts holds, however, that he was not entitled to a preference over general creditors.

Finding that the claimant's duties consisted in advising and assisting the superintendent in developing and operating the mine, exploring the mine, preparing plans, making cost sheets and forms for payrolls, inspecting the mine and machinery, etc., the court says: "I doubt whether the earnings of a professional man, employed primarily because of his learning and his ability to advise helpfully, are properly described as 'wages'; and I do not think that the man himself is a 'workman, clerk or servant,' within this section." (In re Gay & Sturgis, 233 Federal Reporter, 604.)

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*Attorney at law, 829 Security Building, Minneapolis, Minn.

Prominent Mines of Junin, Peru

By Joseph E. Singewald* and Benjamin LeRoy Miller†

SYNOPSIS—A description of three ore deposits of unusual interest. One contains vanadium, another bismuth, and the third, silver. All occur in the western part of the Department of Junin, Peru. The silver and bismuth deposits are near the Cerro de Pasco smelteries, and the Minasragra vanadium deposit is about 18 mi. west of them.

The Minasragra vanadium deposit lies about 18 mi. by trail to the west of the Hauraucaca smeltery. It had been located several times for coal, but was abandoned each time on account of the high sulphur content. In November, 1905, a party of Indians searching for coal brought samples of the material to Antenor Rizo Patron, manager of the Hauraucaca smeltery, who had them analyzed and found that they contained a large percentage of vanadium. The deposit was at once denounced again by E. E. Fernandini, the owner of the smeltery, and Mr. Patron. It happened that D. Foster Hewett was making an examination of vanadium deposits near Yauli for the American Vanadium Co. at the time of the discovery of the vanadium content of this deposit, and consequently visited it. As a result of his investigations the property was purchased by the American Vanadium Co., and since its discovery has supplied about 80% of the world's demand for vanadium. Whereas before its discovery it was something of a problem to meet the demands for vanadium, so remarkable is the richness and size of this deposit that it can be worked only on a relatively small scale in order not to overstock the vanadium market. Mr. Hewett later made other visits to the property, and it is to his careful observations and thorough investigations of the ores, together with determinations of their chemical character by Dr. W. F. Hillebrand, that we owe most of our knowledge of this occurrence. Mr. Hewett's account of it is published in the "Transactions of the American Institute of Mining Engineers" for 1909. Since his last visit considerable work has been done, and at the time of our visit, in the latter part of 1915, it was possible to make a number of observations that lead to conclusions somewhat at variance with those of Mr. Hewett, which will be set forth in this paper.

The trip to Minasragra must be made on muleback from Hauraucaca and requires between 5 and 6 hr., yet it is a trip replete with interest. The first half is across typical rolling pampa lying at an elevation of about 14,000 ft. An occasional llama train is passed bringing in loads of vanadium ore to the railroad or coal to the smeltery or going out to the mines with supplies. At the end of the first hour's ride, one comes in sight of the wonderful "Rock Forest," which lies about 2 mi. to the south of the trail and concerning which one hears so much at Cerro de Pasco. It is an extensive area in which differential erosion has carved the rocks into all sorts of imposing and fantastic shapes and figures that in their variety and number make our famous "Garden of the Gods" appear insignificant. A visit to this place is one of the favorite picnics of the American colony at Cerro de Pasco, and if it were accessible to tourists it would unquestionably be hailed as one of the world's wonders. A short distance farther on one fords the Rio Blanco, on the west side of which the pampa loses its characteristic flatness and becomes somewhat rougher. Much of this part of the trip is along the shores of Lake Punrun, across which is a magnificent range of limestone mountains with the eastern slope so steep as to be practically an escarpment. Quisque is an hacienda, or ranch, belonging to Mr. Fernandini, situated at the foot of the range to the south of the lake. Just before coming to it one crosses a broad, flat valley that slopes down to the lake, and begins the ascent of an outlying knoll amid rough projecting ledges and crags of limestone, and then suddenly finds directly in front of him a most delightful little farmhouse of Spanish style. While resting here a few minutes, we were brought fresh milk by the Indian boys, a kind of liquid refreshment that is rarely served in the high regions of the Andes. Shortly after leaving Quisque, the trail passes through a narrow gorge transverse to the mountains and on the other side comes into the much rougher country in which the vana-

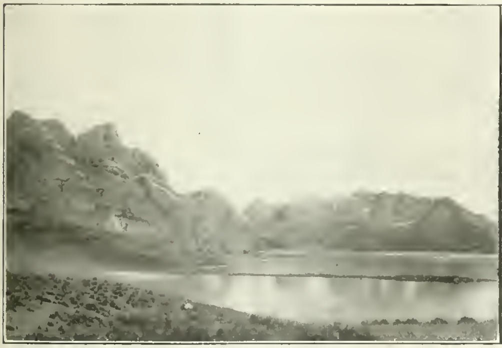
FIG. 1. VIEW OF LAKE PUNRUN, LIMESTONE MOUNTAINS IN THE BACKGROUND

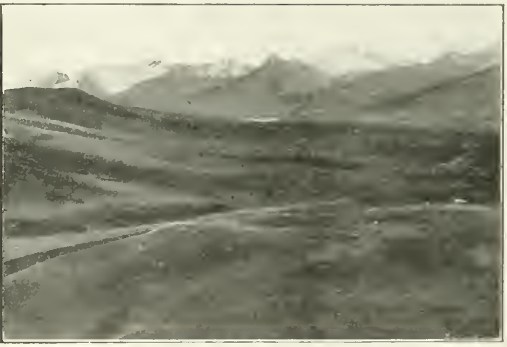
FIG. 3 A VIEW OF THE COUNTRY NORTH OF MINASRAGRA, JUNIN, PERU

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*Associate in economic geology, Johns Hopkins University, Baltimore, Md.

†Professor of geology, Lehigh University, South Bethlehem, Penn.

dium deposit is located. There is now an almost continuous ascent to the elevation of 16,500 ft., at which the mine lies. At this altitude living conditions are primitive, both as to house comforts and food. But if one is a lover of nature in its grandest moods, there are compensating features. Overlooking the mine but a short distance to the west is another imposing range of mountains, likewise formed by a thick series of heavy-bedded limestones, which are capped by numerous glaciers and snow fields; while to the north one looks for miles along a broad, flat valley on the slopes of which countless llamas are grazing, with the horizon formed by a distant ice-capped range. The trip to Minasragra would be worth while even if there were no such reward as seeing that unique vanadium deposit.

Geology of the Minasragra Deposit

The general topographic characteristics of the region have already been indicated. The sedimentary rocks are of Mesozoic age and in the area between the two limestone ranges consist of red and green shales with a few thin layers of limestone in the lower part. The ore deposit occurs entirely within red shales in the upper part of the series. These red shales contain abundant gypsum both as intercalated beds and as a network of stringers and veinlets filling joints and cracks in them. In a gypsum bed exposed at the south end of the mine are patches of native sulphur. Outcrops of dikes and irregular masses of igneous rocks are abundant, ranging in composition from quartz porphyry to diabase.

The orebody is a lens-shaped mass having a length of about 300 ft. and a maximum width of 30 ft.; oriented with a strike approximately parallel to that of the inclosing rocks, but with a westerly dip supposedly steeper than that of the shales. It is made up essentially of quisqueite, coke and patronite. Quisqueite is a black lustrous hydrocarbon, coke a dull-black vesicular hydrocarbon, and patronite a greenish-black mineral that is a sulphide of vanadium. Analyses of these minerals given in Hewett's paper are shown in the accompanying table:

MINERAL ANALYSES ACCORDING TO HEWETT

	Patronite, %	Quisqueite, %	Coke, %
Sulphur, soluble in CS_2	4.50	15.44	0.64
Sulphur, combined	54.29	31.17	5.36
Carbon	3.47	42.81	86.63
Hydrogen	....	0.91	0.25
Nitrogen	....	0.47	0.51
Oxygen, by difference	....	5.39	4.64
Water, at 105	1.90	3.01	None
Ash	....	0.80	1.97
Vanadium	19.53		
Iron	2.92		
Nickel	1.87		
Silica	6.88		
Titanic oxide	1.53		
Alumina (phosphoric acid)	2.00		

Also small amounts of ferric oxide, manganese chromic oxide and alumina.

Small pockets and nests of pyrite are locally abundant, and of interest is the occurrence of a small quantity of a reddish-yellow nickeliferous sulphide of iron to which the name bravoite has been given by Hillebrand. The patronite at the surface has undergone oxidation, and the vanadium close to the surface occurs in the form of hydrated oxides, of which there appear to be a red variety and a brown variety. At a depth of a few feet these give way to a greenish-black oxidation product.

A quartz-porphyry dike cutting across the shales has its outcrop shifted at the ore deposit as if it had been faulted, and Hewett regards the orebody as having been intruded along this fault plane, or fault zone, in a plastic or even liquid condition, as a mass that was probably homogeneous; and that from it the minerals forming it now segregated in a sequence which he determined from a study of polished sections to be quisqueite, coke, patronite. In the hanging wall he thinks there has been some penetration of the patronite into the shales, saying, "Patronite appears to have had the peculiar property, under the conditions of temperature and pressure that existed at the time of the intrusion of the mass, of being able to permeate the porous country rock, even to the degree of saturating it." Replacement of the shales he thinks has taken place only through vanadium solutions formed by the oxidation of the patronite and says, "In some places the solutions have almost entirely replaced portions of the shales, and at other places the vanadium minerals have been precipitated in the cracks and open spaces in the crushed zone."

No positive evidence was seen to indicate that the orebody represents such an intrusion into a definite fault, but rather that it represents a replacement of the shales along a zone of crushing. At the south end of the mine, in a cut made to tram out waste, beyond the limits of workable ore, there is a distinct replacement of certain of the shale layers, which diminishes in amount with increasing distance from the rich ore. A 3-ft. bed of gypsum intercalated in the shale here has not succumbed to replacement. The ore is in the oxidized state and hence may represent replacement by oxidized vanadium solutions in the manner described by Hewett. Better evidence is obtained underground. In the lowest tunnel, 120 ft. below the surface, one can pass from shale to ore through various stages of replacement; and even where the shale is completely gone, the fact that the ore is now found where shale originally existed is unmistakably shown by the complete preservation in much of it of the network of gypsum stringers so characteristic of the shale. Where the mineralizing action has been most intense, the gypsum stringers have been removed and the evidence of replacement destroyed. In the underground workings several gypsum beds are encountered, and even where the overlying and underlying shale is completely replaced by ore, they have persisted, but little affected by the mineralization. A few cases were seen where the gypsum has yielded to a slight extent and contains narrow lenses and stringers of ore. These observations indicate that the gypsum could not entirely resist the mineralization; and it is not surprising, therefore, that the network of narrow gypsum stringers has been removed in a large part of the main mass of the ore.

The faulted quartz-porphyry dike described by Hewitt is the high ledge in the left background of the opencut shown in Fig. 4 and the ridge projecting from the center of the pit to the left of it. According to his view the fault that located the intrusion of the orebody occurred subsequently to the intrusion of this dike. Doubtless, when work first began here, the shift in the dike seemed to be due to a clean-cut fault, but as exposed now in the opencut, it is practically impossible to decide whether the dike was intruded into a curved fissure or whether there was a later movement in the zone of crushing that caused an offset along its strike. Underground the offset is less pronounced than at the surface. Certain it is that there has been no well-defined faulting subsequent to the intrusion of the dike, but at most a slight movement in the shear zone in which the orebody is localized. Then again it appears probable that the dike is later than the ore deposition. Its top has a westerly pitch so that although it outcrops at the surface on the east side of the mine, on the west side it lies some distance below the surface. Furthermore, the ore lies directly on top of the dike and at the contact has the appearance of having been baked or metamorphosed by it, and the orebody comes up to the dike on either side without increase or decrease in width. Another feature of note is that the dike has not been affected by the mineralizers. In other words, if the dike was present when the mineralization took place, the mineralizers were wholly unaffected by its presence—they did not spread at the contact nor did they diminish in quantity or activity there; yet they had no effect upon the dike itself and flowed out over its top, removing all the shale resting on it. It is true that a similar phenomenon is presented by the gypsum beds, but gypsum is a chemical compound of an entirely different nature, and it is conceivable that mineralizers capable of replacing the chemical constituents of shale might not be able to remove gypsum. But chemically, the quartz porphyry is similar to the shale, or at least similar enough to make it difficult to see how such widespread complete replacement of the shale could have been effected and the dike have escaped completely. The weight of evidence now available, therefore, would indicate that the dike is an intrusive across the ore deposit and deflected in that zone of crushing either at the time of its intrusion or by a small later movement.

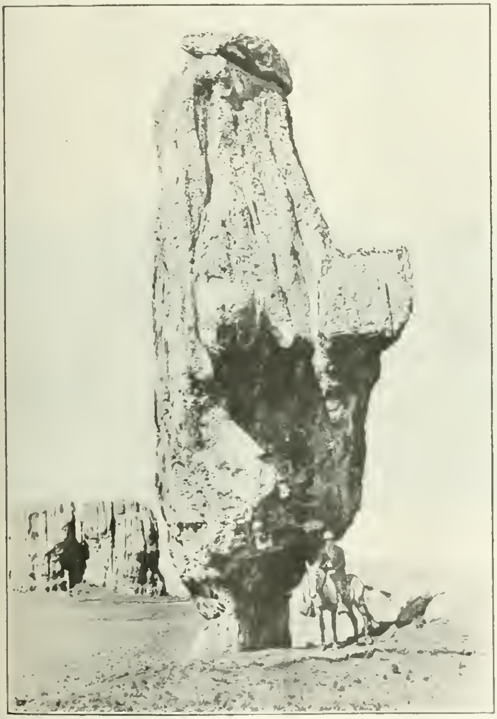

FIG. 2. A TYPICAL VIEW IN THE ROCK FOREST, PERU

As to the nature of the mineralizers there is little that one can say, since the deposit stands in a class by itself. Not even in its vicinity has careful search revealed another deposit like it. That they were of a peculiar nature is evidenced not only by the chemical composition of the ores, but also by the fact that they acted so vigorously on the shales and produced so little effect on an otherwise comparatively easily soluble substance as gypsum. Hewett regards the deposit as an extreme phase of differentiation from asphaltite under the stimulus of the igneous intrusions. But whether such a view is consistent with the new interpretation of the localization herein set forth is questionable.

When the mine was first opened, the oxidized ores were worked in the opencut on the outcrop, and the merchantable ore carried about 20% V_2O_5. Later, attention was directed to the sulphides at greater depth and a roasting plant erected in the valley below the mine, and now the entire output comes from the sulphide ores. A tram track from the roasting plant enters an adit that cuts the deposit 120 ft. below the surface and is connected with the opencut by a raise and ore chutes, so that the ore mined in it is taken out through the adit.

In 1909 the roasting plant was built to burn out the sulphur and increase the vanadium content of the marketable material. This plant consists of four hand-operated, double-tier reverberatory furnaces, with a capacity of about 80 tons. The ore to be roasted is fed at one end of the upper tier and slowly worked over to the other end, where it drops to the lower and is worked in the same way to the discharge end. The time consumed in passing through the furnace is two days. At the temperature of the furnace it is self-burning until all but 3% of the sulphur is expelled, when coal must be added to reduce this to ½%. The fuel used is a semianthracite packed on llamas from some small coal deposits in the region. The roasted ore carries 50% V_2O_5. The quisqueite is not removed in this roasting and is still present in the roasted product.

THE SAN GREGORIO BISMUTH MINE

The San Gregorio bismuth mine is the property of E. E. Fernandini, the owner of the Huaraucaca smeltery, and is situated about a mile to the southeast of that smeltery on the west side of the Cerro de Pasco railroad and three miles south of Fundicion, the Cerro de Pasco smeltery. It is near the base of a small knoll that rises above the pampa to an elevation of about 150 ft. The hill consists of sandstone that varies in texture from quartzitic to saccharoidal, and it is in a brecciated mass of this rock that the ore deposit is found.

The ore consists entirely of oxidized bismuth compounds and is said to be principally the arsenate. It occurs together with a yellow-to-brown colored clay as a matrix of the brecciated sandstone. In places it fills the interstices between the sandstone fragments in the form of the light-yellow bismuth compounds, but more generally it impregnates the yellow and brown clays that make up most of the matrix. The crude ore averages about 3% bismuth. The deposit has been worked in an opencut with a length of 1,000 ft. and a width of 80 ft. At a depth of 20 to 30 ft. below the surface, the bismuth content is said to become very low, and as yet no sulphobismuthides or corresponding bismuth minerals have been encountered of which the deposit may represent the gossan. It is not at all clear whether the ores were deposited in their present condition, or whether they represent the oxidized remnant of primary minerals of a different character; or, if the former is the case, whether they were deposited by ascending or by descending solutions. Consequently the source of the bismuth cannot be explained. All that can be said is that the ore has been localized in the shattered brecciated portion of the sandstone.

As is well known, the world's bismuth market is controlled by a rigorous trust, which assigns to each producer the amount of bismuth that he may furnish. The San Gregorio mine is a party to this agreement, so that its actual production is no criterion of its potentiality as a producer. The tonnage in sight is sufficient to supply the world's demand for bismuth for many years, and it could be produced profitably at 30c. per lb., whereas the average price is $2. The annual mine production of bismuth is a little over 300 tons, and of this the San Gregorio mine is allotted 25 tons. The mine has been in operation about ten years, and during this time the ores have been concentrated in a mill at the Hauraucaca smeltery to yield 20% concentrates, which have been the marketed product. At the same time, a pile of 10,000 tons of middlings averaging 5% bismuth has accumulated, which is now being treated by lixiviation. The material is first roasted and lixiviated with sodium chloride and sulphuric acid. Bismuth sulphide is precipitated from this solution by adding sodium sulphide, and from it native bismuth is recovered by smelting. Mining operations have been suspended, and the entire allotment of bismuth is being obtained by the treatment of these middlings, which are ample to last for a number of years. The Colquijirca silver mine is on the eastern slope of the hill on the opposite side of which, and about 1½ mi. to the southwest, is La Fundicion, the Cerro de Pasco smeltery. The mine is owned and operated by E. E. Fernandini. The daily output at the present time is 80 tons of ore averaging 70 oz. Ag per ton. The lowest grade that can be profitably worked is about 50 oz. Ag. The ore is treated at Fernandini's Hauraucaca smeltery, by concentration and smelting.

The country consists of a series of limestones underlain by shales in which are intercalated beds of coarse and fine conglomerates with a shaly matrix. Within the limestone series itself are impure shaly beds and beds of sandstone of very local occurrence. The formations have a north-south strike and a general easterly dip which has been modified by two minor synclines.

The ore deposit consists of two beds of ore intercalated in the limestone series, which represent replacements of the limestone, and they are separated by a parting of variable thickness but averaging a little more than 2 in. Owing to the folding, the ore horizons outcrop at four points across the section. These outcrops are marked by a series of trenches on the hillside resulting from the extraction of the gossan ores in years gone by. Similar replacements, but on a smaller scale and not resulting in workable ores, have been encountered at lower horizons by the crosscut tunnel. Orebodies such as these with considerable horizontal extent are called *mantos*, which is the Spanish for "mantle" or "covering."

The limestone has been replaced chiefly by black, cherty-looking silica and by pyrite. In some places the *manto* consists almost wholly of the chert, at others almost entirely of pyrite, and then again both minerals are present in abundance. Associated with these minerals, in subordinate amount but in sufficient abundance to be a prominent constituent of the ore, are galena and barite, and the amount of silver the ores carry seems to be closely related to the quantity of these minerals present. The smaller *mantos* referred to in the foot wall consist almost entirely of pyrite and are unworkable on account of their meager silver content. On the other hand, the quantity of galena and barite is not an invariable indication of the quantity of silver the ore carries. It is found that when these minerals are coarsely crystallized, there is less silver than when they occur in smaller crystals, a difference that is especially marked in the case of the galena. The barite in particular occurs in druses and small cavities as a network of interpenetrating tabular crystals, and it and the galena to a less extent have the appearance of hving been introduced later than most of the silica and the pyrite. Associated with the minerals already mentioned, especially in the south end of the mine, a little chalcopyrite is encountered here and there. In the richest ores a little tetrahedrite and probably other "sulphurets" can be recognized.

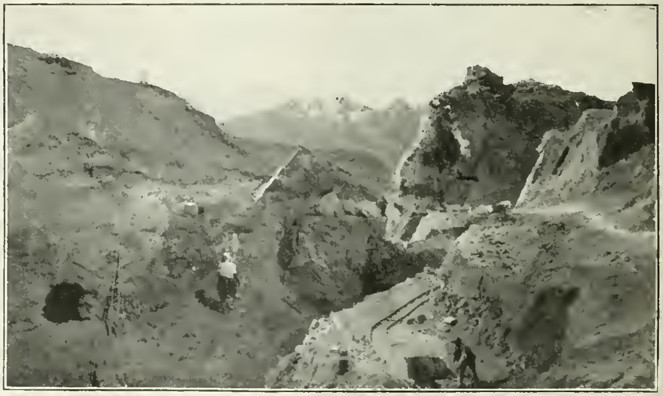

FIG. 4. THE MINASRAGRA VANADIUM MINE, JUNIN, PERU

The mine is remarkable for the magnificent specimens of native silver in the form of coils and clusters of wire silver that is affords. The oxidized zone is not now accessible, but in the sulphide zone there are local areas that have been subjected to the action of oxidation, usually along some zone of disturbance and fracturing, and in these the partly oxidized ores frequently abound in the native silver. Its most common habitat is in the spaces between the interlocking tabular crystals of barite, where it may be found alone or adhering to some of the sulphides, very commonly to the tetrahedrite or other "sulphurets." We are indebted to the kindness of Julio N. Arce, the manager of the mine, for several really wonderfully specimens of this kind.

The mine is developed by means of a tunnel over 1 km. in length and a shaft from the surface which meets the tunnel about 700 m. from the portal, as shown on the cross-section. Mining is now confined to the portion of the orebody below the tunnel level, and the ores are taken out through the tunnel level. Drifts have been run along the strike of the *mantos*, 350 m. to the north and 300 m. to the south, without reaching their limits. From these drifts, close to the tunnel, three inclines 60 and 10 m. apart have been sunk on the *mantos* with a length of 90 m. and levels at each 30 m. The dip of the ore beds in these workings ranges from 35° to 25°. Most of the output comes from this part of the mine, where there is a rich oreshoot averaging over 100 oz. Ag per ton. The *mantos* here have a thickness of 12 m. including a parting of 2 m., and the entire thickness is removed by square-set mining. Adjoining this oreshoot on the south and continuous with it is ore of the same appearance that carries only 5 to 10 oz. Ag per ton and is hence unworkable. This is a striking example of the extreme variation in the silver content of the ores, so that although the *mantos* are continuous throughout the extent of the mine, they consist of workable ore in restricted areas only.

The mine is equipped with modern, electrically driven machinery and has about it an appearance of efficiency that is not commonly seen in the small, locally owned mines of South America.

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Anaconda Begins Production of Electrolytic Zinc

BUTTE CORRESPONDENCE

The first section of five, composing the new zinc refinery of the Anaconda Copper Mining Co., at Great Falls, Mont., was placed in operation on Monday morning, Sept. 11. The 144 electrolytic tanks were filled by 2 o'clock in the afternoon and 1,200 amp. turned on at the new substation. Late Monday afternoon one of the cathodes was taken out and the zinc peeled off the aluminum plate. It was a sheet as thin as paper, but was eagerly prized as souvenirs by scores of officers and employees of the company who had watched the starting of the big plant.

ENTIRE PLANT WILL BE IN OPERATION BY NOVEMBER

Wednesday afternoon the first stripping of the plates netted 25 tons of zinc that was sent to furnaces at Anaconda for transforming into the commercial article. The two new 50-ton furnaces that are to handle the output at Great Falls are being constructed and will be ready for operation about the first of October. By that time it is also expected that two additional units will be operating at the refinery and by Nov. 1 the entire plant with a capacity of 5,000,000 to 6,000,000 lb. of high-grade zinc per month will be in operation.

The first week's trial of the new plant has proved most satisfactory. Frederick Laist, head of the metallurgical department of the Anaconda company, who devised many of the leading features of the new zinc process, as well as many of the other leading officers of the company, spent the week in Great Falls watching the starting of the new refinery.

The zinc is brought in concentrates from the new concentrator at Anaconda. On arrival at Great Falls, it is taken first to the roaster, where it is changed into calcines. This fine powder carries, in addition to zinc, copper, lead, silver and gold. It is next distributed to leaching tanks having a depth of 20 ft. and a diameter of 10 ft. In these it is agitated in acid solution by compressed air forced in from below. After agitation the pulp passes into Dorr thickeners where the lighter solution containing most of the zinc is drawn off and filtered, the pregnant solution being pumped into storage tanks in the refinery proper and sent from there to the electrolytic tanks. These are arranged end to end with six tanks in each battery, the solution cascading from tank to tank. Each tank is 5 ft. long, 3 ft. wide and 3 ft. deep and contains 28 lead anodes and 27 cathodes consisting of aluminum plates upon which the zinc forms and is later stripped off and sent to furnaces for casting into commercial forms. The zinc is 99.9% pure.

Ground for the new plant was broken on Jan. 1 of this year and close to $3,000,000 has been expended in the construction and equipment of this zinc department of the Anaconda company. The aluminum cathodes for the electrolytic tanks alone represent an investment of nearly half a million dollars. Each one has 11 lb. of aluminum and 16 lb. of copper, and there are 20,000 of these in the five sections of the new plant. The copper metal for each cathode is worth between $4 and $5. In addition there is the expense of manufacture.

The new substation that furnishes the electricity for the zinc plant is completed, and three of the five rotary transformers are in place. The plant will use 33,000 hp. when it is operating at capacity. All this power will come from the Rainbow and Big Falls plants of the Montana Power Co., situated within 10 mi. of the new refinery.

The concentrator at Anaconda is completed, and there will be no lack of zinc concentrates for the new refinery as soon as the additional units are put into operation. By Nov. 1 it is estimated that fully 2,000 tons of zinc ores per day will be used for this new department. The ores will come from the Emma, Poulin, Alice, Lexington and other Butte mines of the Anaconda company, and from the Douglas mine in the Pine Creek section of the Coeur d'Alene district in Idaho, which is under option to Anaconda.

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Chinese Mineral Exports Grow

Statistics relating to exports of Chinese mineral products, given by *United States Commerce Reports*, show impressive gains in 1915 over the previous year. Those relating to antimony, pig iron, tin and zinc record large gains, particularly in the value of exports, since the start of the great war, as shown in the following tabulation:

CHINESE MINERAL EXPORTS, 1914-15

Mineral	Quantity 1914	Quantity 1915	Value 1914	Value 1915	Value of U. S. Imports, 1914	Value of U. S. Imports, 1915
Antimony						
Regulus, tons	21,618	25,746	$929,565	$2,873,809	$227,331	$822,527
Ore, tons	7,479	1,843	101,397	81,951	102,820	208,094
Iron						
Pig, tons	66,084	106,112	862,384	1,519,271		....
Ore, tons	[illegible]0,065	310,579	116,277	127,251		
Lead, tons	259	757	11,773	10,119		
Lead ore, tons	1,102	63	141,030	1,670		
Quicksilver, lb.	131,167	461,733	69,869	584,164		
Tin, in slabs, tons	7,948	8,825	5,315,634	5,659,049	....	
Zinc:						
Ore, tons	8,126	9,445	57,218	78,029	31,375	[illegible]
Spelter, tons	512	2,567	21,119	269,976	....	
All other, tons	2,177	9,872	221,887	1,065,329	....	

Of these exports the United States absorbed antimony and zinc invoiced at the values shown in the last column.

⁂

Asbestos Production in the Ural District in Russia is given by a British consular report at 8,689 metric tons in 1915. This was only about half the output of the preceding year.

Details of Practical Mining

Safety Rules for Loggers

The following rules and suggestion from the September, 1916, issue of the *Anode* should be of more than passing interest to those mining companies operating in comparatively virgin territory where a large portion of the timber requirements are filled by loggers employed by the company. These are usually working on a contract basis and for this reason are not under very close supervision, their chief requirement being to turn out a product. However, in case of accident they have to be treated at the company hospital and incur added expense due to their carelessness. In many mining camps the loggers are known for their carelessness and recklessness. Their attention should be called to these rules and their observation enforced by the contractor for his own benefit as well as that of the company and men.

Do not stand or work in the bight of any line.

Do not stand or work close enough to any block so that in case the line breaks the end could possibly whip around and hit you.

Do not stand upon or ride any logs as they are being hauled in by the engine, or in front of them.

Do not stand in front of a log or on the downhill side of a log after the engineer has been given the signal to go ahead.

Do not give the signal to go ahead until you are sure that every man is well out of the way and clear of all limbs.

Carefully inspect, look out for and guard against all falling of dry snags or the tops of trees, when logs come in contact with them as they are being hauled to the landing.

When oiling blocks, do not go near the line or blocks when the engine is in motion.

⁂

Gasoline Motors in Tunnels

In the Wilson Avenue water tunnel, Chicago, which totaled about 45,000 ft. of length in various sections, gasoline locomotives were used satisfactorily, according to H. W. Clausen in the *Journal* of the Western Society of Engineers, May, 1916.

After the drifts had been advanced to where mule hauling became slow and expensive, gasoline locomotives were installed. They were of the four-wheeled type, driven by 40-hp. four-cycle engines running at 800 r.p.m. The locomotives weighed five tons each, attained a speed of 8 mi. per hr. and at that speed developed a drawbar pull of 900 lb. They usually pulled trains of 20 to 25 loaded cars, and in an emergency as many as 57 loaded cars were pulled out of the drift. The exhaust gases thrown off by the internal-combustion engines were passed through a water-box, which removed the smoke and unburned gasoline. The small quantity of CO and CO_2 remaining was ordinarily sufficiently diluted to be unobjectionable.

Gasoline locomotives have been used in other tunnels with unsatisfactory results, but this appears to be due to mechanical defects of construction. These locomotives were supplied by the Baldwin Locomotive Works at a cost of $3,100 each and proved entirely satisfactory in operation.

⁂

Shaft-Timbering Examples

By Albert E. Hall*

After the method of sinking a shaft has been decided and all the troublesome problems that arise concerning details have been satisfactorily solved, there remains the question of timbering. The timbering of course depends among other things upon the nature of the ground, but probably the next consideration is the use to which the shaft is to be put, the demands that are to be made upon it and the life that is to be expected from it. We would not expect to find a prospect shaft or a winze as heavily

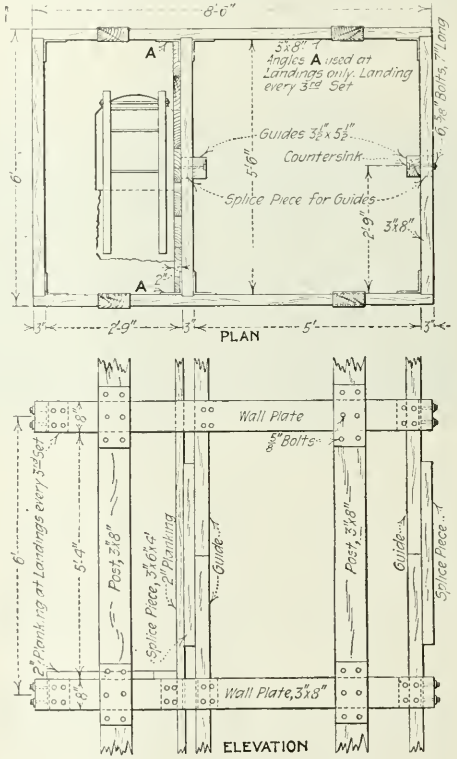

FIG. 1. WINZE AT CREIGHTON MINE, ONTARIO

timbered as the main shaft of a mine with a large output. The first example shows some substantial timbering that is fairly light and yet serves well for a prospect shaft or winze.

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*Superintendent, Sable River Copper Co., Massey, Ont.

The shaft in question, shown in Fig. 1, was sunk as a winze from one level to the next lower, and a drift was run from its bottom to the point where the main shaft was raised. This winze handled all the muck from the shaft, and also from the crosscutting and drifting until the main shaft was completed. The inside dimensions of the winze were 8x5½ ft. There were two compartments, one serving as a ladderway and the other for the cage, which accommodated a one-ton car. All the timber in the winze was 3x8 in., which was easy to handle, quickly framed and stood up well. The total depth was 100 ft., and the sets were placed on 6-ft. centers. The wall and end plates were held together with heavy angles, which were bolted to the timbers. The divider was also secured with angle irons. Four posts were employed, which, instead of being placed at the corners, were set in a litt way. Between the cage and ladderways was planking, while a staging of 2-in. planking was put in about every third set in the ladderway. The guides for the cage were 3½x5½ dressed and were put in in 24-ft. lengths. Splice pieces made of 3x6 were used at the joints and were about 1 ft. long. This winze was sunk at Creighton mine, Ont., Canada.

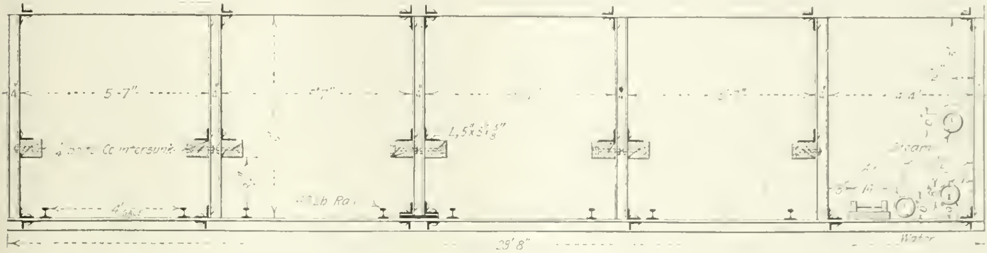
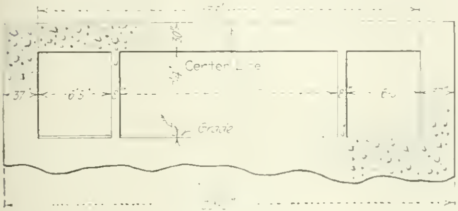
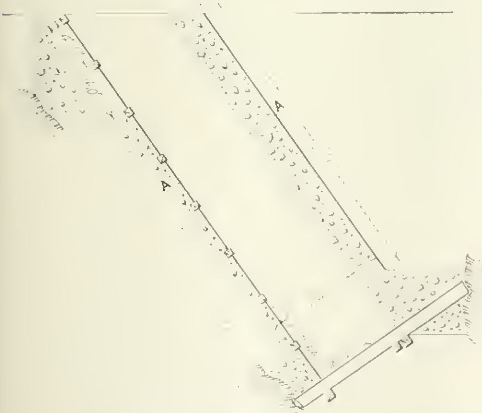


FIG. 2. SHAFT OF NEWPORT MINING CO., IRONWOOD, MICH.



SECTION A-A



SECTION ON CENTER LINE

FIG. 3. INCLINED SHAFT AT CREIGHTON MINE, ONTARIO

In contrast to the light timbering of the foregoing example is that of No. 2 shaft of the Dome mine, Sout Porcupine, Ont. This is a three-compartment shaft having two skipways and one combined ladder and pipe compartment. As originally designed, the ladder and pipes were intended to be in separate compartments, but later this was deemed inadvisable. The inside dimensions are 6x18 ft., and the sets are spaced on 6-ft. centers with a bearer set under every seventeenth regular set. Instead of using one size of timber throughout the set, it was varied to the work it had to do. The wall plates, end plates and corner posts were made all of 8x8 in., while the dividers and divider posts were made only 6x8 in. The shaft was lagged with planking. The sides of the ladder are 2x4 in. spaced 16 in. apart. These are held together by bolts, and between bolts are six rungs made of ⅔-in. pipe set ¾ in. in the sides. The rungs are spaced on 11-in. centers. Where traffic is heavy on the ladders, steel rungs would probably prove superior to pipe, as the latter would wear through in a short time.

The third shaft now described has to meet greater demands than either of the others. This is the "D" shaft of the Newport Mining Co., at Ironwood, Mich., a five-compartment shaft inclined at 68°. One compartment accommodates the pipes and ladder, while two of the others are used as skipways all the time and the remaining two sometimes as skipways and sometimes as cageways, according as the circumstances demand. The skips are run in balance usually, and of each pair one comes to the surface in about 1 min. 40 sec. from the 2,300-ft. level (inclined distance). The sets consist of steel members which in the upper part of the shaft are set on 6-ft. centers, and in the lower part on 4-ft. centers. For bearers, heavy I-beams are used. Both wall plates are sections 5x1¾ in. at 24.1-lb., while the dividers are 4x4 at 13.6-lb. H-sections. The wall plates are spliced, which necessitates one divider being cut shorter than the other. The end plates are the same size as the dividers. For studdles 3x3 at 4.9-lb. angle irons are used. The shaft is lagged with peeled cedar. The skips run on 40-lb. rails fastened to the foot-wall plates. Back runners are also employed. These are 6x8 in. and are held in place both by bolts and by angles. The whole shaft inside is

28x6 ft. The skip compartments are 5 ft. 7 in., while the ladderway is 4 ft. 4 in. wide. The plan of the shaft is shown in Fig. 2.

The fourth and last example of shaft building is found in a new shaft being sunk at the Creighton mine, Ont., known as No. 3 shaft. This is still being sunk, and the timbering has not as yet been fully designed. The concrete collar, however, is finished and is shown in Fig. 3. This collar is strongly reinforced, and at the bottom four heavy 18-in. I-beams are placed. This shaft is 33x7½ ft. inside. The foot-wall plates in the collar are 10x10 in. and are set 2 in. above the concrete, making the height 7 ft. 4 in. in the clear. As shown in the section, the hanging-wall part of the collar at the bottom has not been completed, but this will be put in when the permanent timber is being placed. The shaft is inclined at 55° and has five compartments. In the collar at present there are only three compartments, as shown in Fig. 3. The two end compartments are complete, one being used as a ladderway. The three middle compartments have been left as one, and the two sinking skips run in these. Two division walls of concrete are in place in the collar, and provision has been made so that the two remaining division walls can be put in place when sinking is finished. Below the collar temporary 10x10-in. wall plates have been put in every 10 ft., and the rails are spiked to these. No other timbering has been done except at a few points where loose ground had to be supported.

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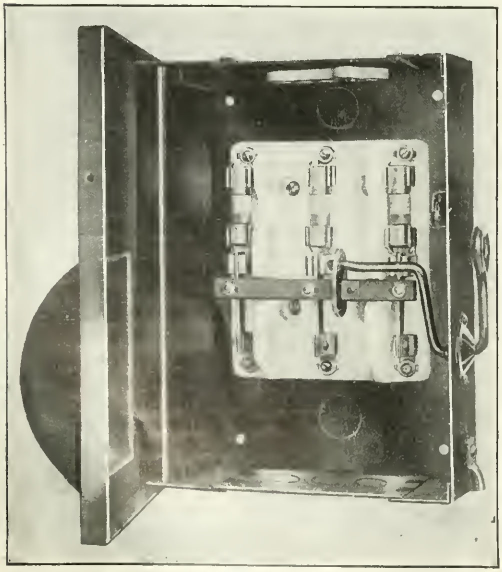
A Practical Safety Switch

By W. D. Lindsey*

Each year one hears of accidents resulting from the use of the open switch, and often such accidents go unrecorded; but were it possible to make an accurate accounting, the total would probably be surprisingly great. An open-switch accident may mean death from shock to a workman and the resultant demoralization of others. Or a switch may be thrown while a repair man is working on shut-down machines. Fires resulting in loss of lives and property are often caused by short-circuit from the open switch.



A SAFETY SWITCH

The "Square D" inclosed switch, which is manufactured by the Western Electric Co., is offered as a remedy for the open-switch evil. Its development has been carried out in accordance with the principles of the safety-first movement in the standardization of electrical equipment.

The switch and cutout unit are completely inclosed in a metal box provided with a hinged cover which is held closed with a simple spring catch. The switch is operated by a crank handle located outside the box. The switch may be locked in the "off" position to prevent accident when repairs are in progress. Means are provided to lock or seal the cover shut to prevent unauthorized persons overfusing the switch or tampering with live connections. These switches are also provided with a label issued by the Underwriters Laboratories, Inc., indicating that they have been examined and tested with the object of classing them as safety apparatus. They have also been approved by the Federal Bureau of Standards and the Workmen's Compensation Service Bureau.

The pressed-steel switch is made for all commercial voltages from 125 to 600, and in capacities of from 30 to 600 amp. All switches for 60 amp. and over are equipped with a quick "break" attachment to prevent the formation of dangerous arcs. The ends of the pressed-steel box are removable and can be equipped with plates for suitable knockouts to fit any wiring condition. The plunger switch has the switch gear inclosed in a cast-metal casing, and as in the case of the pressed-steel type, the mechanism is operated from the outside of the box. The switch mechanism is of the quick make-and-break type, and when closed a gasket in the lid makes the box fire, water and fume proof, so that installations may be made where water, fumes and dust exist without injury to the working parts of the switch. These switches are so constructed that the covers cannot be removed when the switch is in the "on" position; neither can the covers be closed after opening until the mechanism is brought to the "off" positions. This arrangement has been worked out so as to obviate the possibility of short-circuits in dangerous atmosphere in the process of operating the switches.

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Tunnel Backsight

For driving a long tunnel to connect with existing workings alignment is of prime importance. The portal of the tunnel having been chosen and the transit set up and sighted upon a determined point over the tunnel alignment, it is necessary to establish a permanent backsight that can be used during the driving. This should be at a considerable distance and on the same grade as the tunnel. The telescope is reversed and set at the negative grade of the proposed tunnel. The ground contained in the vision of the telescope is then sought and a backsight established. It may be several miles off, but that is only the better. A wooden board 1 ft. square divided into four squares painted diagonally white and black and firmly fixed will give a good backsight that is easily picked up and from which it is easy to keep the tunnel alignment.

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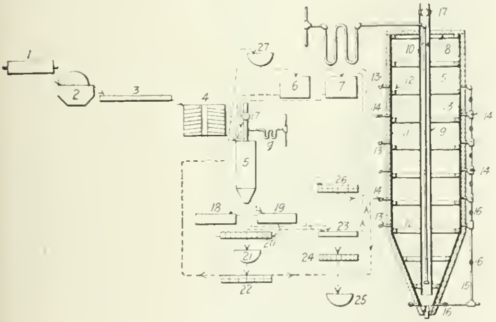
*Western Electric Co., 195 Broadway, New York City.

Details of Milling and Smelting

Lixiviation of Lead and Zinc

A new method of treating complex ores of lead, zinc, iron, silver and copper has been devised by R. S. Handy, of Kellogg, Idaho, and granted U. S. Patent No. 1,185,902. The ore is first ground to pass a 20-mesh screen in the apparatus diagrammatically indicated at 1 in the drawing. After having its surplus moisture removed by the filter 2 and the drier 3, the ore is roasted in the cylindrical roaster 4. Here an ore of the composition indicated is roasted to form as much lead sulphate and ferric oxide as possible. This roasted ore then passes into the filtering tank 5.

The tank is tightly covered and contains an air lift centrally suspended and equipped with discharge holes near the top of the tank. The inside of the tank is covered by a suitable filtering medium 11 secured by circular wooden strips fastened to the tank. These wooden strips form compartments, each of which is drained by suitable pipes leading to a surrounding header. The headers are all connected by the pipe 15 leading to a suction pump not shown. By means of valves 16 the compartments may be consecutively shut off from suction, an arrangement which facilitates draining of the filter tank according to the specific gravities of the contained fluids, when desirable. The valve 17 at the head of the air-lift pipe may be closed at any time and pressure used for filtering instead of suction.



FLOW SHEET OF PROCESS AND SECTION OF FILTER TANK

The roasted ore introduced into this tank is subjected to the leaching action of hot sodium chloride, ammonium chloride or ferrous and ferric chloride, as desired, these solutions being supplied from the storage tanks 6 and 7. Both agitation and aëration are effected by the air lift, after which the pregnant solutions are filtered out into the settling tanks 18 and 19.

When the roasted ore is first subjected to the leaching action of hot sodium chloride, the lead sulphate is dissolved and sodium sulphate formed according to the reaction $PbSO_4 + 2NaCl = PbCl_2 + NaSO_4$, but the ferric oxide and remaining sulphides are not attacked. Arrived in the settling tanks the lead chloride crystallizes out of solution when cool, and the $NaSO_4$ solution is decanted off. The lead chloride is then first filtered in press 20, evaporated in 21 and the dried and fused product separated into metallic lead and chlorine in the electrolytic cells 22. This gaseous chlorine is piped to the apparatus 27, where as hydrochloric acid it attacks iron in the ores to form the ferrous or ferric chloride utilized in leaching the residuum in the filter tank after the lead chloride has been leached, this iron chloride product being stored in the supply tank 6.

The residue from the first filtration consists of the sulphides of lead, copper, zinc and silver, which when attacked by the ferric chloride solution in the filter tank form their respective chlorides—ferrous chloride and sulphur. These solutions after reaching the precipitation boxes 23 from the settling tanks 18 and 19 come in contact with metals that precipitate them, iron being used for precipitating both lead and copper, while copper precipitates the silver. Ferrous chloride in each case is the eventual product remaining in solution; and this is rapidly oxidized by the air to ferric chloride, which is returned to the leaching circuit.

The precipitated metals are collected and melted in the filter 24 and pot 25 respectively. The zinc chloride decanted from the solution of the other metals is led into the electrolytic cells 26, where the metal is deposited by the now well-known action of the electric current.

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Treating Amalgamation Tailings

By John Allingham*

The tailings resulting from old pan-amalgamation mills have been difficult to treat economically—in fact, it is extremely doubtful whether any profit has been made by a well-known company that has treated many thousands of tons of tailings from the Comstock Lode, Nevada.

The tailings contain a great deal of organic matter including charcoal. The silver contained is in the form of chloride and sulphide. The mercury exists as a mercurous salt for the most part, although there is some metallic. By careful panning about 1% of clean concentrate is obtained, assaying 52 oz. silver and 1.2 oz. gold per ton. The copper contained is insoluble in water, but 80% can be dissolved by sodium thiosulphate.

Half the mercury existing as a mercurous salt is soluble in sodium cyanide and sodium sulphocyanide with a precipitation of gray mercury.

$$Hg_2Cl_2 + 2\,KCN = Hg(CN)_2 + 2\,KCl + Hg$$

$$Hg_2Cl_2 + 2\,NaCNS = Hg(CNS)_2 + 2\,KCl + Hg$$

The mercury sulphocyanide forms a double salt with the excess of sodium sulphocyanide present. The me[illegible] is precipitated by zinc and iron. In practice silv[illegible] gold were precipitated on pump runners and lines, [illegible] lines and in tube mills. The cement backing to the [illegible] in the tube mills, ground, assayed 6.2 oz. Au and [illegible]

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*[illegible] N. M.

Ag per ton. The coarse cement scale assayed 5.2 oz. Au and 20.4 oz. Ag per ton.

Coarse material caught on screens at tube-mill discharges, containing a small amount of concentrate and a grayish precipitate, but principally consisting of coarse sand and pieces of flint pebbles, assayed 1.7 oz. Au and 9.4 oz. Ag per ton. The tailings being treated at this time assayed 0.12 oz. Au and 3.6 oz. Ag per ton.

All iron in contact with pregnant solution showed evidence of precipitation of gold and silver, the gold being more easily precipitated than the silver. The precipitation of silver and gold is caused by the mercury being precipitated on the iron and in turn acting as a precipitant for the gold and silver. Gray mercury also precipitates gold and silver from cyanide solutions, but in practice I do not think the small amount present interfers very much with the extraction of the gold and silver, as any precipitated would be dissolved again. However, with weak cyanide solutions, relatively poor extractions are made in the same time as are made with strong solutions, say 0.04% NaCN and 0.2% NaCN. With a strong solution, treating unground tailings, 48 hr. agitation, a washed residue assaying 0.01 oz. Au and 0.9 oz. Ag is easily obtained; the cyanide consumption is about 0.5 lb. per ton more than when using a weaker solution. It may be that any prematurely precipitated gold and silver would not be dissolved by weak solutions in an ordinary time of treatment.

EFFECT OF MERCURIC CHLORIDE ON SOLUTIONS

As the mill solutions contain sulphocyanides, some double sulphocyanide of mercury is formed. This may explain why the addition of mercuric chloride to working solutions, as an aid to extraction in the treatment of silver ores, is not successful. In my experimental work in Mexico, using freshly prepared solutions, the addition of small quantities of mercuric chloride to the solution at the last 24 hr. of treatment always resulted in a better extraction of the silver, while in practice after the mill had run two months, no beneficial result was observed, and the use of mercuric chloride was discontinued.

As has been stated, the mercury in the tailings is partly soluble in sodium thiosulphate, an average of a number of experiments showing that 55% of the mercury could be dissolved by a 0.1% solution of sodium thiosulphate. The mercury can be precipitated from the solution by means of an alkaline sulphide.

As is well known, when sodium thiosulphate is added slowly to mercury salts the following reactions take place:

(1) $Hg_2(NO_3)_2 + Na_2S_2O_3 = Hg_2S + Na_2SO_4 + N_2O_5$

(2) $3\,Hg(NO_3)_2 + 2\,Na_2S_2O_3 = 2\,HgS\,.\,Hg(NO_3)_2 + 2\,Na_2SO_4 + 2\,N_2O_5$

(3) $3\,HgCl_2 + 2\,Na_2S_2O_3 + H_2O = HgS.HgCl_2 + 2\,Na_2SO_4 + 4\,HCl$

But when an excess of sodium thiosulphate is added, then the following reactions occur:

(4) $HgCl_2 + Na_2S_2O_3 = HgS_2O_3 + 2\,NaCl$

(5) $Hg(NO_3)_2 + Na_2S_2O_3 = HgS_2O_3 + 2\,NaNO_3$

(6) $Hg_2(NO_3)_2 + Na_2S_2O_3 = HgS_2O_3 + 2\,NaNO_3 + Hg$

(7) $Hg_2Cl_2 + Na_2S_2O_3 = HgS_2O_3 + 2\,NaCl + Hg$

The mercury thiosulphate in each case dissolves in the excess of sodium thiosulphate, forming a double salt.

The time of agitation in the experimental work varied from 2 to 12 hr., 6 hr. being found to be sufficient. The consumption of "hypo" varied from 3 to 4 lb. of commercial salt per ton of tailings treated. In a 1-hr. agitation, 29% of the gold and 23.9% of the silver were dissolved. Certain experiments show that it is possible to obtain extractions of the gold and silver equally as good as those obtained by cyanidation.

There are yet some 350,000 tons of untreated tailings of the class described awaiting some economical treatment. A great deal of experimental flotation work has been done by many on these tailings, and although 85% of the combined value of the gold and silver has been concentrated, the cleaning of the first concentrate appears to be difficult. From some experiments made personally, to obtain a good result it was necessary to make a first concentrate from 12 to 16% by weight of original charge. Before flotation the charge was given a preliminary treatment with sodium sulphide. In cleaning the concentrate, I found that ground charcoal (about 10 lb. per ton of concentrate) agitated thoroughly with the concentrate effectively assisted in the cleaning.

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Use of Reinforced Concrete in Metallurgical Work

Reinforced concrete has been widely adopted in construction work, and in recent years especially many new applications have been made of this type of construction. It has been extensively used among metallurgical plants for abutments, foundations for metallurgical machinery forms, flues, tanks, tunnels, working platforms and, to a limited extent, for chimneys and furnace bottoms.

At a number of plants reinforced concrete was used for the hearths of multiple-deck roasters of the MacDougall type. An experimental roaster was built of reinforced concrete at Miami, Ariz., by R. C. Canby, but although it served the purpose for which it was constructed, Mr. Canby writes that its length of service was not sufficient to indicate the endurance of concrete for actual operating duty. Regarding the reinforced-concrete roasting furnaces tried at Anaconda, E. P. Mathewson wrote that they were entirely unsatisfactory. A 25-ft. furnace of the Wedge type was built with three floors made of slag concrete and three of quartz concrete. This furnace was a complete failure and had to be rebuilt of brick. He also reported that the several smaller furnaces of the MacDougall type in Great Falls were giving much trouble and were extremely difficult to repair. No more roasting furnaces of this type are to be erected by the Anaconda company.

There is an impression in metallurgical circles that the Great Falls reinforced-concrete roasters were satisfactory, but this seems to be quite at variance with Mr. Mathewson's opinion and experience. Hence it may be assumed that reinforced concrete has practically no technical importance in the construction of the hearths of mechanical roasting furnaces for an operating duty, though it may be of service, under special conditions, for temporary experiments.

Where failure has occurred in reinforced-concrete flue or smoke-stack construction, it seems to have taken place at that section of the flue or stack where the temperature became sufficiently low to permit condensation and sulphatization of the ingredients of the cement.

Mining & Metallurgical Machinery

The Darnall Siphon Filter

The Darnall filter adopted by the United States Army has three important advantages that make it particularly valuable for use in mining camps, where water supply is rarely above suspicion. It eliminates bacteria: it is simple, light and inexpensive; it delivers drinking water continuously, beginning within eight minutes of setting up.

The average reduction of bacteria in the filtered water is over 99%. This result compares favorably with the best municipal filtering plants. Muddy water is made perfectly clear. No taste is imparted to the water.

The filter is designed to be used in conjunction with a coagulant and is absolutely worthless for purifying drinking water unless so used. Used without previously adding a coagulant, it will remove only the gross impurities such as mud and other coarse particles, leaving the dangerous impurities, bacteria, in the filtered water. The Darnall filter is based upon this principle. Alum is added to the water simultaneously with a sufficient quantity of a carbonate to neutralize it; the water is then filtered. By using the two chemicals (alum and soda) in such proportions as to practically neutralize each other, it is possible to produce a precipitate as heavy as may be desired without depending on the uncertain amount of carbonate of lime in the water.

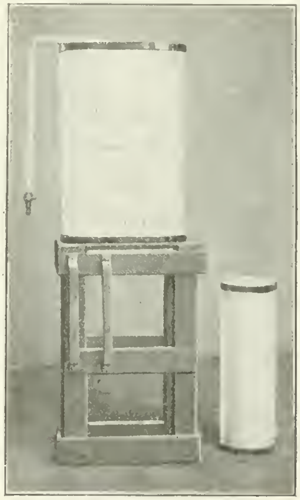

FIG. 1. DARNALL FILTER READY FOR USE

Practically the amount of alum used need never exceed five grains to the gallon of water to be purified. This quantity is sufficient for the foulest and muddiest water. To neutralize this amount of alum, about 2.7 grains of sodium bicarbonate will be required.

The Darnall filter consists of an oval tank 14½x7½x25¼ in., shown in Fig. 1, containing the spool-like form of the filter frame, shown in Fig. 2, upon which are tightly wrapped eight thicknesses of flannel filter-cloth. The coagulating powder is added to the tank and the water filtered by the flannel is siphoned from the interior of the filter spool. The coagulant not only destroys bacteria, but drawn by the filtering action into the interior of the fabric of the flannel, forms a sand-like substance that increases the efficiency of the filtering.

The filter takes only eight minutes to unpack and put at work filtering at the rate of 50 gal. per hour. Owing to its simplicity of construction the work involved in cleaning and sterilizing is small and it can be operated by anyone of ordinary intelligence. It is packed in 11x16x28-in. crate for transportation or shipment, which forms the stand to support it, as shown in Fig. 1; weight of filter and crate complete is 52 lb.

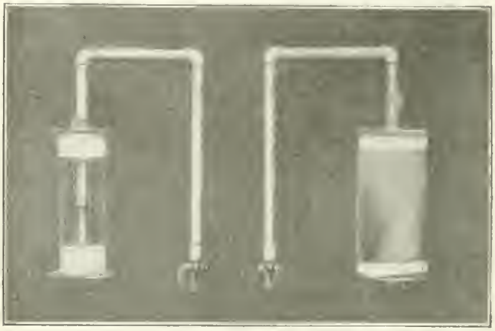

FIG. 2. SIPHON FRAME WITH AND WITHOUT FILTER CLOTH ATTACHED

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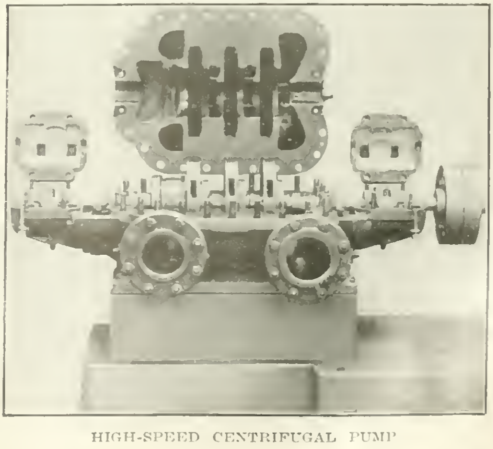
Improved Centrifugal Pump

The development of the steam turbine and that of the high-efficiency multi-stage centrifugal pump have gone hand in hand, but up to the present it has not been entirely practicable to reconcile the speeds of the two machines so that each would work at its best efficiency.

It has been necessary, heretofore, to reduce the speed of the turbine and sacrifice much of its efficiency or else speed up the pump with similar results. To overcome



HIGH-SPEED CENTRIFUGAL PUMP

this difficulty, the Cameron Steam Pump Works has designed and built a multistage centrifugal pump, known as the "BT" type.

The accompanying illustration clearly shows the construction of one of these three-stage pumps. The high-speed feature is a virtue of impeller design. With the ordinary impeller the diameter cannot be reduced sufficiently to get high speed without sacrificing vane length, and consequently efficiency for a certain vane length is necessary in order that the impeller may perform its function without excessive loss. Small external diameter and adequate vane length are obtained in this pump by bringing the vanes well down into the impeller hub, at the same time so turning them that the incoming water is guided smoothly and with little loss into the outer portion of the vanes, where the velocity is generated that is finally converted into useful pressure by means of the external diffusion vane. Additional advantages in the small impeller are light weight and low fiber stresses in the material.

The casing, as shown in the illustration, is divided along the horizontal center line. Both the suction and discharge connections are in the lower half of the casing. The upper half is readily removable, giving full access to the revolving element. There are suitable openings for draining the pump and for displacing the air when starting. Inlet and outlet nozzles can be arranged either on the same or on opposite sides—an important advantage where pumps are installed in limited space.

The shaft is made of high-grade forged steel accurately machined and ground, and wherever it comes in contact with the fluid being pumped, it is thoroughly protected by bronze sleeves, which prevent the stuffing-box packing from scoring the surface of the shaft.

Each impeller is cast solid in one piece and is of the inclosed type. Surrounding each impeller hub is a pair of rings—one stationary, attached to the casing, and one revolving, attached to the impeller. By the use of double rings instead of a single ring it is possible to restore the initial tightness of the joint between the low- and high-pressure sides of each stage without any fitting whatever, whereas a new single ring would have to be of special diameter and then fitted to the impeller hub of the casing to make a tight joint.

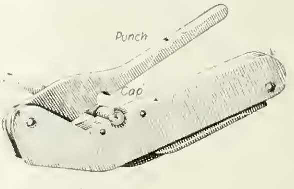
The diffusion ring surrounds the impeller at its periphery, although it is not in contact with it. It contains a series of openings, which receive the water from the impellers at high velocity and, by means of gradually increasing area toward the periphery, reduce the velocity into pressure and enable it to advance to the entrance to the next impeller with much less loss of energy than would be the case if the high velocity of ejection were maintained.

To take care of thrust, which manifests itself in all multistage pumps, this pump is equipped with a simple internal hydraulic balancing device, consisting of a revolving disk attached to the shaft at the inboard, or high-pressure, end. Opposite this disk is a stationary drum of the same diameter. Water at high pressure connects with the space between the disk and the drum, causing the disk to react against the opposing thrust, neutralizing it and holding the rotor in proper relation to the casing. The slight leakage involved in this process is piped back to the suction.

The illustration shows a three-stage type "BT" boiler-feed pump having a capacity of 550 gal. per min. at 3,100 r.p.m. supplied under a pressure of 200 lb. The manufacturers claim that it occupies less space than the ordinary boiler-feed pump of this general type and that it has a much higher efficiency.

A Crimping Knife

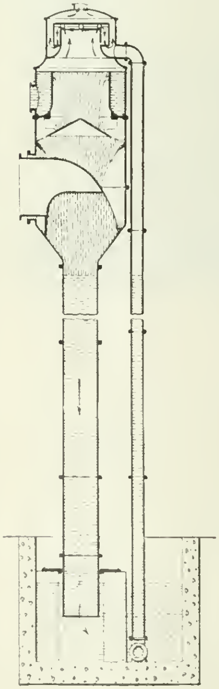
A recent U. S. patent (No. 1,184,746) granted to Ole Hanson, of Lead, S. D., covers an ingenious variation of the ordinary jackknife. A hinged arm on the back has its end sharpened to act as a punch. Near the pivot is a semicircular recess cut partly in the back of the knife and partly in the arm. This recess holds the cap and crimps it on the fuse. This device is recommended to miners as being much safer than the time-honored method of crimping with the teeth.



A CRIMPING KNIFE

Beyer Barometric Condenser

Complete steam condensing plants are now being supplied by the Ingersoll-Rand Co. This equipment includes the Beyer barometric condenser, which is of the counter-current type, in which air and cooling water flow in opposite directions. The steam inlet is at the bottom of the condensing vessel, the water inlet above and the air-removal opening at the top. The sheets of cooling water overflowing the pool at the inlet point meet the entering steam. The two are brought into intimate contact by conical baffle-plates, assisting the water to absorb to its full capacity the latent heat of the steam. The noncondensable air liberated in the condensing action rises through the falling water to the removal point at the top, being cooled to practically the temperature of the incoming water. Ample opportunity is given for the removal of the air content of the water before it mixes with the steam. This not only facilitates the mixing process, but permits the removal of air and vapor at a comparatively low temperature—a distinct advantage, as the reduced volume saves in vacuum-pumpage horsepower. The steam inlet is of large diameter to secure low velocity.



THE BEYER BAROMETRIC CONDENSER

The Mining Situation in South Africa

Special Correspondence

The visit of the party of American engineers and the publication of the report of the Government Mining Engineer raised high hopes that the opening of the East Rand basin would be taken in hand, as already far too long a delay had prejudiced the future of the Rand and of South Africa. The government has, at least, become aware of the urgency of the matter, and recognizing that the lower scale of royalties recommended by Mr. Kotze more nearly met his circumstances, they introduced into Parliament a bill on the lines of his report. Unfortunately for the future of the country, an agitation was set on foot in favor of state mining. The authors of this agitation were no doubt well meaning, but they forgot that delay in this matter is fatal and that the government and people of a country can never lose when 12 to 15s. out of every 20s. worth of gold raised is spent in the country, and in addition the state takes about 25% of all profits. Unfortunately the government had to withdraw the bill, and the matter is again hung up.

A new phthisis act was passed, which introduces a drastic reform. After August of this year every miner working on the Rand must submit to a compulsory medical examination, and every one suffering from tuberculosis is to receive £300 to £400 compensation and to be debarred from future underground work. The awards to sufferers from silicosis are increased in certain cases, and it is probable that further drastic regulations will be enacted to prevent exposure to dust underground.

Mechanics Demand Wage Increase

Some trouble is threatening over the demands of mechanics for increase of wages on account of the higher cost of living. Most of these men receive 20s. per day, but the scale of war bonuses offered by the Chamber of Mines to maimed men and those having dependents does not satisfy the men. There is, needless to say a great shortage of skilled mechanics as, apart from enlistments, over 250 have gone to England for munition work. Having failed to benefit by the bill and other bequests in aid of education in South Africa in starting a university on the Rand, an effort is being made to start one supported by private endowments, but the prospect cannot be said to be bright for obtaining the large funds necessary. In metallurgy very little of a novel character has been brought forward recently. The scope of discovery has apparently been narrowed down to small improvements in details of apparatus and processes. No engineer would have the courage to suggest replacing stamps by stage crushing with rolls, Symons pulverizers, ball mills or other apparatus. As pyrite is much in demand for making sulphuric acid, there does seem an opening for employing a modification of the oil-flotation process to extract iron pyrite from the tailings, and it is just possible that a very small increase in the gold recovery might be made by this means. The local supply is at present being drawn from a deposit 60 ft. wide and 1,500 ft. long on the Areachap farm on the new railway line near the boundary of what used to be German Southwest Africa. This deposit also contains some rich copper ore that is being shipped.

The Kimberley diamond mines of De Beers are washing diamonds from their floors, and mining is starting on a small scale at the Premier mine. Certain producers in German Southwest Africa are allowed to work to give employment to the German population, and the river diggings of the Vaal River also supply stores. North of Pretoria, near the Premier mine, a bench deposit of gravel is being mined with payable results. De Beers and Premier mines have apparently disposed of all their stocks and in view of the American demand are allowing prices to rise. The government, with the idea of establishing a local diamond-cutting industry, imposed a 5% export tax on rough diamonds. This will, however, scarcely be a high enough duty to make the diamond syndicate start a cutting industry in South Africa against its wishes. Since the conquest of the Southwest Territories, the South African government, the Premier and the De Beers, acting together, have had a virtual monopoly of the diamond trade.

Position of the Tin Mines

Tin mining in Southwest Africa can scarcely be said to be flourishing. No new discoveries are being made. The deposits near Cape Town appear to be exhausted. The Zaaiplaats tin mine, which has been mining exceptionally rich pipe deposits and irregular impregnations in the granite and which has paid nearly £400,000 in dividends, appears to be approaching exhaustion. The Rooiberg Tin Mines, which is mining fissure and fracture plane deposits in quartzites overlying the granite, does not appear to be able to locate payable ore below a very shallow depth. Though its possibilities are by no means exhausted and no systematic development at any great depth has been carried out, it is at present under a cloud. The neighboring Leeuwpoort Tin Mines appear to have the best-defined tin lodes in South Africa and have followed them to a depth of 400 ft. on the incline. Their prospects appear to be good at present. They have between 150,000 and 200,000 tons of tin ore carrying over 2% tin and mill about 3,000 tons per month at a good profit.

The alluvial deposits of Swaziland are being worked by hydraulicking and a portable type of electrically driven bucket elevators which appear to be a success, and fair profits are being made. The alluvial deposits of Swaziland are, however, of very similar size and the richest areas were long ago exhausted.

The Messina mine is almost the only producer of copper ore in South Africa except the old mines in Namaqualand, which appear to be approaching exhaustion. The Messina mine has recently been making a large production, but unless prospecting is rewarded by finding new deposits under the old native workings, the short pipe-like lenses of the present mine cannot maintain the past and present rate of production. The Ecksteins explored a deposit of zinc ore with some galena in the dolomite near Zeerust, but were disappointed at the extent of the deposit and, after shipping some ore, stopped work. A promising group of silver-lead lodes at Edendale near Pretoria suffered from mismanagement. They are worthy of further development under competent technical direction. It is not generally known that native bismuth and other bismuth ores occur in gold-bearing quartz reefs quite near Johannesburg in the Pretoria series. An English company called the Natal Ammonium Co. has put up very large works near Vryheid in Natal to distill ammonium sulphate and other products from the extensive beds of oil shale that occur there. Coal mining is active to supply the large demand for local consumption and for bunkering purposes during the war and would be still more active except for shortage of rail trucks. Owing to the continued output of the mining industry, particularly the gold mines, South Africa feels the effect of the war perhaps less than any other part of the colonies of the Empire.

Johannesburg has always been interested in the mineral deposits of Madagascar. Local companies hold large areas of Permian deposits in the northwestern part of the island. Oil seepages are abundant, but the amount of drilling done to date has not succeeded in tapping payable oil deposits, though oil-bearing sandstones are common. The area to be explored is, however, very large and any discovery of oil would be most important. Attention has also been drawn to the occurrence over a wide area of radium-bearing minerals and other rare earths in pegmatite bodies and the detritus from them.

A certain production is being made which would be greater were it not for the war. Graphite is being mined on a fairly large scale but by primitive means. The trouble of economical concentration is being met with here as elsewhere, and there is a possible chance for the introduction of flotation methods.

Superiority of American Pipe

American engineers at work in foreign countries where local conditions precluded the possibility of securing any but English-made pipe, have frequently been humorous or caustic in their comments on results, contributed to the columns of the *Journal*. Readers have been emphatically advised of the superiority of American pipe and fittings, but few reasons have been advanced for that superiority. Those interested in the subject are referred for details to an article entitled "The Manufacture of Water Pipes," by Percy G. Donald, published in *The Ironmonger*, London, June 24, 1916.

The writer is an Englishman empowered by his government to buy pipe for it, after which he had charge of pipe-line construction in Egypt, where extensive lines were built. In his frank admission of the superiority of American pipe over that of English, Canadian and German manufacture, he details reasons for it under the heads of better manufacturing, better threading, better packing methods and lower cost.

English manufacturers are apparently handicapped by lack of a definite set of standards and specifications as regards length, weight per foot and bursting pressure, as well as by the custom of making three different sets of pipe with varying specifications, depending upon whether the pipe is to be used for gas, water or steam. In general, English pipe is lighter than American and uses a considerably finer and shorter thread. The crux of the inferiority of English pipe is apparently found in the difficulty of making tight joints, no matter how heavily coated with red lead. One of the reasons for this appears to be that while the English thread is slightly tapered, incredible as it may seem, the sleeve and other fittings are not tapered. As a result, apertures readily admitting pin points exist where the sleeve joins the pipe. English threads are criticized as too fine by the writer.

Owing to inferior packing methods, 15% of the English pipe had to be rethreaded upon its arrival in the desert, while no American pipe required such treatment. As a result, one pipe-laying gang handling British pipe exclusively could fit only 756 ft. of 6-in. pipe daily, while another gang laid over twice as much American pipe in the same time.

When the water was first pumped through the completed line, a large proportion of the British-made joints leaked, but one could walk for miles along the American-made pipe without finding a single leak. In concluding we quote the English writer's own words: "This is a strong indictment, but when one undertakes work such as this Egyptian pipe-line, possibly the largest of its kind, and hears British sappers and engineers, after experience with Britsh and American pipe, cry with one voice, 'Give us Yankee pipe!' one feels strongly on the point."

Arizona Meeting of A. I. M. E.

Leaving Douglas, Ariz., at 11 p.m. on Tuesday, Sept. 19, the A. I. M. E. special train arrived at Bisbee two hours later. While some of the party were doubtless suffering from the royal hospitality of Douglas, the majority were out next morning for an early start on a visit of inspection to the Bisbee mines.

The second technical session, held that afternoon, was devoted to the subjects of mining and geology. Among other noteworthy papers on the program for presentation were the following: "The Geology of the Warren Mining District," by Y. Bonillas, J. B. Tenny, and Leon Feuchere; "Coöperative Effort in Mining," by Joseph P. Hodgson; and "Gold and Silver Deposits in North and South America," by Waldemar Lindgren. Mr. Lindgren said that the South American resources in precious metals are less than those of the northern continent and that "even progress and enterprise will be unable to raise its production to approach the figures attained by North America."

A further handicapping of the chemical industries of the country, due to a lack of manganese ores, was predicted in a paper by E. C. Harder, of the United States Geological Survey.

David B. Reger, of the West Virginia Geological Survey, in his paper said that the exhaustion of the oil and gas resources of the country is proceeding at a rapid pace, but predicted that the problem of future supply would be partly solved by the securing of deeper producing horizons in high-grade oil regions and later possibly by the mining of deep-sand oil and gas.

The technical session was followed by a most enjoyable banquet and social evening, after which the visitors left for Globe. Here, Thursday morning was spent in a visit of inspection to the mines and reduction works of the Old Dominion company.

At the afternoon's technical session, possible means of developing the flotation process to the greater benefit of the country's mining interests were discussed by the delegates. The discussions were particularly important to mining interests because of the first public presentation of a report of experiments on several miscellaneous wood oils that seem adaptable to use in the flotation process. A statement of some of the values of these oils was presented by R. C. Palmer, of Madison, Wis., Glenn L. Allen, of the Shattuck Arizona Copper Co., and O. C. Ralston, of the United States Bureau of Mines. Another especially striking feature of this discussion was a description by Dr.

Rudolf Gahl, representing Inspiration Consolidated Copper Co., of the exhaustive research and experiments of his company in an effort to develop the flotation process.

Conclusions reached by members representing the leading metal producers of the country were to the effect that the process is now in its infancy and that with the hoped-for discovery of new flotative agents, a brilliant future record is anticipated.

After the evening banquet, the delegates again assembled in technical session to consider the subject of fine grinding. The program included a paper by F. C. Blickensderfer, of the Detroit Copper company, in which he described a comparative test of the Marathon, chilean and Hardinge mills.

On Friday morning the Institute visitors were welcomed at the reduction works of the International Smelting and Refining Co., and at the mills of both the Inspiration and Miami companies.

On resuming the technical sessions in the afternoon, the program included among other noteworthy papers, the following: "Stoping Methods of the Miami Copper Co.," by David B. Scott, and "Mine Fire Methods Employed by the United Verde Copper Co.," by Robert E. Tally.

The paper by W. R. Hamilton, of San Francisco, presented the gasoline-industry data to the meeting and predicted a serious shortage of gasoline on the Pacific Coast, the effect of which is expected to extend throughout the country within the next year. He attributed the future shortage to decreased production of refinable oil (the decrease amounting to 6,000,000 barrels in 1915), steadily increasing consumption, the discontinuance of imports, and the heavy exports due to war's demands.

A paper by Edwin M. Chance depicted the value of chemistry to the coal-mining industry. His conclusions showed the passing of the days when coal is purchased for its looks rather than its heating units ascertained by chemical methods.

At last accounts from *Journal* correspondents, the delegates were anticipating the automobile tour over the Apache Trail to the great Roosevelt Dam, thence to Phœnix, by Saturday night, followed by the Sunday sojourn at the Grand Cañon.

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Trail Smelter Reduces Rates

Recognizing the increasing importance of the Valley mining district in Stevens County, Washington, the Consolidated Mining and Smelting Co., of Canada, has authorized a reduced treatment charge on ores that go into its smelter at Trail, B. C., says *United States Commerce Reports*. The Great Northern R.R. has also announced a reduction in the freight rate, both schedules to become effective about Oct. 1.

The reduction rate will be $1.50 per ton on ore that runs between $25 and $50 per ton, and the freight will be $2.45, or a total freight and treatment charge of $3.95 per ton. If ore values exceed $50 per ton, a proportionate additional charge will be made both on freight and treatment.

*

Molybdenum Ores in Peru have been known for years, according to a recent consular report, but the inaccessibility of the mines and the consequent cost of working them has prevented their exploitation until quite recently, when the prevailing high prices induced some production. The principal mines are at Ricran in the province of Jauja, and Runatullo in Huancayo. The production of concentrates last year was about 4 tons.

NEW PATENTS

United States patent specifications listed below may be obtained from the "Engineering and Mining Journal" at 25c each. British patents are supplied at 40c each.

ARSENICAL MATERIAL—Process of Treating Arsenical Material. Duncan Anderson, Jr. San Francisco, Calif. (U. S. No. 1,198,095; Sept. 12, 1916.)

CLASSIFIER and Dewaterer. Walker J. Boudwin, Salt Lake City, Utah, assignor of one-half to The General Engineering Co., Salt Lake City, Utah. (U. S. No. 1,197,255, Sept 5, 1916.)

CONCENTRATING TABLE. Robert H. Richards, Boston, Mass. (U. S. No. 1,197,398, Sept. 5, 1916.)

CONCENTRATION—Process of Treating Ores. Raymond F. Bacon, Pittsburgh, Penn., assignor, by mesne assignments, to Metals Recovery Co. (U. S. No. 1,197,589, Sept. 12, 1916.)

COPPER REFINING. Ulysses A. Garred, New York, N. Y. (U. S. No. 1,198,434; Sept. 19, 1916.)

CRUSHER—Centrifugal Crusher and Separator. Henry Adams, Stamford, Conn., assignor to The Adams Mining Machinery Corporation, New London, Conn. (U. S. No. 1,197,888, Sept. 12, 1916.)

CYANIDING—Method of Extracting Precious Metals from Their Ores. Thomas B. Crowe, Victor, Colo., assignor to The Portland Gold Mining Co., Colorado Springs, Colo. (U. S. No. 1,198,011; Sept. 12, 1916.)

DRILL—Fluid-Operated Tool. Louis W. Greve, Cleveland, Ohio, assignor to The Cleveland Pneumatic Tool Co., Cleveland, Ohio. (U. S. No. 1,198,125; Sept. 12, 1916.)

DRILL SHARPENER. Henry G. Olive, Metcalf, Ariz. (U. S. No. 1,197,846; Sept. 12, 1916.)

DRILLING—Method of Removing Drilling Tools. Walter O. Snelling, Pittsburgh, Penn. (U. S. No. 1,199,819, Sept. 5, 1916.)

ELECTROLYSIS—Method of Reducing Metals. Robert J. McNitt, Perth Amboy, N. J., assignor to The Roessler & Hasslacher Chemical Co., New York, N. Y. (U. S. No. 1,197,137, Sept. 5, 1916.)

ELECTROLYTIC APPARATUS. William E. Greenawalt, Denver, Colo. (U. S. No. 1,198,024; Sept. 12, 1916.)

FIRE BRICK—Composition of Matter for Making Fire Brick. Earl V. Wagner, Scranton, Penn., assignor to The Wagner Fire Brick Co., Helena, Mont. (U. S. Nos. 1,198,171 and 1,198,172; Sept. 12, 1916.)

LEACHING—Process of Making a Leaching Solution for Extraction of Metals from Their Ores. Henry Byron Slater, Los Angeles, Calif. (U. S. No. 1,195,617; Aug. 22, 1916.)

LEAD MATTE—Treating Lead Matte. Utley Wedge, Ardmore, Penn. (U. S. No. 1,198,882, Sept. 19, 1916.)

MAGNETIC SEPARATION—Method of and Apparatus for Separating Magnetic Material. Fried Krupp Akt., Magdeburg-Buckau, Germany. (Brit. No. 100,064.)

MAGNETIC SEPARATORS—Improvements in or Relating to Magnetic Separators. Fried Krupp Akt. Magdeburg-Buckau, Germany. (Brit. No. 100,063.)

NITROGEN—Process of Fixation of Nitrogen. Adrien Badin, Paris, France, assignor to Société Generale des Nitrures, Paris, France. (U. S. No 1,196,639, Aug. 29, 1916.)

OPEN-HEARTH FURNACES—Utilizing Waste Heat from Open-Hearth Furnaces. Robert M. Snyder, Wilkensburg, Penn. (U. S. No. 1,195,521; Aug. 22, 1916.)

PERCUSSIVE TOOLS—Rotation Mechanism for Percussive Tools. Frederick W. Parsons, Elmira, N. Y., assignor to Ingersoll-Rand Co., Jersey City, N. J. (U. S. No. 1,198,266; Sept. 12, 1916.)

POTASH—Process of Extracting Alkali-Metal Compounds. Henry B. Slater, Riverside, Calif. (U. S. No. 1,197,556; Sept. 5, 1916.)

POTASSIUM SALTS—Process of Recovering Water-Soluble Potassium Salts from Feldspathic Rocks or their Derivatives in the Manufacture of Portland Cement. Frederick W. Huber and Frank Freeland Reath, Riverside, Calif. (U. S. No. 1,194,341, Aug. 8, 1916.)

PULSATING APPARATUS. William A. Smith, Denver, Colo., assignor, by mesne assignments, to The Denver Rock Drill Manufacturing Co., Denver, Colo. (U. S. No. 1,196,010, Aug. 29, 1916.)

QUICKSILVER—Apparatus for Recovering Quicksilver from Its Ore. William H. Landers, New Almaden, Calif., assignor of one-half to Pacific Foundry Co., San Francisco, Calif. (U. S. No. 1,195,236; Aug. 22, 1916.)

ROASTING AND SINTERING ORES, Apparatus for. James Gayley, New York, N. Y., assignor to American Ore Reclamation Co., New York, N. Y. (U. S. No. 1,197,199; Sept. 5, 1916.)

SOLDER—Composition of Matter for Soldering Cast-Iron, Mild Steel, Aluminum, and the Like. William A. Day, Bellingham, Wash. (U. S. No. 1,195,955, Aug. 22, 1916.)

TUNGSTEN POWDER—Art of Producing Tungsten Powder. Frederick G. Keyes and Robert B. Brownlee, Hoboken, N. J., assignors to Cooper Hewitt Electric Co., Hoboken, N. J. (U. S. No. 1,196,699; Aug. 29, 1916.)

VANNER. Robert H. Richards, Jamaica Plain, Mass. (U. S. No. 1,197,399; Sept. 5, 1916.)

WASHING—Apparatus for Washing Coal and Other Minerals. Paul Habets, Montegnée, near Liège, and Anto Frange, Liège, Belgium. (U. S. No. 1,197,932; Sept. 12, 191

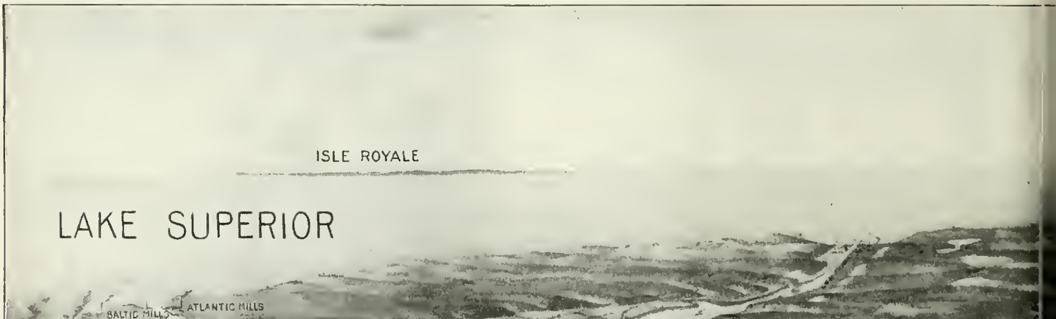
ZINC—Improvements in Process of Alloying Zinc with Iron or Steel. B. F. Dimm, Erie, Penn. (Brit. No. 2,389 of 1915.)

ZINC—Treatment of Zinc Solutions for the Recovery of the Metal Therefrom. Robert Lance, Paris, France. (U. S. No. 1,198,241; Sept. 12, 1916.)

Photographs from the Field

CALIFORNIA GULCH IN LEADVILLE AGAIN TO BE WORKED

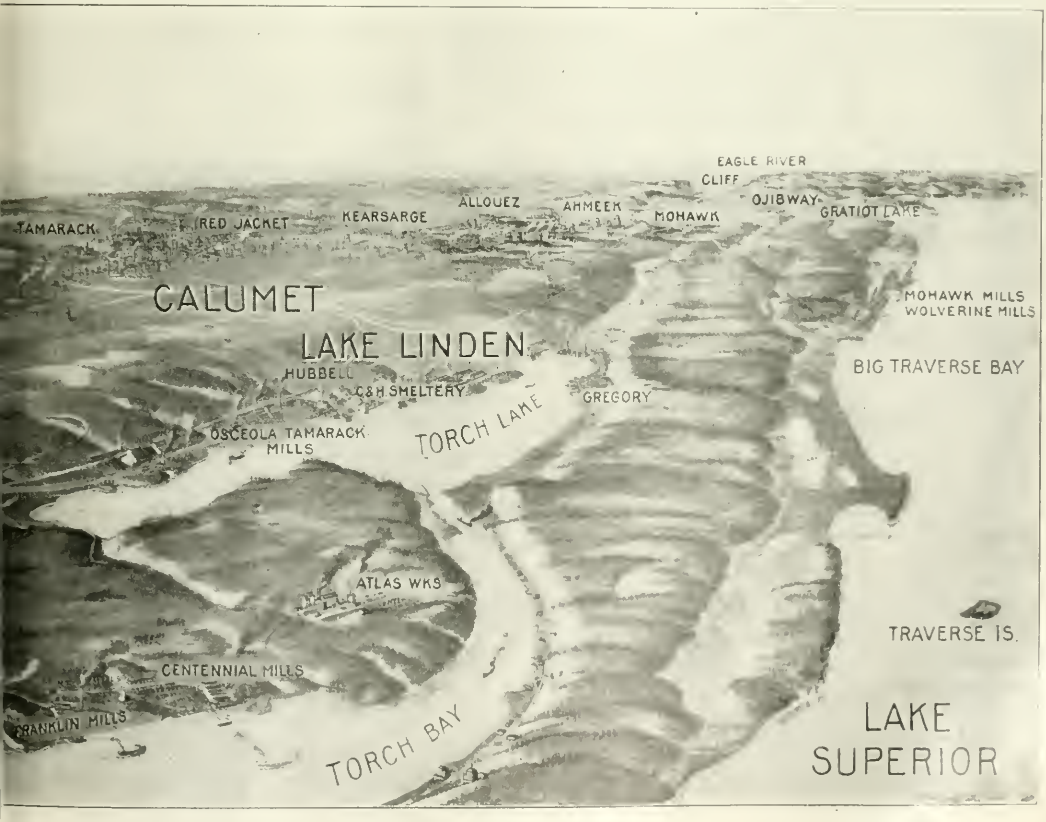
Tailings from some of the mills near the portal of Yak tunnel have accumulated in California Gulch, which will now be worked for zinc and lead, instead of for gold, which was the first metal sought in this Colorado field. Ground has been tested by pits at 50-ft. intervals and concentration in two-compartment jig gave a product carrying 20% zinc and 6% lead; it is expected that further concentrating equipment will bring the concentrates up to the usual grade. The enterprise is to be conducted by a small group of Leadville men, headed by Dr. Max Raabe, a practicing dentist. View at left was taken from old Union smeltery dump looking northeasterly toward Leadville. The other view is looking toward California Gulch; Union slag dump on right; Colorado Midland trestle in middle background



THE LAKE COPPER COUNTRY OF THE UPPER PENINSULA OF MICHIG

DUMPS OF THE PORTLAND MINE IN CRIPPLE CREEK DISTRICT, COLORADO

A new cyanide plant is being built to treat these dumps. The new mill is to be erected to the left and lower down the hill, practically beside the Independence mill. The latter is owned by the Portland company and is handling about 500 tons daily by a combined concentration-cyanidation-flotation treatment consisting of classifying, concentrating, leaching of sands and flotation of fines. Lately concentration has been tried on the flotation tails, the small amount of oil and froth contained therein not appearing to interfere with the work of the tables. At the present Portland dump mill—hidden from view in this picture by one of the dumps—about 600 tons are being treated daily by concentration and subsequent cyaniding of the slimes, the sands being wasted.



ONTAINS THE MOST REMARKABLE KNOWN DEPOSITS OF NATIVE COPPER

Another Mexican Decree

I send you the translation of a decree, issued by Don Venustiano Carranza, First Chief of the Mexican Army, on Aug. 15, and published in the official paper of the government of the state of Chihuahua on Sept. 9. You will note that this decree prohibits foreigners from acquiring property in the republic of Mexico unless they specially renounce beforehand their rights as foreigners as far as ownership in Mexico or any contract or agreement with the Mexican government is concerned.

Leaving to editorial discussion the theoretical right or justice of this and similar decrees, the practical questions that interest the foreigner most are:

Can a foreigner count on the protection given by Mexican laws as administered by a party or by a de facto military government actually in power or likely to be in the near future?

Can a foreigner expect for some time to come to get everywhere in Mexico the same consideration from judges and authorities that a native Mexican will receive, or will race jealousy or race spite put him at a disadvantage?

I believe that the orders to come out of the country, given by the United States Government to its representatives and to all American citizens there, answer these questions.

It is not so many years ago that foreigners and foreign capital were invited to come to the Mexican republic. Foreigners who have been in Mexico for any length of time know how anxious native owners have been and are to sell their lands, mines and other interests of various kinds. If foreign owners are to be considered by the Mexican government as naturalized Mexican citizens as far as their interests in Mexico are concerned, it may be well to consider what has happened to native property owners. It seems that many of the larger owners have had to leave the country, as have United States citizens, and that their properties were confiscated permanently or temporarily for military purposes or through military necessities. What redress can they hope for? Is the foreigner, or rather the United States citizen, to have no better chance of getting protection than the Mexican citizen is likely to get, who for the sake of prudence or safety had to leave the country? If he is to be classed as gringo, or spy, or reactionist, or cientifico, or anything else, and new decrees, imposed by military power, are to tax his ownership out of existence, is he to lose his rights for some reason or other, without being able to solicit the friendly assistance of his government?

It may be proper and necessary for our Government to advise the man who has no interests there to stay out of Mexico or any other foreign country, but the man who went to Mexico in good faith to develop internal industry or trade and acquired property there—has he not the right to call on his own government for some help against the oppressive actions of the representatives of a temporary military government which makes laws that burden the foreigner's rights, but does not and cannot give the necessary protection for him to occupy his property or to work it?

May I beg you for an expression of your esteemed views on this particular subject, which affects widely distributed interests and the welfare of a large number of American citizens? B. W.

New York, Sept. 20, 1916.

The decree referred to by our correspondent is given herewith, the text being a translation from the official newspaper of the government of the state of Chihuahua, No. 36, Sept. 9, 1916:

Federal Government. Department of Fomento.

A seal which says: Department of State and of the Expedition of Development, Colonization and Industry, Mexico.

The First Chief of the Constitutionalist Army, in charge of the executive power, considering that our fundamental laws order that foreigners shall enjoy in Mexico the same rights as Mexicans, and that it is natural and legitimate that they shall be under the same obligations and that the liberality of our democratic institutions shall not be understood to reach and shall not reach to that extremity that foreigners who have become owners of property in our country shall stand in a better judicial condition than Mexicans, as deplorably has taken place, and which will happen if over and above being able to make use of their rights, actions and resources, which are granted by the Mexican laws, when their property and their legal relations are concerned, they can also make use of resources and formulate complaints to their respective governments, this same First Magistrate of the Republic, making use of the extraordinary faculties with which he has been invested, has thought it well to decree that the following resolutions of obligatory character be established throughout the whole of the republic:

First. Foreigners who acquire in the Mexican republic free (baldio) or government ground, mining property, water which is subject to federal jurisdiction or permits for the exploration and development of natural wealth, such as forestry products, petroleum, fisheries, etc., shall present themselves beforehand in writing to the Department of Foreign Relations, making a formal, express and decisive declaration that they, in their capacity of owners or concessionaires and in everything that affects or relates to the property which they wish to acquire, will consider themselves Mexicans, renouncing their rights as foreigners and that of applying to their respective governments, demanding protection or presenting complaints.

Foreign companies, which are incapacitated from acquiring rights in any properties referred to in this circular, as long as they are not naturalized, must submit themselves to the Mexican laws and make the foregoing declaration.

Second. It will be an indispensable requisite, before the Department of Fomento, Colonization and Industry can admit any preëmption (denouncement) or request made by a foreigner in the branches referred to in the foregoing resolution, though it be only an exploration permit, that there be presented with the first application a certificate, issued by the Department of Foreign Relations, in which the declaration is made referred to in the foregoing resolution. If this requisite is wanting, the application is to be thrown out and any acts, proceedings or resolutions which may have taken place before the certificate is presented shall be void and of no legal value. In the titles of ownership, as well as in the permits which relate to property before mentioned and which the Department of Fomento has to give to foreigners, and also in the contracts or public documents which relate to the same and have to be authorized by notaries public, the certificate described in the first resolution has to be literally inserted and, moreover, its contents shall be reproduced as a separate clause. Failure to insert the certificate or the said clause shall make void the respective title, agreement, contract or document.

Third. In all proceedings already started by foreigners, and which are under procedure in the Department of Fomento or in its administrative agencies, relating to any property referred to in these resolutions, the proceedings shall be stopped right away and shall not be continued until the interested parties have presented the certificate before mentioned. If within four months, counted from the date of the present resolutions, the certificate has not been presented by the interested party, his request shall be considered withdrawn and the respective proceedings shall be ordered filed in the archives, without recourse on the part of the interested party against this resolution.

The present resolutions will have an obligatory character throughout the whole of the republic and will be published in the official paper, so that they may be known and be strictly complied with, and they shall go into force on the day on which they are issued.

Constitution and Reforms. Mexico, Aug. 15, 1916. The Subsecretary in charge of the office of the Department of Fomento, Colonization and Industry. Pastor Rouaix.

Editorials

The Great Sale of Copper

The great sale of copper to the allied governments that has been talked about for several weeks back was consummated on Sept. 23, or rather, was reported then. The quantity contracted was 200,000 long tons—448,000,000 lb.—a quantity beyond all precedent for a single transaction. This is about 20% of the world's production in a year just previous to the war. It is about one-sixth of what the American capacity for the production of refined copper is expected to be in the early part of 1917. The contract is for delivery running through the first half of 1917. It may be said, therefore, that about one-third of the *expected* output of American refiners for the first half of 1917 has been preëmpted by this one purchase.

It was natural that this spectacular transaction should be the main theme of gossip, surmise and forecast in the daily papers and in Wall Street. American consumers of copper were represented as being confronted by a famine of their raw material. Judging from that sort of talk, it was to be inferred that a new buyer had suddenly grabbed one-third of the prospective supply out of a market that is already being seriously taxed by the needs of current consumption. This is not so—not at all so.

The allied governments made large purchases of copper in the early part of 1916, contracting for deliveries up to the end of the year. It is the filling of those deliveries that creates to a large extent the strength of the copper market now. The war continuing—and there is no reason to forecast its early termination—it was to be supposed that the Allies would require as much copper as they are taking now. So far as the statistical position of the industry is concerned, there is no difference whether they buy it all in one transaction or buy about 33,000 tons per month later. Either way there is just as much copper left for other consumers; probably there will be as large a free surplus as there has been during the latter part of 1916, especially taking into consideration the increasing refinery capacity.

Moreover, the American consumers do not approach 1917 as a preëmpted market. They have, themselves, during the last fortnight been buying very heavily for the first half of the coming year, no doubt in anticipation of the great sale that has just been consummated, for if it had not been consummated on Sept. 23, it would have had to be done later. Producers supplied them with copper at about the same price as was realized in the big sale. It was natural, therefore, that the copper market should have become rather dull after the culmination of what all had been looking for. We shall see prolonged dull periods between now and the delivery of the last of the copper that has lately been sold.

It is to be remarked, furthermore, that all the copper just bought by the Allies is not necessarily going into war material. Rather does it represent the total requirements of Great Britain and part of that of her allies. For Great Britain has now so organized her industrial affairs that the Munitions Ministry supplies everybody, including the manufacturer who is making cartridges for the front and the manufacturer who is making electrical machinery for some industrial purpose. The running of things in Great Britain is no longer at sixes and sevens. On the other hand, a good deal of the copper that has lately been sold to Connecticut brassmakers is going into munitions.

What the big sale of copper has really done is to insure to certain producers, especially the Anaconda and those for which it sells, similarly as to Phelps, Dodge & Co. and to the producers selling through the American Smelting and Refining Co., the disposition of a large part of their production in 1917 at a very high price. In this respect Anaconda probably fares best as a single producer. The smaller producers, who do not participate directly in the big sale, will nevertheless do so indirectly, for they will have command of the general market in which the withdrawal of the large quantity of copper already contracted will be a backlog. The copper producers are now guaranteed an extraordinary price for their copper and phenomenal profits in 1916. They are guaranteed the same for a considerable part of 1917. They are entitled to a feeling of satisfaction.

*

The Attempted Tyranny of Labor Unions

The consequences of the recent surrender of Congress to the railway unions became quickly apparent. In New York there had previously been a strike of traction employees, which had been settled by mutual agreement. After the passage by Congress of the eight-hour law, so called, the leaders of certain unions decided that they would call a new strike in order to demonstrate their authority. The strike was called, but out of something like 13,000 employees only about 3,000 went out. This interfered more or less with the operation of the surface lines, but as to the subway and the elevated railways—the principal arteries of north and south traffic—the traveler would have been unaware that anything had happened, save for the presence of a brace of policemen on each train and occasionally a new trainman not yet provided with a uniform. In the course of a few days the companies were able to put more and more surface cars in operation. The strike had then proved a fiasco.

Appreciating that, the labor leaders resorted to their usual tactics, the first step being to excite disorders, but those were promptly and ruthlessly suppressed by the police. New York fortunately has a mayor with backbone. He informed the labor leaders that his duty was to maintain order in the city, and that if the police were unable to cope with the situation, he would have the state's military on the ground. The next move of the labor leaders was to call a sympathetic strike of all trades unions in New York, on the ground that it is beneath the dignity of union labor to ride to its work on street cars operated by nonunion men. (Incidentally, it may be remarked that most of the men are union men, and their local union has been recognized by the company, the present trouble being wholly over unwillingness to permit the interference of outside unions.) The last purpose of the labor leaders was simply to throw terror among the populace, by threatening to deprive it of means of livelihood, subsistence, etc. The millions of people in the great city were to be deprived of their right to work, to have light, heat and food, and to enjoy the guaranteed privileges of citizenship simply because the traction companies stood by their 10,000 employees who are satisfied with their employment and refused to break their contract and abandon their own union in order to join the organization ordering the strike. In some ways this situation was similar to what prevailed nationally just previous to Sept. 4, especially in the threats of arrogant labor leaders to subject the mass of the people to great hardship if a handful of citizens could not have their own way. This is the new tyranny of the labor leaders, which was sanctioned by a cowardly Congress. Democratic government was then surrendered by the representatives of the people; fortunately not by the people themselves.

At the present writing it looks as if the general sympathetic strike in New York would also prove a fizzle, and if so, that will be the end of the local traction strike. Reflection upon the recent events in New York produces the poignant regret that Washington did not have the American spunk to fight the thing out with the conductors and engine drivers then and there. If the railway labor leaders had been left to carry out their threats, and if they had done so, probably only a portion of the men would have gone out and probably the principal train service would have been continued just as has been the experience in New York. In New York, fortunately, there is a local government with backbone and nerve, and the fight is being fought. New York may be the new Lexington that is going to inspire the American people to free themselves from its new tyrants

The Copper Stocks

A bull market was well under way, with the leadership of United States Steel, without there being any pronounced stirring of the copper stocks from their prolonged apathy; that is, there were movements here and there, but the bell-wether—Anaconda—scarcely budged. The few stocks that had previously moved upward—like Utah and Inspiration—had good reasons for doing so in the increase of their intrinsic values, or rather the public recognition of it. Thus people, even the well-informed, were slow in appreciating that Dr. Ricketts by conferring upon Inspiration the acme of efficiency in mining, milling and metallurgical methods, endowed it with many millions of previously unsuspected value; but as that was gradually realized, Inspiration advanced in the market. There has similarly been a growing appreciation of Utah's enormous earning capacity and long life and the latent possibility of greatly increased earnings by the introduction of better milling methods. For among the big producers, while Anaconda's and Inspiration's extractions of copper are the most nearly perfect, Utah's is the most imperfect. It is naturally only a matter of a short time before Utah—and also Chino and Ray, which are in about the same position—will wake up to this and get a great deal more copper out of their ore without increasing their cost, just as Anaconda did. Indeed, the awaking is already taking place.

But while these stocks and a few others had appreciated in the market for the reasons mentioned, Anaconda lagged at a lower price than prevailed for it in the early part of 1916 and indeed at a lower price than before the war, although since then the company had remarkably improved its methods of mining, milling and smelting with great increase in its value, had gone more extensively into the general smelting business, which had become very successful, had realized dividends on its large investment in Inspiration, had acquired a promising new porphyry mine of large proportions in Chile, and had gone effectively into the zinc business, utilizing its own important zinc resources, out of which a large profit is already insured. Besides all these, Anaconda had profited largely from the rise in silver as well as in copper and had accumulated a surplus of many millions in its treasury.

Yet the market disregarded all these things, and the stock was sluggish until about 10 days ago. Then with a bull market already in swing, the impending big sale of copper appealed to public imagination and things started in the copper stocks. On Sept. 25 Anaconda sold at 102 and Utah at 99¾, but the full advance was short-lived. A sharp reaction occurred the same day. It was apparently considered that the rises had been too fast, and indeed 10 or 12 points in a week or so was "going some." Nevertheless, it may be regarded that the standard coppers were not even then selling at unduly high levels or out of tune with their real values.

How is the value of the standard coppers to be figured at present? We have forgotten about our old yardsticks of a 15c. average price for copper and liquidating value during known life of mine. Yet we can get our thoughts back to them if we clear our minds. In the first place dismiss all ideas about the 30% earnings on 25c. copper, etc., as promulgated by the Wall Street papers, investors' guides, brokers' dope sheets, etc., and estimate value in the old way. Go back, if you please, to the normal rate of production before the war. Then add the real surplus per share that has been accumulated. Another method would be to figure on the basis of the dividend, whereof the maintenance through thick and thin may reasonably be expected, considering that the accumulated surplus will be a balance wheel to maintain the dividend. Most difficult of computation are those companies that are paying out a very large part of their present great earnings as immediate dividends.

The policy of the copper companies has varied a good deal in this respect. Miami, for example, has increased its dividends proportionately more than any other. Before the war it paid 50c. quarterly. Lately it has been paying $1.50, and there is gossip of a further increase at the next directors' meeting. Although this company is earning more than it is paying out, the policy of the management is evidently to distribute liberally and immediately to the stockholders.

The Hayden-Jackling companies, on the other hand, advanced their dividends to rates that they expect to be able to maintain as a regular thing and then adopted the policy of declaring extras. Probably they could not resist the demands of their stockholders, but in granting them we imagine, nevertheless, that the Utah directors anticipate their ability to maintain their regular $6 per annum as far ahead as anybody can think and intend to keep such a reserve fund as will insure their doing it.

As for Anaconda, it had already demonstrated, before the war, its ability to pay $6 per annum year in and year out. It did not earn it every year, but in some years it earned a good deal more than was necessary and preserved a surplus to supply the deficiencies of the lean years. Anaconda is apparently going to adhere to its old policy, but if it could pay $6 before the war, certainly the change in its conditions should enable it to do something better now and keep it up indefinitely. In fact, the Anaconda directors raised to an $8 rate last quarter and have just declared at the same rate for this quarter, wherefore we may assume that it is what they have in mind to maintain as a regular thing. The question is then, "What is the value of Anaconda as an 8% industrial stock?"

Nobody can but admire the conservatism with which the affairs of most of the standard copper companies are being administered during this period of intoxication. As for their relations to the public, there is no group of companies that tell so fully, so frankly and so frequently about what they are doing. The interest in them is so great, indeed, that the limelight is thrown on them all the time. About the only thing that gives anybody concern is what may be the price of copper after the war. Let us assume the worst. Let us assume that the production may be so stimulated that competition in a waning market may put the price down to 12c. or even 10c. per lb. pending readjustment of conditions. The accumulation of cash now taking place ought to take care of that. In other words, after two years of 25c. copper we might have four years of 10c. copper and still have an average of 15c. for the six years. However, nobody is thinking of 10c. copper, anyhow.

BY THE WAY

A writer in a contemporary considers mining "the most human of all industries"; that is, in its earlier stages. He laments that the extensions of mining in recent times are making it a matter of engineering and machinery and depriving it of the human interest. His ideal is the placer miner with his rocker and "long tom" in some California or Georgia gulch, and his special abomination such exploitations as the Alaska Treadwell, the Utah Copper or a big Mesabi iron mine.

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We do not often publish anonymous letters, but the following, which came from London, must have amused the British censor, who opened and read it, as it did us and as it will our contributor to whom it is addressed.

To the MAN FROM MEXICO

1st September, 1916

After reading your article on "The Mexican Situation" most carefully I have come to the conclusion that you know nothing about the subject you treat, further that you are a DAMNED FOOL! and like all other Americans I have had the misfortune to meet, you are a confoundedly unscrupulous LIAR! A swanky-Pott!! and a WRETCHED LOWN DOWN CONCEITED BLACKGUARD!!!!

A-MEXICAN-
who knows.

Viva Mexico!! y MUERAN LOS GRINGOS!!!

What is a "swanky-Pott?"

St. John Del Rey

The St. John Del Rey Mining Co. for the year ended Feb. 29, 1916, reports a production of 215,000 tons, yielding about $10.50 per ton in gold from its Morro Velho mine, Morro Velho, Brazil. The total cost of mining, milling and development, State and Federal Government duties and general expenses in London amount to about $7.21 per ton of ore. There was also transferred to capital account for improvements an amount equal to about $1.15 per ton. A summary of the work done during the year shows that 3,513 ft. of drifts was run, 291 ft. of shaft was sunk and that 5,600 cu.ft. of excavations was made. In addition to this, 5,010 ft. of airways was opened. Of all the ore hoisted, 2.12% was rejected as waste as compared with 1.81% in 1915 and 0.08% in 1914. Mill recovery averaged 93.52%. The following list taken from the Store Department's Report shows the rise in price of some of the most important stores purchased in England during the past year:

INCREASE IN COST OF SUPPLIES

	% Increase		Increase
Acid, muriatic	29	Magnolia metal	13
Borax	6¼	Percussion caps	11
Bolts and nuts	40	Phosphor-bronze ingots	10
Babbitt metal	7	Steel borer	12
Crucibles	10	Steel plates	51
Cement from England	133	Sacking	13
Carbonate of soda	8	Soft soap	44
Dynamite	8¾	Safety fuse	3
Filter cloth	36	Shovels, miners'	23
Hose for rock drill	8	Wire, G. P. for mine	8½
Iron bars	21	Wire gauze	20

After the prohibition of zinc as an export from England it became necessary for the company to obtain any zinc it could in Brazil and 12.5 tons of sheet zinc was purchased at a price 111% over that paid for the last consignment from England. Steel plates purchased in Rio were 164% above the price for which they could have been imported from England. Iron bars showed an increase of 119% and explosives, taking into consideration the decreased nitroglycerin content, advanced 35%.

Owing to a loss in transmission from generating stations to the axles of the motors at the mine, which may be taken at 10% more or less, the effective horsepower delivered at the mine amounts to about 2,975. The approximate daily hydraulic power has been 520 hp., and that of steam and gas engines, which had to be made use of during the dry season, amounted to 75.5 hp. The entire running cost in each case of the horsepower delivered per 24 hr. is given as follows: Electrical power, 1.68c.; hydraulic power, 5.78c.; steam and gas power, 51.80c.

It is stated that the hydraulic power cost is increased owing to the fact that the water is brought to the mine from several small sources, as well as from one large one and by water courses of great length, and a considerable portion of the water brought in is used as milling water and for other purposes, which represents power but is not estimated as such.

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Gold-Mining Machinery May Be Imported in Russia Free of duty, according to an imperial decree dated May 13-26 1913, reported by the "Board of Trade Journal" of London. To assist the gold-mining industries of the Urals and Siberia gold mining apparatus is to be admitted free of duty for a period of 10 years. The decree covers gold dredges, complete as well as appurtenances such as electric motors, boilers, drilling apparatus and casing, also equipment for crushing gold ores and extracting the gold by chemical processes, such as cyanidation, etc. This decree should be of material assistance to the Lena Goldfields as this company has in contemplation an important installation of dredging equipment on its extensive property near Bodaibo, Siberia.

PERSONALS

H. Foster Bain is going to China in October.

M. L. Requa has returned from Alaska to San Francisco.

John F. Spedding, recently at Ely, Minn., is now at Nagpur in British India.

E. A. Austin is now at Jarbidge, Nev. He was lately at Iditarod, Alaska.

C. W. Purington is in New York. His headquarters are at the Harvard Club.

Edwin E. Chase and son, of Denver, have gone to southern Nevada on mining business.

Paul Wels has gone from Brooklyn, N. Y., to the Cerro de Pasco Mining Co., La Fundicion, Peru.

Harry B. Harling has returned to New York after a professional trip to several of the Western States.

J. L. Head, recently at Flat River, Mo., is now with the Calumet & Arizona Mining Co. at Warren, Ariz.

Edward L. Dufourcq has removed his offices as consulting mining engineer to No. 18 Broadway, New York.

F. W. Schumacher, president of the Schumacher Mining Co., of Porcupine, Ont., is making an inspection of the property.

Wilson W. Hughes, formerly at Guanajuato, Mexico, is now with the Monitor Belmont Mining Co. at Belmont, Nev., as superintendent.

Charles F. Williamson is now at Reno, Nev. He was formerly mining engineer for the Cananea Consolidated Copper Co. in Mexico.

Kirby Thomas, of New York, has been for some months investigating the iron ore resources of southwestern Virginia and east Tennessee.

L. L. Morrill will have charge of the New York office of Mason, Fenwick & Lawrence in the St. Paul Building. He was lately in their Washington office.

L. B. Wallace, formerly superintendent for the International Smelting Co. at Miami, Ariz., has gone to Chile to take charge of a smelting plant there.

F. G. Clapp and **C. T. Griswold** have recently been engaged in geological examinations in Texas on behalf of clients of the Associated Geological Engineers.

Edward J. Cornish has been elected president of the National Lead Co. in place of W. W. Lawrence, deceased. He has been vice-president for several years.

A. L. Conner has been promoted to general manager of the Gulf States Steel Co., succeeding C. A. Moffett, who has been advanced to vice-president of the company.

L. O. Howard, formerly superintendent of the Old Dominion smeltery and mill at Globe, Ariz., is now in charge of the International Smelting Co.'s works at Miami.

O. J. Fisk and **B. J. Goodwin** are conducting a series of chloridizing, roasting and leaching tests on the copper-platinum ore of the Boss mine, Goodsprings, Nev.

P. J. Freeman, professor in the department of applied mechanics of the University of Kansas, has resigned to become engineer of tests for the Pittsburgh Testing Laboratory.

C. W. Hays, formerly with Boyts, Porter & Co., Connellsville, Penn., is now associated with the Ross Mechanical Supply Co., Pittsburgh, in charge of the pump department.

George S. Patterson, formerly with the New Jersey Zinc Co., at Franklin Furnace, N. J., has assumed the superintendency of the Northern Ore Co.'s property at Edwards, St. Lawrence County, N. Y.

H. H. Colley has succeeded L. O. Howard as superintendent of the Old Dominion mill and smeltery at Globe, Ariz. Mr. Colley was formerly assistant smelter superintendent at the Copper Queen works at Douglas.

Archibald G. Smith, general superintendent of the open-hearth steel plant of the Youngstown Iron and Steel Co., Youngstown, Ohio, has resigned, and it is stated will go with the Trumbull Steel Co., Warren, Ohio.

W. E. Donaldson, for several years with the Carnegie Steel Co., has been appointed special agent for the United States Steel Corporation in charge of the slag department. This is a new department, having charge of the commercial use and distribution of slag.

Herbert C. Hoover, Chairman of the American Commission for Belgian Relief, narrowly escaped being struck by a bomb when on the Dutch steamship "Prins Hendrik" which was seized by German naval forces while bound from Flushing for London. It is said that the steamship was attacked by an allied aëroplane, which dropped a bomb wounding a passenger who was standing beside Mr. Hoover.

Robert E. Cranston has been appointed consulting engineer to the Mining Associates, Ltd., operating the Rawley mine, near Salida, Colo. He is developing and equipping the property for production, and expects to make periodic trips to the property during the course of this work.

C. J. Barr, superintendent of the steel plant and furnace divisions of the Tennessee Coal, Iron and Railroad Co., at Ensley, Ala., has resigned to accept the management of the Algoma steel mills at Algoma, Ont. He is succeeded by **W. G. Mathias**, assistant general superintendent. **Karl Landgrabe**, superintendent of blast furnaces, succeeds Mr. Mathias and is in turn succeeded by **W. H. Oldham**.

H. R. Hanley, until recently general manager of the Bully Hill Copper Co., has been appointed superintendent of the new electrolytic plant that the U. S. Smelting Co. is going to erect near Kennett, Calif. Mr. Hanley was one of the most important factors in the development of the electrolytic process in the Bully Hill experimental plant, and much of the knowledge of details that makes this a workable process is due to him.

Hector F. Escardo, mining engineer of the Cerro de Pasco Mining Co., and **William Bull**, both Peruvians, were visitors in Butte recently. They are making a study of mining methods and water power development as it has been carried on by the Anaconda Copper Mining Co. and the Montana Power Co. in the Butte mines and Montana districts. They spent a couple of days making a study of the Washoe works at Anaconda where they were the guests of E. P. Mathewson, general manager of the plant. They also paid a visit to Great Falls to inspect the new copper and zinc refineries. While there they visited the plants of the Montana Power Co. at Big Falls and Rainbow.

OBITUARY

Anton Huth died recently at Spanaway, Wash., aged 63 years. He was president of the South Keystone Mining Co., Amador City, Calif. He was also interested in several other mines on the Mother Lode and in Washington.

Sir Sigmund Neumann for years a prominent figure in Transvaal gold mining, died at his residence at Bournemouth, England, Sept. 6, aged 59 years. Sir Sigmund was the sole partner in S. Neumann & Co., merchants, and partner in Neumann, Lubeck & Co., and was connected with a number of public companies. He was chairman of the Salisbury House Estate and a director of the African Banking Corporation, the East Rand Proprietary Mines, the London Joint Stock Bank, the Premier Diamond Mining Co. and the Rand Mines. In 1912 he was given the title of baronet, which will be inherited by his son Cecil.

SOCIETIES

American Chemical Society—The annual meeting begun in New York, Sept. 25 with a large attendance.

American Mining Congress—The nineteenth annual meeting will open at the Hotel La Salle, Chicago, Nov. 12. One of the chief subjects will be the Revision of the Mining Laws.

Mining and Metallurgical Society of America—At a meeting of the New York Section, held at the Engineers' Club, on Sept. 21, the following officers were elected: W. R. Ingalls, chairman; W. Y. Westervelt, vice-chairman; D. M. Liddell, secretary-treasurer.

Chicago Association of Commerce—Three cash prizes, $50, $30 and $20, are offered by the Engineers' Subdivision of the Chicago Association of Commerce for the three best papers, not to exceed 3,000 words, on any one of the following subjects: (1) "Engineering and Civic Progress." (2) "The Engineer of the Future." (3) "The Business Relation of the Engineer to the Commercial World." The contest is open to undergraduates and graduates of any recognized school of engineering in the United States during the years 1915 and 1916. The judges of the relative merits of the papers will be F. H. Newell, professor of civil engineering, University of Illinois; John W. Alvord, consulting engineer, Chicago, and John F. Hayford, director, College of Engineering, Northwestern University. All papers should be mailed to Engineers' Subdivision Contest, the Chicago Association of Commerce, 10 South La Salle St., Chicago, and must be received not later than Nov. 1 next.

Editorial Correspondence

JACKSON, CALIF.—Sept. 25

(By Telegraph)

Strikers Now Quiet. Three hundred paraded on Sunday. Three cases of assault by strikers; one man badly beaten; one house and one automobile stoned; three arrests made. All mines in good condition to stand long shutdown. Plenty of men ready to work if protection were assured.

SAN FRANCISCO—Sept. 19

Closing of Gold Mines in Amador County occurred Sept. 19 as a result of too much Union Federation of Miners. For several months there has been a quiet agitation carried on along the Mother Lode, supposedly by direction of the Union Federation. The operators of 11 gold mines, including all the producing mines in Amador County, knowing that this agitation was going on and anticipating that the demand for increased wages would be made, posted an announcement on Sept. 2 that if such demand were made, the mines would be closed. This announcement was published in the "Journal" of Sept. 9. The local branch of the federation at Jackson denied positively that there was any thought of a strike or demand for increased wages. The union seemed to be indignant at being charged with strike intentions after wages had been voluntarily increased by the mine owners some months ago. The operators were not inclined to believe the denial of the intended demand and kept a sharp lookout for developments. On Sept. 15, a notice was addressed to the mine operators and owners of Amador County by the secretary of the local union, inviting the operators and owners to discuss the matter of establishing a uniform wage scale for Amador County. The substantial contents of the notice follows: "The union will meet you individually or collectively, preferring the latter. If any operator or owner does not communicate with us respecting this matter before Monday, Sept. 18, 1916, it will be taken for granted that such operator or owner refuses to meet the union." Evidently the federation took the silence of the mine owners to mean that they would not recognize the union. In that surmise the union is no doubt entirely correct. It may also be assumed that if the announcement of Sept. 2 had not been posted, there would have been a concerted demand by members of the union for an increase of wages or for establishment of a uniform wage scale. It is not at all certain that the men, who are not members of the union, would have joined in the demand for increased wages and it is even probable that all of the members of the union are not in harmony with the leaders. In the town of Plymouth, a number of miners working at the Plymouth Consolidated have recently acquired new homes, a number of which have not yet been fully paid for. These men like other men of family in other camps in the county are desirous of maintaining their homes and continuing their employment. So there is a disposition on the part of a probable majority of the mine workers in Amador County to let well enough alone, particularly since they are aware that the increased cost of gold mining, without increase in the value of product, is sufficient cause for owners and operators to refuse any further demand for increased wages. This walkout, if continued, will not permanently injure the large owners, but it will cripple some of the smaller operators and will drive investors away from Amador County and for a long time have a depressing effect upon the gold-mining industry of the state, as well as upon Mother Lode activities.

Consulting and Safety Engineer is the title of a position created by the California Metal Producers Association to be effective on Nov. 1, 1916. Edwin Higgins, chief mine inspector for the Industrial Accident Commission, will occupy the position, resigning his present office on Oct. 31. The duties, so far as the association as a whole is concerned, will consist in consultation and advice as to the best methods of mine safety in conformity with the law of the state, suggestions and assistance in the selection of safety devices, and the keeping of records for the benefit of members, relating to the safety situation. But in addition to these duties Mr. Higgins has entered into a contract agreement with a number of the largest mines in California to make regular visits of inspection on the surface and underground, consult with the superintendents and managers and advise in particular regrading safety methods, devices and practice; in fact, to assist in placing these mines in the safest condition possible. The mines that have entered into this special contract, to date, are the following named on the Mother Lode in Amador County: Argonaut, Kennedy, South Eureka, Bunker Hill, Fremont, Plymouth Consolidated, and the Empire in Nevada County. Other mines have already tentatively agreed to the undertaking and before the date of this publication will no doubt have entered into the contract. The successful carrying out of the plan will without doubt add largely to the number; some of the managers already agreeing upon the practicability and the terms of the plan, await the confirmation of the directorate of their companies. The mine owners and operators have no desire to take mine inspection out of the hands of state officials, nor to make a law unto themselves; but wish solely to make their properties so safe to workmen and so thoroughly in accord with the laws governing mine safety that the duties of official inspectors will be less arduous and less costly, to aid the state in the effort to insure the safety of miners and the protection of mine property. It is not improbable that every important producing mine within the membership of the Metal Producers Association will become a party to this special agreement to secure first-hand service of an expert safety engineer. The ultimate result of the success of the plan should be the placing of the mines in California in a position far in advance of the present and provide for a reduced rate of mine insurance. Mr. Higgins has had 12 years' experience in this character of work in connection with the U. S. Bureau of Mines and as practical mine superintendent. He is a graduate of Lehigh University, with the class of 1902. He was for two years assistant editor of the "Journal" and in that experience visited some of the most important mining states and gathered a broad knowledge of mine conditions and studied a large field of "details of practical mining."

BUTTE—Sept. 21

U. S. Bureau of Mines Rescue Car will soon be coming to Butte. The federal government has selected Butte as the headquarters for one of the three new mine-rescue cars and it is understood that the cars will be ready by the end of the year. Each car will carry a crew of six men and will cost $20,000. Butte's car will be stationed near the School of Mines in the western part of the city. R. A. Hill, of the U. S. Bureau of Mines is expected in Butte within 10 days to organize the Butte miners into teams for training in this work.

Montana's Accident Board has just issued its first report for the 12 months ended June 30, 1916. The financial statements as well as the general effect of the workingmen's compensation law upon Montana's industries, as presented in the report, prove the law to be a good one and the administration of it during the first year highly commendable. In compensation, medical and hospital fees the board paid out during the year the sum of $293,399. This was distributed to 6,802 injured employees and to beneficiaries and dependents. Pending cases under all plans at the end of the year aggregated about $95,000, making a total liability for the year of about $1,100 a day. Of the total number of accidents 136 were fatal for which compensation amounting to $169,111 was awarded. The other cases were permanent-total, permanent-partial and temporary disability. The real truth and cause back of these gratifying figures rest in the fact that because of the stimulus of the law all of the employers and employees of the state are now engaged in a most active rivalry to surpass in the 'safety first' propaganda, with the result that both fatal and minor accidents are becoming of less frequent occurrence in all industries. While the law is elective, it has been accepted by 96% of the employers and 98% of the employees in the state. During the year there has in no instance been an appeal from the ruling of the board, showing that the law itself and its administration have been satisfactory to both employers and employees.

DENVER—Sept. 19

Sale of Mount Champion Mine, which is above timber line on Mount Champion in the Saguache Range, southwest of Leadville, has been announced in most of the Colorado mining papers. This mine has been making a splendid record despite its handicap as to situation and it is unquestionably in fine condition to continue its production of high-grade gold ore, but the "Journal's" correspondent is informed, on the best of authority, that the deal for the transfer of the property has not actually been consummated although all interested parties are now in New York conducting negotiations.

Tungsten Prices in the Boulder Field remain around $18 to $23 per unit for 60% concentrate, and $15 to $20 per unit for 60% ore. This difference is due to the fact that concentration removes objectionable elements in the crude ore. For 25% ore, the price per unit varies from $9.40 to $10, while for 10% ore, the price is $7.80 to $9 per unit. In the northern portion of the field, the National Tungsten Mines Co. has finished the erection of its mill building in Spring Gulch and the machinery will be installed soon.

SALT LAKE CITY—Sept. 22

The Haulage Question in Big Cottonwood is presenting further difficulties; and the mining companies, which—since the failure of the transportation company organized to use tractors and trailers—have been using horse-drawn vehicles, are threatened with legal action on the part of the city. As before stated in these columns, the cause of the controversy is the matter of city water coming from the cañon. In the spring the road was improved and widened by joint contribution from the city and county, and the mining companies, with a view to the elimination of teams. The mining companies are offering to give more money for road work, in the same proportion as before. The companies chiefly concerned are the Cardiff and the Boston Development, the latter operating the Maxfield mine. The Cardiff—recently developed into an important producer—is at present shipping about 120 tons daily, bringing its ores to market by the use of teams, and motor trucks. Hauling in the Cottonwoods is at all times hampered by the steepness of the grades and the shortness of the shipping season.

Ohio Stockholders' Protective Committees, in Salt Lake City, New York and Boston are taking action and have made public announcements asking for the deposition of stock by its holders. A New York committee, consisting of C. E. Graham, Frederick W. Frost, W. J. Brown, A. W. Middleton, E. C. Devereux and C. H. Stanton, asks that the stock, duly endorsed for transfer be deposited at the earliest possible date with the Central Trust Co. of New York, 54 Wall St., New York, and will provide certificates of deposit for all stock issued. Another New York committee, sponsored by the North American Liquidating Co., consists of Charles A. Kittle, George E. Macomber, Frank B. Cook, Edwin S. Hooley and H. E. Rogers; its depository is the New York Trust Co. The Salt Lake committee, made up of George Baglin, W. M. Havenor and J. R. Whitney, has made a similar announcement to Utah stockholders, naming the Columbia Trust Co., of Salt Lake City, as the depository. The committee announces the belief that a feasible plan can be worked out for the reorganization of the company, in such a manner as to save the property to the stockholders, if sufficient stock will join in such a movement. It is estimated that there are between 75,000 and 100,000 shares of Ohio Copper stock owned in Utah.

MIDAS, NEV.—Sept. 20

Gold Circle District, reached from Midas, continues to be active. Last year, the Dorr company built on the Elko Prince property a mill of 50 ton capacity. The mill began operating in the autumn and has been running steadily ever since on ore that was supposed to go about $48 per ton; down to the 700 level there was estimated to be $1,250,000 in sight. Work since then has indicated that the value of the Elko Prince was under-estimated as the vein proved wider and richer as depth was attained. The Elko Prince company last year gave a lease on its June Bell claim to Paul Ehlers who has opened a parallel vein about 400 ft. from the Prince vein. Ehlers has taken out about $20,000 worth of ore from his lease. The Prince company decided to crosscut to the June Bell from its main working tunnel and found the vein which gives every appearance of being the equal of the original vein. Unfortunately for the camp, the Prince gives out no facts or data about the work but it sends out monthly from 8 to 9 bars of bullion that weighs about 1,200 lb. Next to the Prince is the Judge property under lease to Hayes & Raymond. Their last crushing was 28 tons which went $120 per ton. It is now a company under the name of the Old Judge Leasing Co. which has decided to purchase an electric hoist and sink 200 ft. from the level of its adit. About a mile south is the Rex mine and mill. At present the 5-stamp mill is leased to the lessees of the Queen mine who haul their ore there for $3.50 per ton. The Rex mine was operated intermittently for six or seven years and produced about $400,000 to the 200-ft. level. The workings are in bad shape but last year Howell and Liddell had the Rex and the Colorado Grandee No. 3 under lease and they did well. They took about 4,000 tons from the Grandee that went from $6 to $12 per ton; the vein is from 8 to 10 ft. wide but has not been opened below 185 ft. Last winter Martin Brown and Jacob Jacobson took a lease on the old Queen property in the southern part of camp and they have opened a large body of low-grade ore some of which goes from $16 to $20 per ton. William Ray leasing on the Missing Link is sending a crushing to the Prince mill for treatment; it is about 25 tons, estimated to go $60 per ton. He sent a 21-ton shipment to the Murray smeltery this spring that went $113 per ton. Up the cañon about 2 mi., Charles Randall made a good strike this spring, the ore running high in silver; in fact, the silver predominates. He is down about 40 ft. and has just sent 12 tons of high-grade ore to Red House, 28 mi. away, for shipment to the smeltery.

JOPLIN—Sept. 23

Organization of Mine Operators of the Joplin district is scheduled finally for Sept. 25 when a meeting will be held in Webb City, Mo. The new organization is to be strictly an ore-producers association, no one being eligible who is in any way affiliated with the smelting interests. Every member must be a "bona fide" ore producer whose interests in that industry are paramount to any other interest engaged in, it being the desire of the association to prevent the possibility of divided interests, breaking into the activities of the organization, a feature that has always been a disturbing factor in past efforts of organizations in the Joplin field.

Lower Prices for Powder was the unofficial prediction of an official of one of the big powder companies in an informal address before a meeting of mine operators here. This ray of sunshine was brought by N. P. Rood, of the Hercules Powder Co., who said that there had been one reduction of $2 per hundred in the price of powder since May, and that another reduction would probably take place before the first of the year. Any reduction of powder cost will be a welcome feature to the sheet-ground districts where there has been a large decrease in production because of the inability of the mine operators to hold the cost of production down to a point below the price received for their product. While ore prices have returned to somewhere near before-the-war quotations, powder is still selling at greatly advanced prices, seriously handicapping many of the sheet-ground mines.

Surplus of Zinc Ore is estimated at 17,000 tons for this district by Richard Jenkins, secretary of the Southwest Missouri Mine Safety and Sanitation Association, after a careful survey in which he was assisted by special representatives in virtually all the camps. This is a reduction of about 6,000 tons in the past six weeks, but it has come about almost entirely during the last two weeks, when purchases have been much heavier than production. Previous to this, production while much curtailed has been steadily greater than the amount of ore purchased each week. Those mines closed because ore faces were too thin to work at a profit with $65 ore, and the mines down on account of lack of water for wet concentration, have remained closed. In addition, during the last week there has been added curtailment through inability to get electric power for anything besides pumping. The new turbine at the Riverton, Kan., plant of the local electric company is being put in operation and until it gets completely in going condition there will be a shortage of current.

DULUTH, MINN.—Sept. 23

Mesabi Range's Greatest Tonnage is being attained this year, in spite of a strike which closed many of the underground mines for a few weeks. Only one or two mines on the entire range are now closed and they will not be operated during the winter. The Mesabi is sending out more ore than at any time in its history. Every ton is being moved that the railroads and boats can handle. Much more could be mined if the transportation facilities permitted. There is a general belief among the mining men that there will be an increase in iron-ore prices for 1917 and the underground mines will undoubtedly endeaver to get out all of the ore that they can during the winter months for shipment next year. They have felt right along that the 1916 prices were not high enough and some have refused to dispose of their higher grades, preferring to hold them for higher prices. This is not only true on the Mesabi but on some of the Michigan ranges as well. The possibility of higher prices will be a big stimulus to the mining business and the entire Lake Superior district should have one of the basiest winters in years.

TORONTO—Sept. 23

Prospecting Expedition into Greenland is being arranged by a party of experienced prospectors of Northern Ontario, including A. H. Reamsbottom, of South Porcupine and the McDonough brothers, pioneers of the Boston Creek field. An old Yukon prospector who died last year claimed to have discovered rich placer deposits in Greenland six years ago and left samples of the gold and charts showing the route and location, which will be used by the party who propose to reach Greenland by taking their own boat from Labrador.

The Mining News

ALASKA

ALASKA MINES CORPORATION (Nome)—Formed to acquire 1,860 acres of placer ground and dredges of Nome Consolidated, not especially profitable under former management. New capital and additional ground and dredges to be provided by present organization. New officers and directors are: James C Gayley, president. Theron I. Crane and Henry B. Livingston, vice-presidents: W. S. Reed, secretary and treasurer; August Heckscher, Mahlon W. Newton, Louis H. Eisenlohr and E. E. Powell. F. H. Minard, 111 Broadway, New York, is to be consulting engineer.

ARIZONA

Gila County

A. J. BOVARD AND B. F. REYNOLDS, of Rawhide, Nev., report rich gold strike 10 mi. north of Globe; 20-in. streak runs $100 a ton.

GREATER MIAMI COPPER (Miami)—Development being pushed; contemplate erecting 50-ton mill.

INTERNATIONAL SMELTING (Miami)—Producing about 16,000,000 lb. copper monthly; L. O. Howard is now in charge.

SUPERIOR & BOSTON (Copper Hill)—Stoping in oxidized zone from 800-ft. level upward. Sinking McGaw shaft to 1,400 level.

ARIZONA COMMERCIAL (Globe)—Posted initial dividend of 50c. for Oct. 31. Production at rate of 4,500,000 lb. per year and is increasing.

MEXICAN (Globe)—Shields, Medlin & Munday leasing on this old silver property, 6 mi. east of Globe, report opening high-grade streak of silver ore.

OLD DOMINION (Globe)—Making plans for installation of reverberatory and roasting plants; H. H. Colley, now in charge of smeltery and mill.

INSPIRATION (Miami)—Hoisted in August 490,000 tons of ore, from which approximately 11,000,000 lb. of copper was recovered. Live Oak tunnel leading to churn-drill area going slowly, account heavy ground.

Mohave County

U. S. GEOLOGICAL SURVEY has sent L. F. Biggs into Oatman district to begin preliminary work for geologic map of district.

TOM REED (Oatman)—Shaft on Red Cloud claim, wholly surrounded by the United Eastern, is down about 520 ft. Orebody recently struck in Aztec claim crosscut for 18 ft. and reported to average $14.67.

Pima County

BLUEBIRD AND JUMBO GROUPS in Ajo district sold to Oklahoma men through W. B. Batson of Tucson; development by churn drills planned.

Yavapai County

MONTEZUMA (Crown King)—Being financed by Colorado Springs investors; flotation plant to recover zinc, lead, gold and silver being planned; camp buildings being erected; J. P. Waldron in charge.

BEE HIVE GOLD (Congress Junction)—New organization formed by Charles Zeiger, of El Paso, to develop and operate group of nine patented gold claims, 12 mi. east of Congress Junction; developed by 3,000 ft. tunnels, drifts and raises; equipment, houses for 50 people, boarding house, commissary, shops and offices, compressor, Jackhamers and hoisting engine.

CALIFORNIA

Amador County

ARGONAUT (Jackson)—Expected that new milling installation will be in operation by 1917.

CENTRAL EUREKA (Sutter Creek)—Shaft repaired and sump cleaned out preparatory to sinking below 3,200 level. New drilling machinery to be installed.

CONSOLIDATED AMADOR (Sutter Creek)—Water lowered and shaft repaired to 650-ft. point. Grading for new steel headframe and hoist nearly completed. The 56-in. circular saw installed.

PLYMOUTH CONSOLIDATED (Plymouth)—Supt. James F. Parks reports for August: Milled 10,600 tons, total value, $57,585. Working expense $25,280; development, $9,838; surplus, $22,467. Other capital expended $7,319.

Calaveras County

ECLIPSE (Mokelumne Hill)—W. H. Morrison and J. Miller, of Stockton have begun work on this old gravel mine in Chili gulch, owned by A. H. McCarty. Machinery for washing gravel and saving black sand will be installed. Gold is coarse, with some $2 to $10 nuggets.

Eldorado County

ROCKY BAR (Fairplay)—Reported sold to Omer Denny and L. P. Denny. Property equipped with gravel-mining machinery.

PYRAMID (Placerville)—Old 500-ft shaft retimbered; will be deepened 200 ft. before starting levels. Property well equipped. Charles Evans, superintendent.

BADGER HILL (Placerville)—This deep gravel mine in Camino district being reopened after idleness of 22 years, by Bryant Koch and Wood. Tunnel has been cleaned 200 ft.; new 600-ft. tunnel will be driven.

Mariposa County

PENN (Campo Seco)—Suits by 33 farmers for alleged injury to crops by the smeltery were dismissed on Sept. 1[illegible]

Modoc County

HESS (Alturas)—Stamps again dropping on free-milling ore from 20-ft. vein. Depth of mine less than 200 ft. Irving Clint, superintendent.

Nevada County

UNION HILL (Grass Valley)—High-grade scheelite encountered, only property in district in which tungsten has been developed.

EMPIRE (Grass Valley)—Recent completion of new 60-stamp mill it is stated will be followed by combination of present two concentration plants into one, and dismantling of Pennsylvania mill and cyanide plant. New construction to include about 1-mi. of electric road.

Placer County

GLENN (Auburn)—Main gravel channel encountered after two years of prospecting. About 20 years ago an upper channel produced $10,000. F. A. Moss and associates are owners.

GOLDEN STREAK GOLD MINING CO. (Colfax)—Incorporated to operate property in Iowa Hill district, directors are Henry Lobner, F. H. Schulze, F. D. Kuenzley, P. W. C[illegible] and Walter Schulze, of Colfax.

San Bernardino County

CALIFORNIA TRONA (Trona)—Claims of H. E. L[illegible] against this company's Searles Lake locations dismissed by Judge H. T. Dewhirst on Sept. 14.

Shasta County

GOLD LEAF (Redding)—Property near Middle Creek has resumed production. Ore hauled by team to Redding and shipped to Kennett.

MAMMOTH COPPER (Kennett)—Site for new $350,000 electrolytic-zinc plant is being prepared on Big Back Bone Creek, about one-half mile above the copper smeltery. Expected plant to be in operation in six months. Plant will operate on zinc byproduct from the copper baghouse. Herbert Hanley will be superintendent.

COLORADO

Boulder County

LOGAN (Crisman)—A 25-ton flotation plant will be built.

BLACK CLOUD (Salina)—Mill purchased recently by Denver men and will be remodeled into flotation plant.

PRIMOS (Lakewood)—Hoisting engineer killed recently by explosion of 10 sticks dynamite while adjusting primers.

Lake County

VALLEY (Leadville)—Large body of oxidized-iron ore, containing considerable silver and manganese, opened on 150-ft. level below adit on Prospect Mountain. Discovery considered important as ore is similar to that found in first contact on Fryer, Carbonate and Breece hills.

Saguache County

RALEIGH (Bonanza)—Mine has large body of complex sulphide ore. Three-compartment raise being driven from 1,200- to 600-ft. level. Tramway will be built from portal of haulage tunnel, where mill will be built, to Shirley station on Denver & Rio Grande R.R., to handle concentrate. Lower tunnel is 6,000 ft. in length.

San Juan County

SHIPMENTS FROM SILVERTON of ore and concentrates during August: Davey Leasing Co., 61 cars; Sunnyside, 35; Gold King, 32; S. D. & G. Leasing Co. and Silver Lake, 25 cars each; Iowa-Tiger, 18; St. Paul, 10, Mears-Wilfley and Barstow, 8 cars each, Whale Lease, 6; Highland Mary, 5; Silver Ledge, Genesee, and Kopei Leasing Co., 3 each; Dives Congress, Morgan, and Andrene & Jackson, 2 each; Joker Tunnel, Reno Leasing Co., Hudson, Carbonate King, Pride of the West, Big Giant and Intersection, one car each, total 257 cars. Cars averaged about 22 tons each, or a total of about 5,654 tons.

QUEEN CITY (Silverton)—Rich lead-silver ore opened in this Ohio Creek property.

SILVER LEDGE (Chattanooga)—Mill running steadily. Concentrates shipped to Durango smelting plant.

PRIDE OF THE WEST (Silverton)—Bertoldi & Giono sold their lease and bond to New York men. A. W. Harrison now in charge.

SILVER LAKE MILL (Silverton)—During August treated 1,628 tons of custom ore from following properties: Little Dora, 26 cars, Congress, 15 Green Mountain, 10, S. D. & G. Leasing Co., 7, Genesee, 4; Champion and Atlantic, 3 each; Detroit & Colorado and St. Paul, 2 each, and Barstow, one car; total 74 cars.

San Miguel County

SHIPMENTS FROM TELLURIDE during August [illegible] Tomboy, 45 cars. Smuggler-Union and Black Bear, 32 [illegible] Durango and 20 cars to Blende. Liberty Bell, 19 ca[illegible] Columbia, 2; Anderson, 1; total 129 cars, mostly concentrate.

FOURTH OF JULY (Sawpit)—Being developed by [illegible] men; payable ore opened.

BLACK BEAR (Pandora)—Mine buildings being improved preparatory to winter operations. Shaft will be enlarged and skip will replace bucket now in use.

MELDRUM UNITED TUNNELS CO. (Telluride)—Stockholders' meeting elected W. E. Wheeler, president, and decided upon active development in near future.

MOODY (Vanadium)—Payable silver-lead ore opened in this property about 5 mi. from Vanadium. Oreshoot cut by 6-ft. winze near breast of 550-ft. development drift.

OPHIR GOLD MINES AND REDUCTION CO. (Ophir)—New incorporation to develop Belisle and Sankey gold and molybdenum properties near Ophir. Directors are C. M. Goddard, of Denver; J. M. Belisle and N. Sankey, of Norwood.

WAGNER DEVELOPMENT (Telluride)—Company purchased milling and tramway equipment of Junta Consolidated in Bear Creek, and will remove to Alta property it is operating in Gold King Basin.

Summit County

AUGUST GOLD PRODUCTION of Breckenridge estimated to be $80,000. Four dredges now working. These, with Dunkin mine, are largest producers of gold in district.

TOMSON (Robinson)—Strike of ruby silver near Columbia lease.

KIMBERLY (Robinson)—Concentrating mill to be put in commission soon.

MICHIGAN (Robinson)—Car crude ore being shipped daily in addition to ore sent to mill.

ALSATIAN (Breckenridge)—This silver mine at head of McCullough Gulch being reopened.

JESSIE (Breckenridge)—Development work under way; 16 men working. Small shoots gold-zinc ore opened.

ONEER CONSOLIDATED (Breckenridge)—Purchased 160 acres on Gibson Hill, including Little Corporal group, Cleveland lode and Ophir placer. Some of the dumps will be treated in Extension mill, now being overhauled.

WELLINGTON (Breckenridge)—In August shipped 95 cars ore and concentrates. One car crude zinc ore per day shipped; ore assays nearly 50% zinc and comes from fifth or deepest level. New adition to dry mill nearly completed; this will add materially to production of concentrate. Sallie Barber mine unwatered, and mining under way.

Teller County

LITTLE DAISY (Cripple Creek)—Operations to be resumed on this Bull Hill property.

MODOC MINING AND MILLING CO. (Cripple Creek)—Three cars ore being shipped weekly.

IDAHO

Idaho County

INTERNATIONAL (Orogrande)—Development in progress by Spokane men. Mill may be installed. Frank Sockolich in charge.

UNA GOLD MINING CO. (Orogrande)—A 1,020-ft. crosscut tunnel being driven to tap orebody at depth of 300 ft. Manager, Ralston McQuaig.

GOLD DROP (Elk City)—Installation of 15-ton experimental mill completed. New hoisting machinery being installed. H. L. Herkelroth, owner.

ELK CITY GOLD DREDGING (Elk City)—M. A. Lungo is making inspection of company's 380 acres of placer ground. May start present small dredge and install larger boat in near future.

Shoshone County

FIRST REGULAR SHIPMENTS TO ANACONDA from the Douglas zinc-lead mine in Pine Creek began Sept. 19; comprised 400 tons high in zinc; Anaconda's royalty on this ore is $3 per ton. Ore is milled at Anaconda and concentrates treated at new electrolytic zinc plant at Great Falls, Mont. Option extended six months and new machinery ordered to expedite development.

SILVERADO (Mullan)—In raise from 4,000-ft. tunnel, gray copper ore was opened in vein 6 to 9 ft. wide. All machinery for 100-ton mill on ground or en route.

IDAHO-NEVADA (Wallace)—Will soon ship car of copper ore from this Placer Creek property. Enlarging shaft station for new hoist. May install electric pump. A. D. Marshall in charge.

VIENNA-INTERNATIONAL (Wallace)—Compressor to be installed at this Placer Creek property under bond to F. C. Bailey, of Spokane. Encouraging ore showings. W. B. Lively, superintendent.

HECLA (Burke)—Will increase its mill capacity at Gem 200 tons per day; present capacity, 450 tons. Other improvements include new change house, addition to mine bins and new sorting plant.

RAINBOW MINING AND MILLING (Wallace)—At the No. 2 property on Little North Fork, two shifts are driving main tunnel, now in 350 ft. Some silver-lead-zinc ore encountered but tunnel objective is from 300 to 500 ft. farther.

MICHIGAN

Copper

CHEROKEE (Houghton)—Shaft being sunk in the lode, is down 80 ft.

WHITE PINE EXTENSION (Ontonagon)—Shaft down 230 ft. Crosscutting to lode.

VICTORIA (Victoria)—New shaft down to 24th level; employing 300 men. Mill handling 450 tons daily; eight new tables to be added.

OSCEOLA CONSOLIDATED (Osceola)—Old Osceola section of property supplying only about 600 tons per day. Kearsarge sections have increased tonnage to 4,200 tons daily.

Iron

AT NEGAUNEE, a large cave of ground occurred recently on the Mary Charlotte and Rolling Mill properties; ground had been fenced off as it was known it would cave. The hole is about 200 ft. long and 75 ft. wide; capping went into abandoned workings.

NEWPORT (Ironwood)—New Woodbury shaft now being concreted. Will not be ready for use until after first of year.

SECTION 21 (Ishpeming)—Some ore to be shipped from piles that have been in stock for years. Mine, idle for some time, may resume.

JONES & LAUGHLIN (Ishpeming)—Orders received to ship 35,000 tons from Iron Mountain pit, idle several years. Ore is low grade.

ATHENS (Negaunee)—Shaft down nearly 2,000 ft. Averaging about 150 ft. per month. Shaft will be over 2,600 ft. when bottomed. Will be deepest iron-mine shaft in Lake Superior district. Permanent hoisting equipment being used in sinking.

CLEVELAND-CLIFFS IRON (Ishpeming) — New water power plant on Dead River in commission. About 1,200-hp. is sent to Maas mine station for distribution. Company's other plant furnishes about 5,000 hp. Still more will be needed when mines now being developed are ready to start mining.

MINNESOTA

Mesabi Range

SHENANGO (Virginia)—New steel headframe installed.

SILVER (Virginia)—Electric haulage recently installed underground.

ALPENA (Virginia)—Three shifts now being employed; many of old crew are back.

CLARK (Chisholm)—Mine working again with two shifts. About 900 tons being hoisted daily.

JEAN (Eveleth)—Property to be stripped by Roberts & Kingston for Kingston & Co.

SHIRAS (Buhl)—With resumption of operations here, every mine in Buhl district now working. Crews being increased daily.

CHISHOLM (Chisholm)—Operations cannot be resumed here until Jan. 1. Shaft is being concreted; delay in getting steel sets and girders.

HARTLEY (Chisholm)—Operations to be resumed in pit shortly. Mine closed down five years. Equipment being overhauled. Not much ore can be shipped before close of navigation.

HARRISON (Nashwauk)—Mine developing into large shipper; five shovels in pit. Concentrating plant is working two shifts. Shipments from this mine and the Kevin, operated in conjunction with the Harrison by Butler Brothers, amount to as high as 12,000 tons a day.

WEBB (Hibbing)—Washing plant for underground ore is operating, after some weeks of experimentation; capacity 75 tons an hour. Mine comprises three 40-acre tracts; one is completely developed underground and the other 40 will also be developed by this method, the ore to be trammed to present shaft. One shovel is stripping another 40; Winston-Dear Co. has excavating contract.

MISSOURI

Joplin District

BIN SIX (Joplin)—Sunk new shaft 110 ft. in seven weeks. Drill holes showed ore from 117 to 138 ft.

MERCHANTS (Commerce, Okla.) — Starting shaft after sinking five drill boles, showing ore at about 200 ft.

BRYAN & CO. (Joplin)—Started coal mining in Continental Zinc Co.'s zinc-lead tract. Getting out about 30 tons of firm, soft coal daily.

KANSOURI (Blue Mound, Kan.)—Sinking shaft on Chubb land, following thorough drilling. Ore face 18-ft. thick indicated at 225 ft.

BLOUNT & CO. (Commerce, Okla.)—Arranging for new mill on tract recently drilled out. Sixteen holes showed good formation; last hole 8 to 27% of blende.

ADIRONDACK (Joplin)—Constructing 300-ton mill on city's land. Two shafts now being put in shape, third being started. Two more will be put down later. Pittsburgh, Penn., men principally interested.

Northern Arkansas

MORNING STAR (Rush)—Operations resumed after two weeks shut down. Recent strike above old Star tunnel continues in good ore.

ARKA-HOMA (Rush)—Planning two new mills, one on Eureka Hollow mine at Tomahawk and other at Bing End on Panther Creek; will use oil engines.

MONTANA

Beaverhead County

BANNACK GOLD (Bannack)—New concentrator, nearing completion, will have capacity to treat all ore from the several groups owned by company. Mill largest in Beaverhead County.

Broadwater County

BLACK FRIDAY (Radersburg)—This gold property will be operated by Breitung & Co., Ltd., of 11 Pine St., New York. Mine is being pumped out.

Madison County

IN SUMMIT DISTRICT AROUND VIRGINIA CITY, some exceptionally rich streaks of gold ore have been encountered recently. High-grade samples taken from the Raine and from the Summit Development Co.'s property, which includes the Shafter mine. Activity in the old camp increasing daily and there are prospects of a brisk revival.

Silver Bow County

BUTTE & GREAT FALLS (Butte)—Purchased Snowdrift and Rio Tinto claims adjoining company's property; being explored on 500 level by diamond drilling. Sinking will be carried to 1,000 level. The 700-ft. crosscut has opened several well mineralized veins.

BUTTE & SUPERIOR (Butte)—According to report filed in Federal court in connection with Minerals Separation litigation, company treated 31,733 tons of ore in its flotation plant during August, producing 7,502 tons of concentrates at a cost of $4.89 per ton of concentrates; value, $49.45 per ton.

NEVADA

Esmeralda County

REORGANIZED CRACKER JACK (Goldfield)—Several feet of excellent ore reported in raise from south drift on 120-ft. level.

REORGANIZED BLACK BUTTE (Goldfield)—Purchased 6-in. core drill to prospect property at depth. Mine workings now 350 ft. deep. Past production about $500,000 gross.

JUMBO EXTENSION (Goldfield)—Preliminary estimate for August shows 2,443.65 dry tons shipped, gross value $72,000. Freight, treatment and sampling $26,500; smelting losses $7,000; operating costs $15,500; net realization $23,000.

Nye County

TONOPAH ORE PRODUCTION for week ended Sept. 16 was 9,247 tons valued at $192,326 compared with 8,134 tons for week previous. Producers were: Tonopah Belmont, 2,924 tons; Tonopah Extension, 2,200; Tonopah Mining, 2,100, West End, 769; Jim Butler, 750; Halifax, 210; Rescue-Eula, 162, North Star, 55; miscellaneous, 86 tons.

TONOPAH MINING (Tonopah)—Profit for August, $59,570 from treatment of 8,098 dry tons averaging $15.50 per ton and yielding 140,185 oz. bullion valued at $120,555.

TONOPAH EAST END DEVELOPMENT CO. (Tonopah)—Stockholders ratified agreement by which Tonopah Belmont acquires 51% of stock, leaving 300,000 shares in treasury, in consideration of expending $50,000 in development. Claims lie about two miles easterly from Belmont mine.

TONOPAH WESTERN CONSOLIDATED MINING CO. (Tonopah)—Recently incorporated to develop area between Tonopah Bonanza on the north and Great Western Consolidated on the south. Contemplate development from Great Western shaft. Area embraces about 650 acres, 2 mi. westerly from Tonopah Extension mine.

Storey County

CON. VIRGINIA (Virginia)—West crosscut 2,700 level advanced 15 ft. to 105-ft. point, passing through vein porphyry.

MEXICAN (Virginia)—Old west crosscut, 2,500 level, reopened to 110-ft. point. Mexican mill received 578 tons custom ore, average assay $17.27.

UNION CONSOLIDATED (Virginia)—Ore extraction 465 tons, from 2,400 and 2,500 levels: 149 tons, $29.13; 114 tons, $10.68; 51 tons, $12.61; 50 tons, $11.40; 55 tons, $10.01; 46 tons, $13.61.

SIERRA NEVADA (Virginia)—Raise in northwest drift on 2,400 level extended 16 ft., top in ore averaging $30. Saved 30 tons ore from extension of raise, averaging $16; saved 82 tons, averaging $12.34 from south boundary line stope. North drift on 1,500 level cleaned out to 250-ft. point; east crosscut, 2,600 level, advanced 12 ft.

White Pine County

CONSOLIDATED COPPERMINES (Kimberly)—About 60 men working on remodeling of old Giroux mill into flotation plant. Callow cells being installed. Walker J. Boudwin is in charge for the General Engineering Co. which has the contract.

NEW MEXICO

Socorro County

OAKS CO. (Mogollon)—Operating Clifton-Eberle group; making regular shipments to custom mill of ore taken from development; no stoping to date.

EUREKA (Mogollon)—D. E. Bearup encountered high-grade ore in No. 3 tunnel. First-grade ore being sacked for shipment to smeltery; second-class treated in local mills.

GOLD EAGLE (Mogollon)—Work resumed by owner, Louis Gramas. About 400 ft. of tunnels and 80 ft. of shafting has been done. Denver men relinquished bond owing to lack of funds.

MOGOLLON MINES CO. (Mogollon)—Milled 4,200 tons ore in August; shipped 3,100 lb. gold and silver bullion and several tons concentrates. Station being cut for 900-ft. level in new shaft and sinking will be continued when completed.

PACIFIC (Mogollon)—At this mine, operated by Socorro Mining and Milling Co. under agreement with the Oaks Co., carpenters are completing loading station and terminal for aërial tramway to Socorro mill, at which end construction is practically complete. All intermediate towers are in place and cable and other equipment on ground. Line will deliver 75 tons of ore daily to mill. Sinking of shaft below the 500 is in progress.

SOCORRO MINING & MILLING CO. (Mogollon)—Bullion production for August was approximately 70,000 oz. gold and silver and a quantity of concentrates which go to smeltery at El Paso. Company has adopted elevator-and-conveyor system to dispose of mill tailings, but installation is delayed by equipment having gone astray in transit. At the Johnson mine new shaft has reached depth of 200 ft., in ore most of distance. O. L. Walker, chemist, is making flotation tests on various ores of the camp; ores in northern end of district susceptible to this treatment.

UTAH

Beaver County

CEDAR-TALISMAN (Milford)—At meeting held Sept. 15, resignation of H. S. Joseph, managing director, accepted, and G. L. Bemis appointed director. Lead-silver as well as zinc ore being mined.

Juab County

TINTIC SHIPMENTS for week ended Sept. 14 amounted to 193 cars, largest tonnage in some time.

COLORADO (Silver City)—Station being cut on 1,500 level, where prospecting will be done before further sinking is attempted.

EUREKA HILL (Eureka)—Dividend of $1 per share declared Sept. 13, on 10,000 shares outstanding. Operations carried on by lessees only.

GRAND CENTRAL (Eureka)—Electricity to be used for hoisting. Equipment similar to that at the Eagle & Blue Bell will probably be installed.

RIDGE & VALLEY (Eureka)—Drifting and crosscutting being done on 1,500 level. Winze being sunk to 1,700. Small electric hoist to be installed here.

GEMINI (Eureka)—Rich shipment of silver ore by lessees from 1,400 level. Returns expected to be between $13,000 and $14,000; company to receive 50% royalty.

EUREKA MINES (Eureka)—Development being done through 1,300 level of Gemini. Several stringers and benches of lead ore cut. Property recently incorporated. Jackson MacChrystal manager.

DRAGON CONSOLIDATED (Silver City)—Sinking from 500 to 900-ft. level, at north end of property, near Iron Blossom line. Large shipments of iron ore being continued, siliceous ore shipped to Tintic mill.

SIOUX CONSOLIDATED (Eureka)—Contract for sinking main shaft given to Duncan & Allen, three shifts will be used in sinking to 1,000-ft. level. Winze on 600 level being sunk in search of continuation of Iron Blossom copper deposits.

Piute County

WEDGE (Marysvale)—Developing at this gold property in Horse Heaven section of camp.

SHAMROCK (Marysvale)—No. 3 tunnel, Bullion Cañon now in 170 ft.; objective 210 ft. Work being done by hand drilling.

Summit County

PARK CITY SHIPMENTS for week ended Sept. 14 amounted to 3,170,280 lb. of ore and concentrates; Silver King Coalition largest shipper. Corrected shipments for August given at 9,072 tons.

REVELATOR (Park City)—Six inches of good ore opened at this Snake Creek property.

ONTARIO (Park City)—Shipments of dry silver ore, restricted by accumulation at smelteries, have been resumed.

SILVER KING COALITION (Park City)—Much better saving being made since installation of new flotation equipment.

DALY (Park City)—Good ore opened in several places. Property recently inspected by George D. Blood. Walter Harris, superintendent.

BROADWATER MILL (Park City)—Three week's test run completed, Sept. 11, under direction of M. H Kuryla. Thought probable some changes will be made in mill, and work resumed. Large accumulations of tailings to be treated if profitable.

CANADA

Ontario

KENZIE (Elk Lake)—Operations have been resumed with E. C. Taylor in charge.

SMITH (Munro)—These claims adjoining the Croesus sold to Montreal-Toronto syndicate.

GIFFORD (Cobalt)—Winze is now 100 ft. below the 200-ft. level on a wide calcite-quartz vein.

MILLER INDEPENDENCE (Boston Creek)—Hardinge ball mill of 45 tons daily capacity and flotation plant of 80 ton capacity ordered.

KING DODDS (Kowkash)—Tash-Orn Gold Mines, Ltd., which owns 14 claims at Tashota, has secured controlling interest in this property.

HUDSON BAY (Cobalt)—Two veins recently found on surface greatly improved with stripping. One shows 4 in. of high-grade ore estimated to contain 1,500 oz. silver per ton.

INTERNATIONAL MOLYBDENUM CO. (Orillia)—The first ferro-molybdenum produced commercially in Canada was run Sept. 21. One electric furnace running steadily and two others will shortly be in operation.

MEXICO

SIXTEEN AMERICAN MINING COMPANIES dispatched Sept. 26 to Franklin K. Lane, chairman of the American division of the Mexican-American Commission in session at New London, Conn., a joint protest concerning confiscatory taxes in Mexico and destruction of property and life by raiders. The protest was prepared by William Loeb, Jr., a director of the American Smelting and Refining Co. and signed by officials of 15 other mining companies. The tax of 13% on gross value of ore mined and threatened confiscation in the event of suspension was especially protested against. Conditions in Mexico are stated to have grown worse instead of better and the de facto government unable to maintain order. Prime requisites to the resumption of operations, according to the statement, are: Protection from bandit raids on life and property; reduction of present excessive taxation; permission to buy Mexican currency at its market value, the discontinuance of labor control by government decree, permission to import food for employees, better transportation facilities; better sanitary conditions and a concerted campaign against disease.

CUBA

DAVISON CHEMICAL CO., of Baltimore, U. S. A., understood to have $1,500,000 bond issue in contemplation to finance building of railroad to the Carlotta cupriferous pyrite deposit it is developing in Santa Clara province, about [illegible] mi. [illegible] of Cienfuegos.

POTASH DEPOSITS near Motembo, along boundary of Matanzas and Santa Clara provinces, reported in [illegible] series of wild cablegrams to New York "Times" from London. Followed in five days by advertisements of stock offerings in Cuban Potash Corporation. Potash content [illegible] to range from [illegible] to [illegible], and 10,000-acre tract optioned. No confirmation available at this time from dependable sources.

The Market Report

Metal Markets

NEW YORK—Sept. 27

The outstanding feature of the week was the sale of an enormous quantity of copper to the agents of the Allied Governments. This having been consummated, the copper market became dull. Lead was active at unchanged prices. Spelter was dull and a little weaker

Copper, Tin, Lead and Zinc

Copper—The expected sale of a very large quantity of copper to the agents of the Allied Governments was concluded on Sept. 23, and was immediately announced. The quantity was 200,000 long tons—448,000,000 lb. Delivery is to be during the first half of 1917. Price has not been specifically stated by any of the parties to the transaction, nor have any further details Nearly all of the principal selling agencies participated in the business. It appears that the transaction was negotiated by the agency of the British Munitions Ministry with the Anaconda Copper Mining Co. and the American Smelting and Refining Co. Participations were offered to other selling agencies to such amounts as desired by them, the principal agencies undertaking to furnish such quantity to make up the round lot as was not arranged for otherwise. The total transaction is estimated as covering about one-third of the expected production of American refiners in the first half of 1917. Certain producers participated in the sale exactly to the extent of one-third of their expected output Inasmuch as some agencies and producers did not participate, others must have contracted to deliver more than one-third of their output.

Even before the consummation of this transaction, the copper market became dull and after its announcement became very dull, contrary to expectations in many quarters. It became evident then that the large domestic transactions of the previous fortnight had been anticipatory. The business of last week whereof we had reports was a little less than 18,000,000 lb., compared with about 60,000,000 lb. in the previous week This business was again chiefly for domestic account and was done at a wide range of prices, the average being 26.73c., cash, New York. Copper for October-November delivery exists no longer except as trifling quantities in second hands, and with one or two small producers. Occasional sales of lots of 100,000 lb. or so were made at 28½c., r.t. A moderate quantity of December copper was sold at 27½c., r.t., equivalent to 27¼c., cash, New York. The bulk of the business was for delivery during the first half of 1917, this taking the form of contracts for first quarter, second quarter, or first half.

The supply of copper available for delivery by producers during 1916 is now nearly zero and the market for that delivery is but nominal. There are some important consumers who have failed to cover their requirements and are desirous of buying million-pound lots. It is estimated in authoritative quarters that less than 25% of the expected production in the first quarter of 1917 remains unsold.

Copper exports from Baltimore for the week included 3,072,760 lb. to Archangel, Russia; 249,972 lb. copper and 389,339 lb. brass to Marseilles, France.

Copper Sheets are nominal at 37.5c. per lb. for hot rolled and 38.5c. for cold rolled. Copper wire is 32@32½c. per lb. for large lots at mill. These prices are mostly nominal; as already explained much sheet and wire business is now done on a toll basis.

Tin There was but little change in this market. There was fairly good business for future delivery, but the near-by position continued dull and depressed.

Lead Some large and attractive offers developing on Sept. 21, business was done in large volume by several producers at a small concession in price, but thereafter all of the business on New York basis was reported done at 7c., save for an occasional stray lot The St. Louis market fell into more regular step with New York. The lead position is very strong but little lead for October delivery remains that has not already been pre-empted. Some very interesting export business has been done during the last wek

Spelter—This market was very dull and a little weaker, but toward the close there was a firmer tone, and, indeed, an increased volume of business.

Opinions among zinc producers are divergent The optimists look for an improvement in price, arguing that the recent large purchases of copper must herald large requirements for spelter The pessimists admit that that may be so, but point out that the buying of spelter may be carried on month by month up to the middle of next year, just as it has been done of late, and point out further that the American production has probably not yet attained its maximum. It is admitted that numerous uneconomical producers have blown out, but in the main they were small ones, and the older, more important producers are still making extensions of plant. Thus important additions to Hillsboro and Rose Lake are in construction. The production of electrolytic zinc is also making headway.

The Donora Zinc Works now has all of its 10 furnaces in operation.

Exports from Baltimore for the week included 168,094 lb. spelter to London.

Zinc Sheets are in steady demand and business is fair. Quotations are unchanged at $15 per 100 lb., f.o.b. Peru, Ill., less 8% discount.

Other Metals

NEW YORK—Sept. 27

Aluminum Demand continues good and available supplies do not increase. Prices are a shade firmer, No. 1 ingots being quoted at 62@63c., New York. Contract deliveries are slow.

Antimony—This market continued dull and weaker. We quote 10½@11½c.

Quicksilver—The price was unchanged at $75, New York, fair business reported done. San Francisco reports, by telegraph, $75, market strong.

Nickel—Demand is good both from domestic and export business. Prices are firm and unchanged at 45@50c. per lb. for ordinary forms, according to size of order A premium of 5c. per lb. is charged for electrolytic nickel.

An export of 1,900 tons nickel to Russia is reported this week.

Minor Metals Current quotations for **Bismuth** are $3.15@3.30 per lb., New York.—**Cadmium** is quoted at $1.45@1.50 per lb.—**Cerium**, electrolytic, is sold at $8@9 per lb.—**Cobalt Metal** is quoted at $1.25 per lb. **Magnesium** is steady, with sales at $3.75@4 per lb. for 99% pure —**Selenium** is from $3 up to $5 per lb., according to size of order.

Gold, Silver and Platinum

NEW YORK—Sept. 27

Gold The Department of Commerce reports the total imports of gold into the United States for the eight months ended Aug. 31, 1916, at $290,325,463; exports, $93,581,157; net imports, $196,744,306. The August imports were $41,238,718; exports, $11,780,000; leaving $29,458,798 as the net imports The largest imports this year were in June, when $122,734,730 came in

Silver– The market continues steady and as visible supplies have not increased the tone of the market continues good, with offerings being absorbed at current figures.

Mexican dollars in New York were quoted on Sept. 21, 22 and 23 at 53⅛@56c.; Sept. 25, 26 and 27 at 53⅜@56⅜c. Prices showed very little variation during the week, and there was only a small demand.

Platinum—There was a sharp advance in price on brisk demand from jewelry manufacturers. In the early part of the week sales were made at $86, and in the latter part, at $90. We quote $88 as the average for the week

Zinc and Lead Ore Markets

Platteville, Wis., Sept. 23—Quotations of the district are according to the following figures: Base price per 2,000-lb. ton for material assaying 60% zinc is $58 for premium ore down to $50 for medium grade. For material assaying 80% lead the base price per 2,000-lb. ton is $74. Shipments for the week were 3,291 tons of zinc ore, 174 tons of lead ore, and 1,283 tons of sulphur ore. For the year to date, the figures are 90,758 tons of zinc ore, 3,233 tons of lead ore, and 22,073 tons of sulphur ore. Shipped during week to separating plants, 3,055 tons of zinc ore.

Joplin, Mo., Sept. 23—Price quotations per 2,000 lb.: Blende, high, $61.85; 60% zinc, premium ore, $65; medium grades, $63@60; low, $55. Calamine, per ton 40% zinc, $45@35. Average selling price, all grades of zinc, $55.47 per ton Lead, base price, $70@75 per ton, 80% metal content; high price, $72.30; average selling price, all grades of lead, $68.99 per ton.

Shipments of the week: Blende, 7,667 tons; calamine, 662 tons; lead, 1,254 tons. Value, all ores, $548,590 for the week; the year to date, $27,653,590.

With a stronger demand and higher base being paid, the greater tonnage of medium to low grades of blende shipping reduces the average value per ton. Some quite low-grade calamine shipping is offset in average value by a larger tonnage of best grades, and this average is advancing

A second week of heavier tonnage shipment increases the situation here by lowering the stock in the bins. During the past week mines dependent upon hydroelectric power were idle several

SILVER AND STERLING EXCHANGE

Sept.	Sterling Exchange	Silver New York, Cents	Silver London, Pence	Sept.	Sterling, Exchange	Silver New York, Cents	Silver London, Pence
21	4.7575	68⅞	32¾	25	4.7575	69¼	$32\frac{15}{16}$
22	4.7575	68⅞	32¾	26	4.7575	69¼	$32\frac{15}{16}$
23	4.7575	68⅞	32¾	27	4.7575	69¼	$32\frac{15}{16}$

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine.

DAILY PRICES OF METALS IN NEW YORK

	Copper	Tin	Lead		Zinc
Sept.	Electrolytic	Spot.	N. Y.	St. L.	St. L.
21	26½ @27	38⅞	6.90 @7.00	6.75 @6.92½	8.87½ @9.12½
22	26½ @27	38¾	7.00	6.82½ @6.92½	8.87½ @9.12½
23	26½ @27	38¾	7.00	6.82½ @6.92½	8.75 @9.00
25	26½ @27	39	7.00	6.82½ @6.92½	8.62½ @8.87½
26	26½ @27	38⅞	7.00	6.82½ @6.92½	8.75 @9.00
27	26½ @27	39	7.00	6.82½ @6.92½	8.75 @9.00

The quotations herein are our appraisal of the average markets for copper, lead, spelter and tin based on wholesale contracts for the ordinary deliveries of the trade as made by producers and agencies; and represent, to the best of our judgment, the prevailing values of the metals, reduced to basis of New York, cash, except where St. Louis is basing point.

The quotations for electrolytic copper are for cakes, ingots and wirebars. Electrolytic copper is commonly sold at prices including delivery to the consumers and is subject to discounts, etc. The price quoted for copper on "regular terms" (r.t.) is the gross price including freight to the buyer's works and is subject to a discount for cash. The difference between the price delivered and the New York cash equivalent is at present about 0.25c. on domestic business. The price of electrolytic cathodes is 0.05 to 0.10c. below that of electrolytic. Quotations for lead represent wholesale transactions in the open market for good ordinary brands. Quotations for spelter are for ordinary Prime Western brands. Only St. Louis price is given, St. Louis being basing market. We quote New York price at 17c. per 100 lb. above St. Louis.

Some current freight rates on metals per 100 lb are: St. Louis-New York 17c.; St. Louis-Chicago, 6.3c.; St. Louis-Pittsburgh, 13.1 cents.

LONDON

	Copper			Tin		Lead	Zinc
	Standard		Electrolytic				
Sept.	Spot	3 Mos.		Spot	3 Mos.	Spot	Spot
21	116½	113	136½	173	173½	30¾	55
22	116	113	136½	171¼	171½	30¾	54
23							
25	116	113	136½	172	172½	31¼	52
26	116	113	138	172	172¼	31½	52
27	116½	113½	138	173	173¼	31½	52

The above table gives the closing quotations on London Metal Exchange All prices are in pounds sterling per ton of 2,240 lb Copper quotations for electrolytic are subject to 3% discount For convenience in comparison of London prices, in pounds sterling per 2,240 lb., with American prices in cents per pound the following approximate ratios are given, reckoning exchange at 4.80 £15 = 3.21c.; £20 = 4.29c.; £30 = 6.43c.; £40 = 8.57c.; £60 = 12.85c. Variations, £1 = 0.21⅜ cents.

days during the installation of an additional turbine to increase the units of power. Otherwise conditions are improving, with mills gradually increasing their outputting capacity.

OTHER ORES

Manganese Ore continues steady at around 65c. per unit for Brazilian and Indian ores. The same price is paid for domestic ores, 45 to 50%. The quantity of domestic ores offered is not large.

Imports at Baltimore for the week included 11,100 tons of manganese ore from Brazil.

Antimony Ore—Sales reported at $1@1.10, and a small quantity for special purposes at $1.60 per unit.

Tungsten Ore—This market was substantially unchanged, sales being made at $16@17 per unit.

Charles Hardy makes the following interesting report: "The market has shown considerably more interest and the inquiries for ores from the home users have been more numerous than they have been for the last two or three months. Further quantities were booked for shipment abroad and the quantities required for Europe seem to be still very great as the agents for the Allies have now appeared again in the South American market with a view to buy direct there. Business has actually been done in Argentina for direct shipment to France, and in the other market negotiations are still continuing. Business with England is still impossible on account of the low prices fixed there by the minister of munitions for ferro-tungsten, 5s. 6d. per lb. and over, tungsten powder, 6s. 3d. per lb.; this corresponds approximately with $1.20@1.48, American currency and at these prices the American manufacturers would compete in that market. France, Italy and Russia, however, who have no sources of supply for the ore have to fix higher prices and are therefore the only Allied countries which are now buying ores in this market."

Iron Trade Review

NEW YORK—Sept. 27

The iron and steel trades show no decrease in activity. The mills are taking in business in excess of their deliveries and the question is how they can fill their orders.

Export business is offered freely; in fact the question is how much can be taken. It seems as if Europe would buy any quantity of steel that the mills can furnish. Domestic orders are on the increase as manufacturers are now looking forward to supply their needs for iron and steel in the first half of 1917. It seems to be more a question of deliveries than of prices. The pressing demand is for plates and shapes for shipbuilding and car building. The activity in the shipyards is augmented by new orders, so that there is no sign of decrease.

Light rails are in unusual demand and the mills making them are utilizing discard steel, of which large sales were recently made, and which is well adapted for this purpose.

The pig-iron market is strong and active and prices generally are advancing. Both basic and foundry iron are in demand and some heavy contracts for basic running well into next year have been placed. There is a demand for bessemer and low phosphorus iron for export. Some people are debating a possible shortage of bessemer ores this winter.

A list of new openhearth steel plants completed in 1916 is published by the "Iron Age." It shows new plants having a total capacity of 2,700,000 tons of steel ingots yearly. Other plants with a capacity of 500,000 tons will be completed by the end of the year.

Scrap is in demand, especially heavy steel melting scrap, showing the activity of the basic openhearth steel furnaces. Prices are advancing.

The Carnegie Steel Co. is putting up installations for pulverizing coal at its Homestead and Clairton works. The object is to test the use of pulverized coal in the openhearth steel furnaces.

Exports from Baltimore for the week included 13,438,918 lb. steel rails and fastenings, 1,685,689 lb. steel billets and bars to France; 661,220 lb. steel beams, 749,852 lb. nails, 20,347,508 lb. steel billets and forgings to Great Britain.

National Association of Sheet and Tinplate Manufacturers has completed its organization and established offices in the Oliver Building, Pittsburgh. Walter W. Lower is secretary and treasurer.

PITTSBURGH—Sept. 26

The steel market is in the midst of another general advance in prices. All along the line prices are hardening and deliveries obtainable at base prices are placed farther in the future. A regular advance in bars, plates and shapes is predicted to occur within a fortnight, probably about $3 a ton, and an advance of $2 a ton is predicted for wire products, while the sheet market is hardening.

Buyers generally are showing more confidence in the future, and many jobbers, who recently were predicting that a break would occur in the market by this time, are now taking hold for next year. In sheets, which are not yet offered for next year, there has been some buying for this year's delivery against later requirements.

In steel for specific consumption there is greater demand. Following moderate purchases of cars in the past fortnight the railroads are out for at least 20,000 freight cars. There is inquiry for a total of 60,000 tons of plates, for the Sinclair Oil Co.'s pipe lines, 800 mi. of 6- and 8-in., and there is continued demand for ship steel. The new naval program of the United States involves about 200,000 tons to be let in about a month.

While the mills are confining their activities very largely to the booking of orders for specific tonnages and avoiding the making of open contracts for future specification, their bookings are exceeding their shipments and thus they are becoming sold farther and farther ahead. While two months ago it was regarded as optimistic to predict that the mills would operate at capacity through the first half of next year it now looks as though it will not be long until activity through the whole year is practically assured.

Steel production is increasing and is now at nearly normal rate, following the curtailed production of the hot weather.

Pig Iron—The pig-iron market has grown decidedly excited this week and prices are advancing rather sharply. The buying is somewhat heavier, but the change seems to be due chiefly to the sellers having had a fresh accretion of courage, while consumers feel that there is much less risk in taking hold than in staying out of the market. The gap between pig iron and steel prices is so very wide that buyers could afford to pay much higher prices for pig iron. Bessemer is very scarce, the output from now to the opening of Lake navigation next year being limited by the supplies of bessemer ores. There is no general shortage of pig iron in evidence at present or in immediate prospect, but some consumers are keeping themselves supplied by having producers anticipate shipments. While bessemer was quotable at $21, Valley, a week ago, sales of 20,000 to 30,000 tons have since been made at $22, and $22.50 is now demanded, with very limited offerings, and small tonnages have sold at this figure. Basic, which a week ago was quotable at 25c. advance to $18.25, Valley, has sold at $18.50 and is now held at $19, with limited offerings. Foundry is up 50c., partly in sympathy. We quote: Bessemer, $22.50; basic, foundry and malleable, $19; forge, $18.50, f.o.b. Valley furnaces, 95c. higher delivered Pittsburgh.

Steel—On Sept. 20 the Carnegie Steel Co. made fourth-quarter prices to holders of long-term contracts for billets and sheet bars, the regular basis being $42 or $43 but with concessions to some consumers. The average advance over third-quarter prices is about $5 a ton. In the general market steel is hardly obtainable, but is quotable at $45@50. A sheet mill which makes steel itself has bought 1,000 tons of bessemer sheet bars at $45. Ordinary wire rods are sometimes available to regular customers at $55, prices ranging up to $90 for high carbon rods. The Inland Steel Co. is offering ingots at $36 or $37, Chicago, having a temporary surplus of steel making over blooming mill capacity.

FERROALLOYS

Spiegeleisen is active and firm in price, standard 20% manganese selling at $40@45 per ton at furnace; high grade, 25 to 30%, brings $55@60 per ton.

Ferrosilicon, 50%, is firmer, and is quoted at $86@89 per ton at furnace according to size of order. Bessemer ferrosilicon ranges from $30 for 9%, up to $41 for 16%, all per ton at furnace.

Ferromanganese—The market is now steadier on contract, with imported at $164 and domestic at $165, it being held that deliveries are somewhat more certain on the latter, but the market is not very active. Prompt generally quoted $165@170 per ton.

FOREIGN IRON

New South Wales Pig Iron production in 1915 was 76,318 tons, an increase of 1,168 tons over 1914. The production was from Eskbank Furnace at Lithgow. The material used was 134,681 tons of iron ore mined at Tallawang and Coombing, 96,316 tons coke; 42,379 tons limestone. The quantity of steel ingots made was 25,010 tons.

German Pig Iron Production in August is reported at 1,145,000 metric tons, being 11,000 tons more than in July. This brings the total for the eight months ended Aug. 31 up to 8,776,638 tons.

German Steel Production in June is reported by the German Iron and Steel Union at 1,319,762 metric tons, being 92,375 tons less than in May. For the six months ended June 30 the total make was: Converter steel, 3,830,559 tons; openhearth, 3,294,041; direct castings, 185,610; crucible, 52,920; electric, 85,797; total, 7,718,827 tons. This is an increase of 1,561,827 tons over last year.

Australia—The pig-iron production of the new works built by the Broken Hill Proprietary Co. at Newcastle, N. S. W., in 1915 was 120,000 tons; steel, 99,000 tons. The make of steel at present is 6,600 tons monthly and the company is adding four openhearth furnaces to its plant. A rolling mill for structural steel and light rails is also being added. With the new furnaces the company will be able to make 12,000 tons of steel ingots monthly.

IRON ORE

Of the total shipments of iron ore from the Lake Superior region in August, 8,115,686 tons, or 82.1% of the total were received at Lake Erie ports.

COKE

Coke production in the Connellsville region week ended Sept. 16 is reported by the "Courier" at 395,117 net tons, shipments, 396,307 tons. Production is increasing slowly, as labor is scarce.

The H. Koppers Co., Pittsburgh, has received a contract from the Bethlehem Steel Co. for the erection of 60 byproduct coke ovens of the Koppers type at Steelton, Penn. Equipment will be installed for the recovery of several byproducts of coal. Early this month the Bethlehem Steel Co. placed a contract with the Koppers company for a byproduct coke plant of 240 ovens and a benzol recovery plant at Sparrows Point, Md.

Connellsville—The market has advanced sharply. For several days prompt furnace coke has been selling at $3.25, against sales a week ago at $2.85, with no higher than $3 quoted. A contract for high-grade furnace coke for first half has been put through at $3, while on three inquiries totalling 40,000 tons a month $3 and $3.25 is being quoted. Until recently consumers had expected lower prices for first half, when $2.50 and even a shade less had been done on the current half year. Foundry coke is up 25c. to $3.50@3.75 for either spot or contract. The strength of coke is not due to any particular increase in demand, but rests upon the advance in the coal market, coupled with the shortage of labor at coke ovens. At present prices there is little profit in the coke over prices obtainable for raw coal.

Coal and Coke Tonnage Pennsylvania R.R. lines east of Pittsburgh and Erie, eight months ended Aug. 31, in net tons:

	1915	1916	Changes
Anthracite	6,811,293	7,767,748	I 956,455
Bituminous	27,703,075	32,576,476	I 4,873,401
Coke	7,222,840	9,682,236	I 2,459,396
Total	41,737,208	50,026,460	I 8,289,252

The total increase was 19.9%. The total August tonnage in 1916 was 6,167,709, an increase of 711,232 tons, or 12.9%, over last year.

Brisish Fuel Exports eight months ended Aug. 31, in gross tons:

	1915	1916	Changes
Coal	29,522,179	25,799,197	D 3,722,982
Coke	576,218	1,019,896	I 443,678
Briquettes	864,503	925,213	I 60,710
Steamer coal	9,657,927	8,758,199	D 899,728
Total	40,620,827	36,502,505	D 4,118,322

The steamer coal is coal sent abroad for use of steamships in foreign trade, or delivered to such steamships in British ports.

Chemicals

NEW YORK—Sept. 27

The general market continues in a healthy condition. Heavy chemicals are in good demand with most prices steady.

Arsenic—Demand does not vary much at this season, but is fairly up to the current supply. Prices are unchanged at $6@6.25 per 100 lb., according to size of order, for both spot and futures.

Copper Sulphate—The export demand has died down and sales are chiefly to domestic consumers. Prices show little change, standard grades bringing $10@10.50 per 100 lb., according to size of order.

Nitrate of Soda—The market has been rather quiet during the week with only a moderate business forward. Prices are easier, $2.90@2.95 per 100 lb. being quoted for both spot and futures. Despatches from Chile give shipments for the eight months ended Aug. 31 as below, in gross tons:

To	1915	1916	Changes
Europe	546,300	877,400	I 331,100
United States	595,950	786,300	I 190,350
Total	1,142,250	1,663,700	I 521,450

The total quantity afloat to Europe at the end of August was 278,500 tons.

Potash Salts—There is much interest in the reported discovery of a large deposit of potash salts at Montembo in Cuba. Should the reports prove true, the discovery will have a very important influence on the market here. German potash salts are practically unobtainable and a new supply will be welcomed.

Sulphur—The market continues very firm [illegible] freight rates are still a factor. Quotations [illegible] $35 per ton, New York, for spot and $[illegible] for futures.

Sulphuric Acid—Demand is good and prices are steady at $1 per 100 lb. for 60-deg. and $1.50 per 100 lb. for 66-deg. acid. Some concessions are said to have been made on large contracts for future delivery, sales of 66-deg. acid being reported at $25 per ton for future delivery.

Assessments

Company	Delinq.	Sale	Amt.
Andes, Nev.	Oct. 11	Nov. 1	0.02
Beaver Mines, Utah	Sept. 30	Oct. 21	0.0025
Blue Star, Ida	Sept 25	Oct. 21	0.02
Boston Dev., Utah	Sept. 27	Oct. 14	0.03
Buffalo Cons., Utah	Sept. 23	Oct. 14	0.005
Bull Valley, Utah	Oct. 10	Oct. 31	0.004
Cash Boy, Nev.	Sept 1	Oct. 15	0.01
Chief Cons. Ext., Utah	Oct 10	Nov. 1	0.002
Colonial, Ida	Aug. 26	Oct. 10	0.001
Comstock Cons., Utah	Sept. 25	Oct. 10	0.0005
Con. Virginia, Nev	Sept 29	Oct. 20	0.05
Crown Point, Utah	Sept 16	Oct. 10	0.005
Eagle Mountain, Ida	Oct 2	Nov. 4	0.001
Giant, Ida.	Oct 5	Nov. 9	0.003
Gold Bond, Utah	Sept 29	Oct. 24	0.001
Goldstrike Bon., Utah	Sept 25	Oct. 16	0.0025
Great Western, Nev	Sept 26	Oct. 18	0.01
Idaho-Nevada, Ida	Sept. 14	Oct. 14	0.002
Independent, Ida	Oct. 7	Nov. 7	0.005
Leonora, Utah	Sept. 27	Oct. 16	0.005
Manhattan Cons., Nev			0.01
Murray Copper, Utah	Oct. 9	Nov. 8	0.001
North Tintic, Utah	Oct. 10	Nov. 1	0.002
Neva, Utah	Sept 23	Oct. 10	0.002
Old Veteran, Ida	Sept 9	Oct. 7	0.002
Rio Grande Grubstake, Nev.	Sept 22	Oct. 31	0.002
Royal Copper, Ida	Sept. 22	Oct 22	0.001
Sells, Utah	Sept. 21	Oct 7	0.06
Sierra Nevada, Nev	Oct. 12	Nov. 2	0.10
Silver Pick, Nev.	Sept. 25	Oct. 30	0.01
Smuggler, Utah	Sept. 20	Oct. 18	0.005
Spearhead, Nev	Oct. 2	Nov. 2	0.01
Springfield Tunnel, Calif.	Aug. 15		0.05
Syndicate, Utah	Sept. 18	Oct. 14	0.0015
Tarbox, Mont	Sept. 28	Oct. 28	0.005
Tooele Chief, Utah	Sept. 25	Oct. 10	0.001
Tonopah-Bonanza, Nev.	Sept. 19	Oct. 16	0.01
Tyler, Ida	Sept. 12	Oct. 12	0.0015
Umatilla, Nev	Sept. 18	Oct. 24	0.0025
Uvada, Nev.	Oct. 9	Oct. 26	0.02
West Toledo, Utah	Sept 12	Oct. 3	0.01
Diamondfield Bl'k B'tte, Nev.	Oct 12	Nov. 18	0.01

Stock Quotations

SAN FRANCISCO Sept. 26	
Name of Comp.	Bid.
Alta	04
Andes	08
Best & Belcher	05
Bullion	02
Caledonia	33
Challenge Con.	08
Confidence	15
Cons. Imperial	01
Con Virginia	13
Gould & Curry	03
Hale & Norcross	05
Jacket-Cr Pt.	06
Mexican	16
Occidental	70
Ophir	18
Overman	05
Savage	12
Seg Belcher	03
Sierra Nevada	25
Union Con	65
Utah Con	02
Belmont	4 35
Jim Butler	85
MacNamara	05
Midway	20
Mont -Tonopah	22
North Star	16
Rescue Eula	27
West End Con	77
Atlanta	09
Blue Bell	‡ 01
Booth	10
C.O.D. Con	02
Comb. Frac	06
D'field B.B.	02
D'field Daisy	03
Jumbo Extension	37
Round Mountain	40
Sandstorm Kendall	03
Silver Pick	22
Central Eureka	08
Argo	10
Ariz. Central	15
Big Jim	1 35
Lazy Boy	12
Oatman No. Star	09
Tom Reed	2 00
United Eastern	3 87½
United Western	09

LONDON Sept. 13	
Alaska-Mexican	£1 3 9
Alaska Tre'dwell	5 7 6
Burma Corp	3 19 4
Cam & Motor	0 11 6
Camp Bird	0 8 0
El Oro	0 10 0
Esperanza	0 12 0
Mexico Mines	3 15 0
Nechi, pfd.	0 12 9
Oroville	0 16 9
Santa Gert'dis	0 12 0
Tomboy	1 2 0

SALT LAKE Sept. 25	
Name of Comp.	Bid
Alta Con	‡ 25½
Black Jack	06
Cardiff	7 50
Colorado Mining	.17
Crown Point	‡.04½
Daly-Judge	7.15
Emma Cop	2 00
Gold Chain	17
Grand Central	62
Iron Blossom	1 47½
Lower Mammoth	05
May Day	08
Opohongo	‡ 01
Prince Con	1 40
Seven Troughs	‡ 03
Silver King Coal'n	2 85
Silver King Con.	3 45
Sioux Con	11
So. Hecla	1 90
Uncle Sam	04
Wilbert	06
Yankee	16

COLO. SPRINGS Sept 26	
Acacia	03¾
Cresson	6 25
Doctor Jack Pot	.09½
Elkton Con	14¾
El Paso	49
Findlay	03¾
Gold Sovereign	06
Golden Cycle	2 36
Granite	73
Isabella	22
Jack Pot	05½
Jerry Johnson	‡ 04
Mary McKinney	30
Portland	2 00
Vindicator	2 01

TORONTO Sept. 25	
Adanac	‡25
Bailey	09
Chambers Ferland	20
Coniagas	4 80
La Rose	59
Peterson Lake	22
Right of Way	05½
Seneca Superior	25
T. & Hudson Bay	65 00
Temiskaming	62
Wettlaufer-Lor	11
Dome Exten	35
Dome Lake	57
Foley O'Brien	68½
Hollinger	6 90
Jupiter	29
McIntyre	1 45
Newray	69
Porcu. Crown	75
Vipond	37
West Dome	.38

N. Y. EXCH. Sept. 26	
Name of Comp.	Clg.
Alaska Gold M	13¾
Alaska Juneau	7⅛
Am.Sm.&Ref.,com	113¾
Am. Sm. & Ref., pf.	115½
Am. Sm. Sec., pf. A	95
Am. Sm. Sec., pf. B	87½
Am. Zinc	43¼
Am. Zinc, pf	77
Anaconda	97¼
Batopilas Min	1⅞
Bethlehem Steel	568
Bethlehem Steel, pf.	135
Butte & Superior	64¾
Chile Cop	23¼
Chino	57½
Colo. Fuel & Iron	56½
Crucible Steel	92½
Dome Mines	24⅝
Federal M. & S.	16
Federal M. & S., pf.	40
Great Nor., ore ctf.	44¼
Greene Cananea	51½
Homestake	133
Inspiration Con.	67¼
International Nickel	53¾
Kennecott	55⅝
Lackawanna Steel	81¼
Miami Copper	40¼
Nat'l Lead, com.	70
National Lead, pf.	114¾
Nev. Consol.	23
Ontario Min	7
Quicksilver	2¾
Quicksilver, pf	4¼
Ray Con	26¼
Republic I&S, com.	69¾
Republic I&S, pf.	110¾
Sloss-Sheffield	59
Tennessee Copper	24¼
Utah Copper	96½
U. S. Steel, com	115
U. S. Steel, pf.	121
Va. Iron C. & C	50

N. Y. CURB Sept. 26	
Beaver Con.	45
Buffalo Mines	95
Butte & N. Y.	1⅝
Butte C. & Z.	7⅜
Caledonia	.59
Can. Cop. Corpn.	1⅝
Cashboy	.06
Cerro de Pasco	40
Con. Ariz. Sm.	1½
Con. Coppermines	2⅜
Con. Nev.-Utah	25
Crystal Cop.	$1\frac{3}{16}$
First Nat. Cop.	5⅜
Florence	.76
Goldfield Con.	.71
Goldfield Merger	08
Granite	20
Hecla Min	5¼
Howe Sound	5
Jerome Verde	$2\frac{3}{16}$
Joplin Ore & Spel	52
Kerr Lake	$4\frac{15}{16}$
Magma	19
Majestic	63
McKinley-Dar-Sa.	65
Mother Lode	.38½
Nevada Hills	21
N. Y. & Hond.	15½
Nipissing Mines	8¾
Oro	.03
Ray Hercules	4⅛
Rochester Mines	50
St. Joseph Lead	17¾
Standard S. L.	$1\frac{7}{16}$
Stewart	25
Success	.39
Tonopah	5½
Tonopah Ex.	$5\frac{7}{16}$
Tribullion	⅜
United Verde Ext.	42¼
United Zinc	5
White Knob, pf.	1½
White Oaks	5¼

BOSTON EXCH Sept. 26	
Name of Comp.	Bid
Adventure	4¾
Ahmeek	107
Algomah	1½
Allouez	68½
Ariz. Com., ctfs.	12¾
Bonanza	.38
Butte-Ballaklava	1¾
Calumet & Ariz.	76
Calumet & Hecla	585
Centennial	19
Copper Range	68½
Daly West	2¾
East Butte	15¼
Franklin	9
Granby	93½
Hancock	14¼
Helvetia	.25
Indiana	3
Island Cr'k, com.	42½
Island Cr'k, pfd.	90
Isle Royale	36
Keweenaw	6¾
Lake	13½
La Salle	1½
Mason Valley	4¼
Mass	15½
Mayflower	2¾
Michigan	3⅞
Mohawk	94½
New Arcadian	7½
New Idria	16
North Butte	23
North Lake	2
Ojibway	1⅝
Old Colony	2
Old Dominion	70½
Osceola	95¾
Quincy	91¼
St. Mary's M. L.	88½
Santa Fe	2¾
Shannon	9⅝
Shattuck-Ariz.	32¼
So. Lake	6
So. Utah	.36
Superior	17½
Superior & Bost.	5¼
Tamarack	42
Trinity	7½
Tuolumne	.59
U. S. Smelting	77
U. S. Smelt'g, pf.	52¼
Utah Apex	4
Utah Con.	14½
Utah Metal	6½
Victoria	4
Winona	5
Wolverine	48½
Wyandot	1¾

BOSTON CURB Sept. 26	
Bingham Mines	11⅜
Boston Ely	1
Boston & Mont.	1
Butte & Lon'n Dev.	.59
Calaveras	5⅛
Calumet-Corbin	.02½
Chief Con	2
Cortez	40
Crown Reserve	56
Davis-Daly	2
Eagle & Blue Bell	1⅞
Houghton Copper	1¾
Iron Cap Cop., pf	5½
Mexican Metals	31
Mines of America	2½
Mojave Tungsten	$4\frac{3}{16}$
Nat. Zinc & Lead	1
Nevada-Douglas	$1\frac{11}{16}$
New Baltic	1½
New Cornelia	17¼
Ohio Copper	15
Oneco	75
Raven Copper	‡ 07
Rex Cons.	34
Rilla	.14
Yukon Gold	2¼

‡Last Quotations.

Monthly Average Prices of Metals

SILVER

Month	New York			London		
	1914	1915	1916	1914	1915	1916
January	56.572	48.855	56.775	26.553	22.731	26.960
February	57.506	48.477	56.755	26.573	22.753	26.975
March	58.067	50.241	57.935	26.788	23.708	27.597
April	58.519	50.250	64.415	26.958	23.709	30.662
May	58.175	49.915	74.269	26.704	23.570	35.477
June	56.471	49.034	65.024	25.948	23.267	31.060
July	54.678	47.519	62.940	25.219	22.597	30.000
August	54.344	47.163	66.083	25.979	22.780	31.498
September	53.290	48.680	..	24.260	23.591	.
October	50.654	49.385	.....	23.199	23.925	.....
November	49.082	51.714	....	22.703	25.094	.....
December	49.375	54.971	.....	22.900	26.373	......
Year	54.811	49.684		25.314	23.675	......

New York quotations cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

COPPER

Month	New York		London			
	Electrolytic		Standard		Electrolytic	
	1915	1916	1915	1916	1915	1916
Jan.	13.641	24.008	60.756	88.083	65.719	116.167
Feb.	14.394	26.440	63.494	102.667	*	133.167
Mar.	14.787	26.310	66.152	107.714	*	136.000
April	16.811	27.895	75.096	124.319	*	137.389
May	18.506	28.625	77.600	135.457	*	152.522
June	19.477	26.601	82.574	112.432	95.333	137.455
July	18.796	23.865	76.011	95.119	91.409	125.500
Aug.	16.941	26.120	68.673	110.283	82.333	126.304
Sept.	17.502	......	68.915	....	85.250	......
Oct	17.686	......	72.601	....	88.000	....
Nov.	18.627	......	77.744	....	93.273	.
Dec.	20.133	......	80.773	.....	100.43	....
Year	17.275	......	72.532	....	......	.....

TIN

Month	New York		London	
	1915	1916	1915	1916
January	34.260	41.825	156.550	175.548
February	37.415	42.717	176.925	181.107
March	48.426	50.741	180.141	193.609
April	47.884	51.230	166.225	199.736
May	38.790	49.125	162.675	196.511
June	40.288	42.231	167.636	179.466
July	37.423	38.510	167.080	168.357
August	34.389	38.565	151.440	169.870
September	33.125	...	152.625	....
October	33.080	...	151.554	....
November	39.224	.....	167.670	.....
December	38.779	....	167.000	....
Av. year	38.590	.....	163.960	....

LEAD

Month	New York		St. Louis		London	
	1915	1916	1915	1916	1915	1916
January	3.729	5.921	3.548	5.826	18.606	31.167
February	3.827	6.246	3.718	6.164	19.122	31.988
March	4.053	7.136	3.997	7.375	21.883	34.440
April	4.221	7.630	4.142	7.655	21.094	34.368
May	4.274	7.463	4.182	7.332	20.347	32.967
June	5.932	6.936	5.836	6.749	25.170	31.011
July	5.659	6.352	5.531	6.185	24.611	28.137
August	4.656	6.244	4.520	6.088	21.946	29.734
September	4.610	......	4.490	......	23.151	......
October	4.600	......	4.499	.....	23.994	......
November	5.155	......	5.078	.....	26.278	.....
December	5.355	......	5.266	.....	28.807	......
Year	4.673	......	4.567	......	22.917	......

SPELTER

Month	New York		St. Louis		London	
	1915	1916	1915	1916	1915	1916
Jan.	6.386	16.915	6.211	16.745	30.844	89.810
Feb.	8.436	18.420	8.255	18.260	39.819	97.762
Mar.	8.541	16.846	8.360	16.676	44.141	95.048
April	10.012	16.695	9.837	16.525	49.888	99.056
May	14.781	14.276	14.610	14.106	68.100	94.217
June	21.208	11.752	21.038	11.582	100.614	68.591
July	19.026	8.925	18.856	8.755	97.250	50.750
Aug.	12.781	8.730	12.611	8.560	67.786	51.587
Sept.	13.440	...	13.270	......	67.841	......
Oct	12.800	...	12.596	......	66.536	......
Nov.	15.962	...	15.792	......	88.409	......
Dec.	15.391	......	15.221	.....	89.400	......
Year	13.230	......	13.054	......	67.553	......

New York and St. Louis quotations, cents per pound. London, pounds sterling per long ton. * Not reported.

PIG IRON IN PITTSBURGH

Month	Bessemer‡		Basic‡		No. 2 Foundry	
	1915	1916	1915	1916	1915	1916
January	$14.59	$21.60	$13.45	$18.78	$13.90	$19.70
February	14.55	21.16	13.45	18.93	13.90	19.51
March	14.55	21.81	13.45	19.20	13.95	19.45
April	14.55	21.65	13.45	18.95	13.95	19.45
May	14.61	21.78	13.60	19.11	13.83	19.58
June	14.70	21.95	13.67	18.95	13.77	19.34
July	14.94	21.95	13.91	18.95	13.68	19.20
August	16.01	21.95	15.31	18.95	14.75	19.25
September	16.86	......	15.95	......	15.70	......
October	16.95	......	15.96	......	15.80	......
November	17.57	.....	16.47	......	17.20	.....
December	19.97	......	18.44	......	18.95	..
Year	$15.82	.....	$14.76	......	$14.95	....

‡As reported by W. P. Snyder & Co.

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Metallurgical Works Tramways

By W. C. Capron* and C. R. Kuzell†

SYNOPSIS—Steam locomotives are in most general use in metallurgical plant service because of their complete utility on all tracks. Electric locomotives partly make up their deficiency in this respect by using crab or reel attachments to supply traction over tracks lacking power supply. Compressed-air locomotives, though well adapted to intermittent service, have an efficiency of only 18% in the utilization of their power. Gasoline locomotives have a low first cost, but are not well adapted to intermittent service. Cars used for all sorts of metallurgical service detailed; operating costs compared.

In writing this article descriptive of tramways our aim is to limit its scope to tramways found at metallurgical works. It has to do with the current practice in interdepartmental haulage in metallurgical works of various kinds and of different magnitudes. The field is so large and comprises so many different modifications of engines, motors and cars that space limits the thoroughness of description. Undoubtedly there are installations embracing interesting features which could have been described in this paper, but which did not happen to come under our observation.

Operating costs have been rather difficult to obtain, especially on a comparable basis, but enough have been presented to show the wide variation according to conditions and to the size of the system. An attempt has also been made to compare the operating costs of different systems at similar plants. Figures of this kind are always welcome to the engineer, but it must be remembered that such a comparison is by no means absolute, because no two systems or tramming layouts can possibly be alike or have exactly the same work to perform. The data for this paper were practically all furnished by officials of the companies whose equipment is described. Our requests for various information were very courteously and painstakingly complied with. Sincere thanks are due to those gentlemen who have so willingly allowed descriptions of their equipment and their records to be put into print and even compared with others.

Selection of equipment for tramways is governed by the conditions met with in individual cases and is usually a separate problem for each installation. One system cannot be installed in exactly the same manner at two plants and produce identical results unless conditions happen to be similar. Features of several successful systems suited to meet the needs of a proposed new system, however, can be combined into a harmoniously and economically operating unit, hence the advantage of studying that which operates successfully elsewhere.

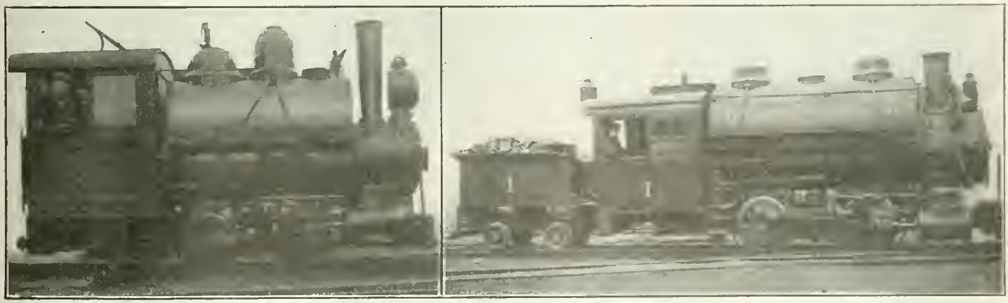

FIG. 1. 10½-TON, 20-IN. GAGE

FIG. 2. 30-TON, 36-IN. GAGE

Figs. 1 and 2—Steam locomotives, contrasting light and heavy designs

The motive power available at the least expense per unit of power expressed in drawbar pull will usually decide the kind of locomotive and the details will be decided by the particular service to be performed. Sometimes, however, safety, utility or other causes demand the selection of motive power that does not furnish drawbar pull at the lowest possible cost. Assuming that the engine efficiency is the same, the factors of power cost that vary with plant location are cost of fuel, labor, supplies, depreciation and upkeep. One locality may have the advantage of cheap coal, another of hydro-electric power, another of cheap gasoline and oil. Western smelteries have to contend with higher costs for labor and supplies than the metallurgical works in the East. Any one of these advantages or disadvantages should influence the selection of the kind of locomotive and the whole tramming system.

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*Assistant chief engineer, Washoe Reduction Works, Anaconda, Mont.

†Metallurgist, Washoe Reduction Works, Anaconda, Mont.

The use of steam locomotives is widespread. There are many variations met with in design, weight, track gage, etc. Fig. 1 illustrates a 10½-ton engine used in a New England plant that utilizes a very narrow track gage. Fig. 2 shows a much heavier type, common in Middle Western steel plants. This particular one is also adapted to a narrow-gage, 36-in. system. Fig. 3 shows a low, comparatively light engine used on a standard-gage system in a Nevada copper smeltery. Its two main features are its small height of only 6 ft. 6 in. above rails and its short wheelbase of only 4 ft. 6 in. These illustrations serve to show the flexibility in design: one may have a large, heavy engine on a narrow track, a light and small engine on a wide-gage track, or vice versa.

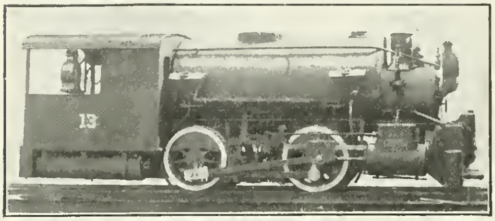


FIG. 3. 12-TON STANDARD GAGE STEAM LOCOMOTIVE

Table 1 presents comparative data on several typical steam-engine tramming systems at plants situated at widely distant points:

TABLE 1. STEAM LOCOMOTIVES COST DATA

Location of Plant	No. 1 Pittsburgh	No 2 Connecticut	No. 3 Illinois	No. 4 Nevada	No. 5 Illinois
Gage of tracks...	23-in.	20-in.	36-in.	Standard	36-in.
Number of engines in service.	38	3	22	6	1
Weight of engines	20-21 tons 7-8 tons 3-26½ tons 3-16 tons 3-12 tons	10½ tons	9-24 tons 6-30 tons 7-49 tons	Variable up to 17 tons	11 tons
Cost of engines	$2,500 to $4,500	$2,500	$4,500 to $7,000	(Largest) $4,000	$2,300
Durability of engines	Said to be satisfactory	One has been in service for 8 yr. and shows little depreciation	Will serve for 16 mos. 24 hr. per day before being overhauled	Overhauled once in two years	Has not been in service very long
Cost of engine upkeep per day...	$1.37	$0.77	$3.72	$6.84	$2.23
Coal burned per engine per day..	½ to 1¼ tons	¼ ton per shift	2½ tons per day	¼ ton per day	½ ton per day
Cost of coal per day (Approx.)...	$1.50	$3.17	$1.50	$5.50	$1.50
Total cost per ton hauled......	Not available	$0.023	Not available	$0.0551	$0.099
Total cost per ton mile......	Not available	$0.084	Not available	$0.086	$0.4'6

Improvements in the design of the electric motor and in its applications to haulage make the electric locomotive a close competitor of the steam.

Perhaps the principal disadvantage of the electric locomotive is its lack of complete utility as compared with the steam engine. The latter can go almost anywhere in a surface plant where two rails can be laid, while the former must always be connected with the source of electric power or must carry its power in storage batteries. For entering places where the rails are not equipped with either a trolley wire or third-rail system, special modifications of the electric locomotive have been made such as those with the "crab" attachment and the "reel" attachment. The former permits the locomotive to stand on the track served by trolley wire or third rail, and to pay out a cable and hook to reach the cars to be moved. The latter carries an electric conductor cable on a reel which can be attached to a convenient point on the trolley wire or third rail and thus furnish power to the locomotive as it proceeds along some unelectrified portion of the system.

The storage-battery motor has all the utility of the steam engine and makes no smoke nuisance, but has the disadvantage of inefficiency in the use of power, which so far has prohibited its extensive application in tramming operations.

The electric locomotive can be designed to meet almost any requirement in haulage problems, and the variations in use are numerous. Fig. 4 illustrates a 25-ton standard-gage locomotive used at the Cleveland ore docks for handling ore cars. Current at 250 volts is supplied from a third rail laid between the tracks and completely insulated. Such a locomotive costs in the neighborhood of $7,000.

Fig. 5 shows a 25-ton locomotive used for hauling 30-ton slag ladles at Great Falls, Mont. It receives 500-volt current either from a third rail at the end of the ties, or by a pantagraph trolley from an overhead wire. It carries a special compressor and compressed-air storage tanks for use in dumping ladles. Such a locomotive costs about $11,500.

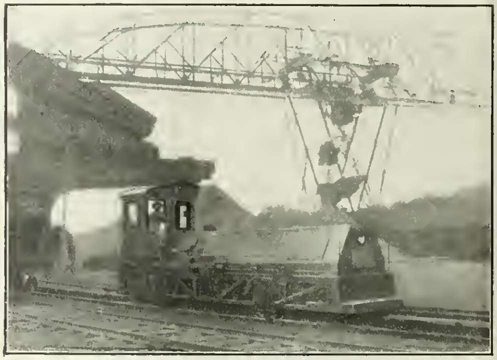


FIG. 4. 25-TON LOCOMOTIVE FOR HANDLING ORE CARS

Fig. 6 shows an 18-ton unit for copper-smeltery work in the Southwest. It carries air-brake equipment and a special pantagraph trolley. It is build for standard gage. Its price is about $4,500.

Fig. 7 shows a 10-ton machine used at Great Falls, Mont. It is equipped for third-rail operation and carries air-brake equipment together with air equipment for operating discharge gates on specially designed hoppered cars. Such a machine costs about $4,000.

Electric locomotives using alternating current are by no means common. Fig. 8 shows a 9-ton locomotive built for a South American copper-smelting works. It is built for a 30-in. gage and carries a three-phase, 60-cycle 220-volt induction motor geared to one axle only. The approximate price of this locomotive is $2,200.

In addition to the kinds of locomotives shown in the foregoing illustrations, there are in service in metallurgical works many electric locomotives that were originally designed for mine service. Occasionally they are found equipped with cable reels and the like to enable them to work over unelectrified portions of the tramway.

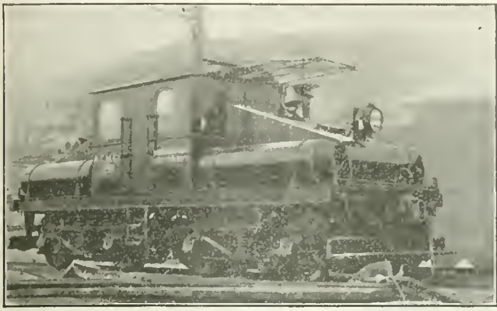


FIG. 5. 25-TON LOCOMOTIVE EQUIPPED WITH COMPRESSED-AIR TANKS

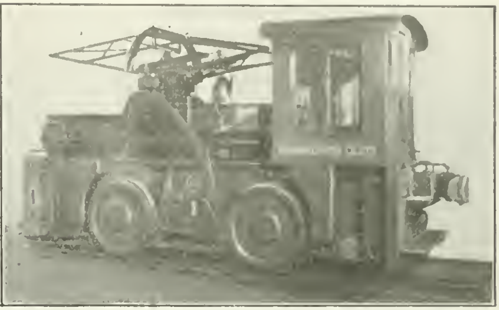


FIG. 6. 18-TON LOCOMOTIVE EQUIPPED WITH SPECIAL PANTAGRAPH TROLLEY

Figs. 5 and 6—Contrasting special types of electric locomotives

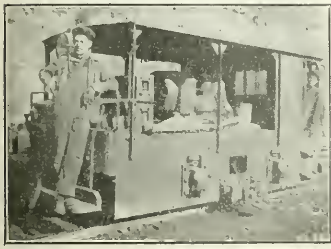


FIG. 7. 10-TON LOCOMOTIVE OF UNUSUAL DESIGN

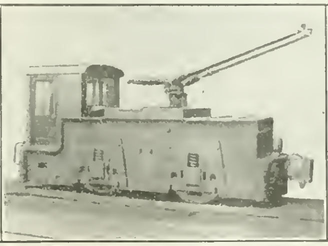


FIG. 8. 9-TON ALTERNATING-CURRENT INDUCTION MOTOR

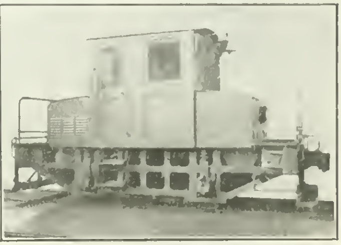


FIG. 9. 25-TON STORAGE-BATTERY LOCOMOTIVE

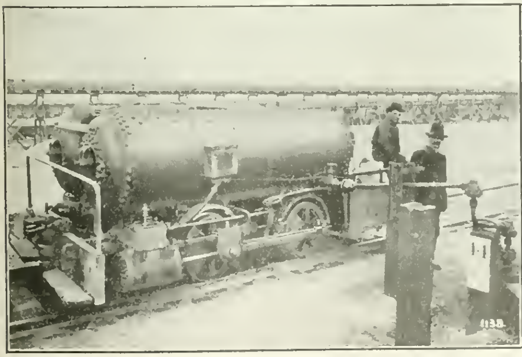


FIG. 10. 15-TON COMPRESSED-AIR LOCOMOTIVE

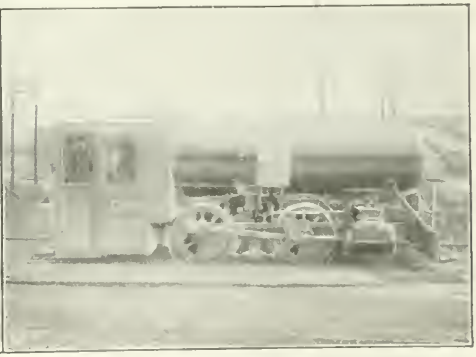


FIG 11. 22-TON LOCOMOTIVE AND CAB

An electric locomotive that seems to be coming into service particularly to meet special conditions is the storage-battery type. It is expected that its now narrow field of usefulness will considerably broaden as storage batteries are developed to a point of greater efficiency. Fig. 9 shows a 25-ton locomotive used at a Boston industrial works. It is equipped with 110-volt motors, the current being supplied by 48 cells of ironclad-type storage battery. It is equipped with hand brakes. Its cost is in the neighborhood of $4,000.

A number of mines are said to be successfully using storage-battery locomotives of small sizes for their haulage work, but as far as known they have not yet come into service in metallurgical works.

Compressed-air locomotives are not extensively used, but are employed in a few notable instances. A very large installation is in operation at Anaconda, Mont. In fact, it is said that compressed-air locomotives are used at these works more extensively and continuously than at any other works in the world. The system has about 12 mi. of standard-gage track laid with 60-lb. rails. This is all included in an area about ½ mi. square. The minimum radius of curvature is 40′, and the heaviest grade in the system is a little over 4%. The locomotive equipment consists of seventeen 15-ton engines, of the type shown in Fig. 10 and two 22-ton engines of Fig. 11 type. The machinery is in most respects the same as would be employed on a steam locomotive of the same size, the chief difference being that the cylinders are ribbed in order that they may the more rapidly absorb heat from the atmosphere, instead of being lagged to prevent the loss of heat as is the case with steam locomotives. Compressed air at 900 lb. pressure is distributed by pipes to 40 locomotive-charging stations well placed throughout the works. The air is compressed in the main power house by three 4-stage cross-compound compressors and one 3-stage triple-expansion compressor.

The service performed by these locomotives is extremely intermittent, requiring three to four hundred stops per engine per shift of eight hours. The compressed-air engine seems to be particularly adapted to such service, as it is capable of rapid starting and stopping. The principal objection to the use of the compressed-air locomotives is their low efficiency in the utilization of power. The ratio of the indicated power per cubic foot of free air used by the locomotive cylinders is about 18% of the indicated power of the compressor steam cylinders per cubic foot of free air compressed. This ratio is actually less, owing to the leakage of air from pipes and charging stations. Extreme cold weather further decreases the efficiency of the air engines just at a time when there is an increased demand for power to move frozen cars. Consequently the work performed by an air engine is considerably impaired in winter weather.

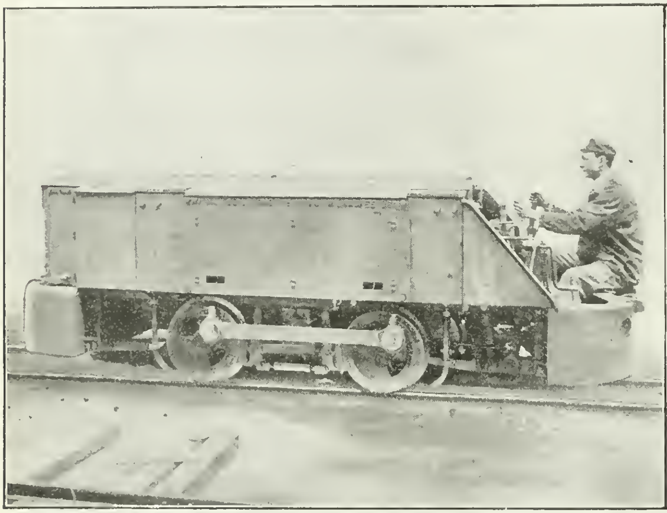


FIG. 12. GASOLINE MOTOR READY FOR SERVICE

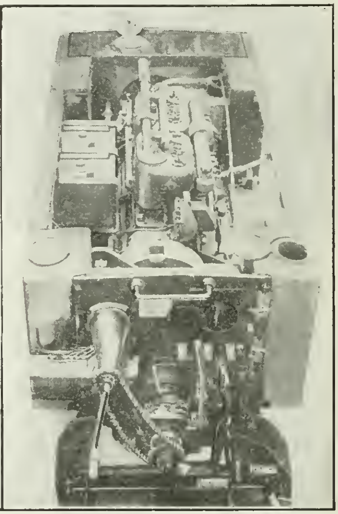


FIG. 13. MOTOR HOUSING REMOVED

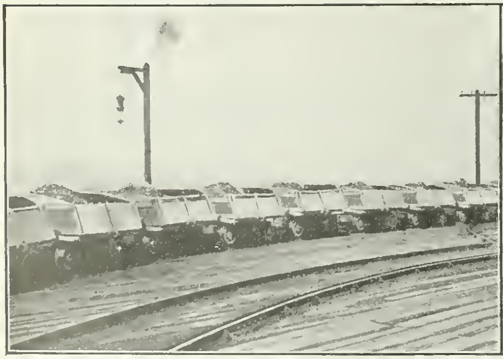


FIG. 14. SIDE-DISCHARGE FURNACE CHARGE CARS

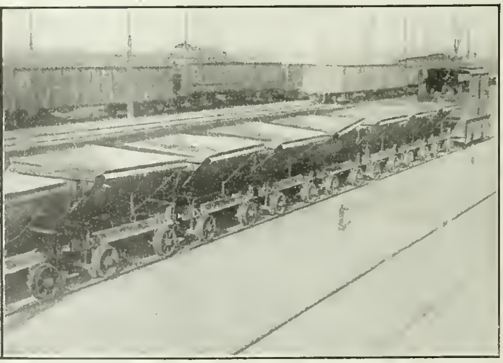


FIG. 15. ROLLING SIDE-DISCHARGE V-TYPE CAR

The use of the internal-combustion engine as the motive power for industrial locomotives is being developed, and a number of manufacturers have them on the market. Mining companies are using them in many instances, but they are employed only in isolated cases about metallurgical works. The first cost of such an installation should be small because each locomotive is a self-contained power plant in itself. The high efficiency of the gas engine is quite an appealing feature, especially where gasoline or engine distillate can be obtained at low prices. The nature of this type of engine, however, does not seem to make it easily adaptable to the demands of frequent starting and stopping characteristic of metallurgical works tramming service. Even if frequent starting and stopping could be perfectly accomplished by means of a clutch, it would be necessary to run the engine while idle during stops, and this method of operation would in practice undoubtedly result in the speeding of the engine, thereby wasting fuel. Figs. 12 and 13 show a gasoline locomotive with and without its housing. The latter view gives some idea of the mechanism to be kept in shape.

The tramway cars are, almost without exception, of steel construction. They must be designed for easy and rapid emptying and are therefore of the bottom-gate discharge, lateral-gate discharge or rolling "U" type. For lumpy material the gates are necessarily as large as design will permit. Fig. 14 shows a familiar type of side-dump furnace charge car. Such cars can be made to discharge on either side by simply raising up the opposite side. This may be accomplished by hand with the aid of a bar, but the cars shown in the illustration are tilted by means of a compressed-air cylinder suspended from a traveling trolley at the furnace. Fig. 17 is a dimensional outline of a similar car used at another works.

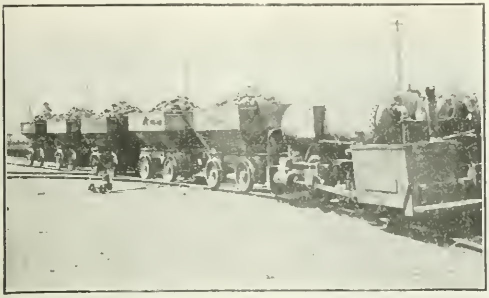
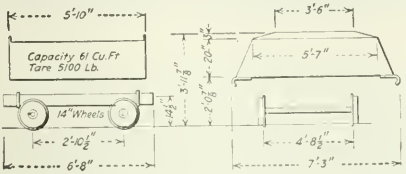
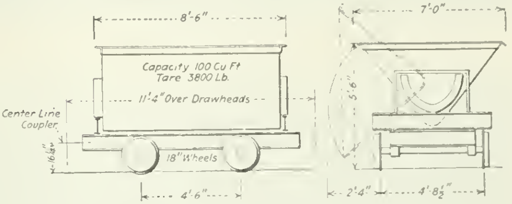


FIG. 16. BOTTOM-DISCHARGE CARS



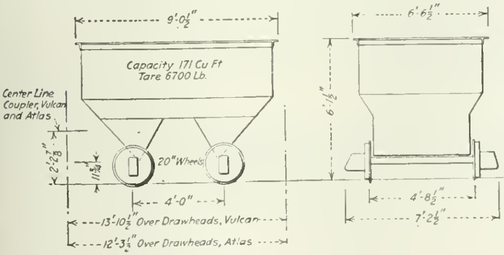
Blast-Furnace Charging Car

Fig. 17



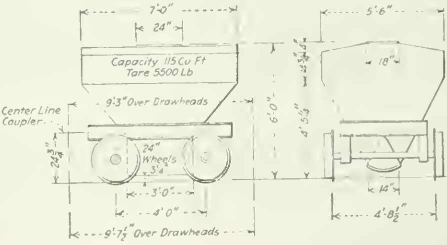
U-Type Car

Fig. 18


9'-0½"
Capacity 171 Cu Ft
Tare 6700 Lb.
Center Line Coupler, Vulcan and Atlas
2'-2⅞"
11¾"
20" Wheels
4'-0"
13'-10½" Over Drawheads, Vulcan
12'-3½" Over Drawheads, Atlas
6'-6½"
6'-1½"
4'-8½"
7'-2½"

Concentrates Car

Fig 19



Calcine Car

Fig. 20

FIGS. 17 TO 20. TYPES OF SMALL CARS USED IN THE OPERATION OF SMELTING WORKS

Figs. 15 and 18 illustrate the rolling "U" type of side-discharge car. It has no gates and discharges its load when rolled over as shown. It may be dumped on either side, and when in motion it is held in its upright position by means of a chain in each corner. This car is well adapted for the handling of refuse to the dump or for granular material to discharge on storage piles.

The bottom-dump cars in Fig. 16 are shown loaded with run-of-mine coal being transferred to furnace-supply hoppers. For large, coarse material such as accretions that are cleaned up around a furnace, cars with larger discharge gates must be used. A fairly satisfactory but somewhat clumsy design has large, hinged bottom gates that are wound up by means of chains and a ratchet device or simply pried up with a bar and secured by means of a catch.

The cars shown in Figs. 15, 16 and 18 are also suitable for the transportation of fine material that is wet or that is not too fine to be blown away by the wind, such as jig and table concentrates. Another form of such car is shown by dimensional outline in Fig. 19. It is larger than the others, having a capacity for 13 tons of concentrates, and it has two discharge gates to facilitate clean discharge.

Fine dry material that makes quantities of dust requires a car that is at least partly inclosed on top. A

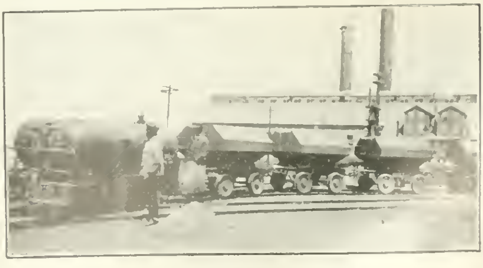


FIG 21. CALCINE AND DUST CARS

freely moving and at the same time tightly fitting discharge gate is also essential. Such materials as dried or calcined fine concentrates and flue dust require cars of this type. Figs. 20 and 21 illustrate the commonly used form of car. The top is not entirely closed, just enough of a hole being left in the top to enable the trainmen to spot the car under the loading chute without using time to attain accuracy. Fig. 22 shows a more recent and improved design in calcine cars. It has large capacity (about 15 tons net), is equipped with air brakes and pneumatic discharge gates and is of splendid construction throughout.

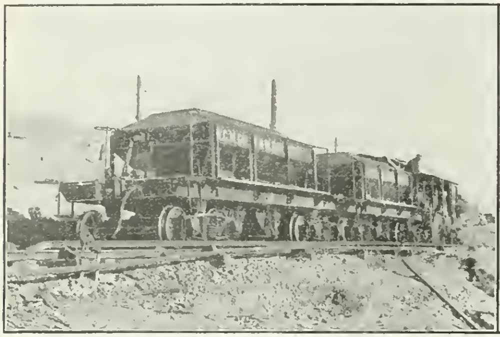


FIG. 22. 15-TON CALCINE CAR

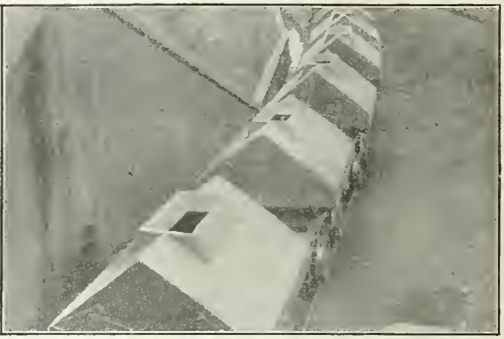


FIG. 23. REMODELED TOP OF CALCINE CAR

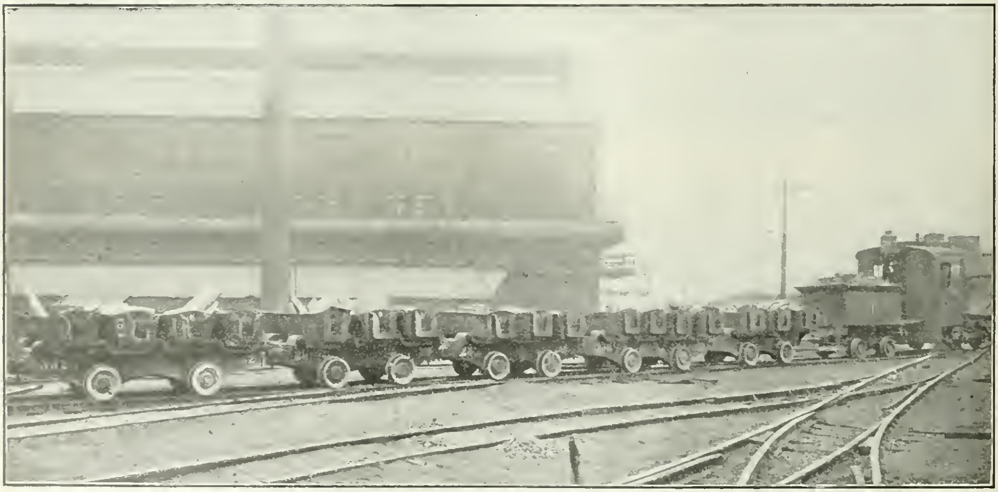


FIG. 25. OPENHEARTH CHARGING BOXES CARRIED ON SPECIAL CARS

The advent of flotation concentrates has confronted the smelteries with the problem of how best to transport such extremely fine material after it is dried or calcined. In the latter case it may have a temperature of 900° F. or more, and to say the least, it is very wild, as it will flow like water and find its way through the finest holes. In the loading and unloading of the cars dense clouds of choking fumes and dust are liberated, causing considerable discomfort to all persons in the vicinity and furthermore causing a loss of fines that is appreciable. To partly eliminate the dusting while loading the cars shown in Fig. 21, their tops were remodeled as indicated in Fig. 23. To overcome the disagreeable fumes made while dumping, the car shown in Fig. 22 has been remodeled with a new discharge gate that permits of its being telescoped by a vertically movable collar set in the closed top of the receiving bin or hopper over the smelting furnace.

Cars for the transportation of metals are usually designed to suit the particular needs of the individual service. Such cars generally take the form of heavy, massive trucks owing to the great weight and small bulk carried. A neat car designed to transport pigs of lead is shown in Fig. 24. The special charging boxes used in charging cold metals to openhearth furnaces are shown in Fig. 25. They are brought before the charging machine in trains of massive cars.

Molten smeltery products are handled in either lined or unlined vessels according to the cutting effect of the molten material on the shell of the vessel. Molten iron is handled in a brick-lined ladle car. Copper matte is handled in a somewhat similar ladle that is lined with clay or that may be unlined if made of heavy cast iron or steel and if operated in such a way that the iron is protected from the washing effect of the incoming stream of molten metal. Fig. 26 shows sheet-iron ladles that are lined with a thin coating of clay. These ladles have a capacity of 12 tons of molten copper matte. A different type of conveyance for molten matte is a large brick-lined tank car so arranged that the tank can be tilted to transfer a charge to a converter.

Fig. 27 shows a slag ladle of 300-cu.ft. capacity. It dumps by means of compressed air. Its whole chargé of 30 tons of slag can be instantly thrown over the dump, skull and all, leaving the ladle clean for the next trip.

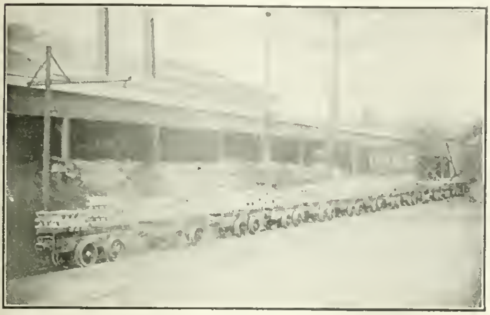


FIG. 24 CARS FOR LOADS OF PIG LEAD

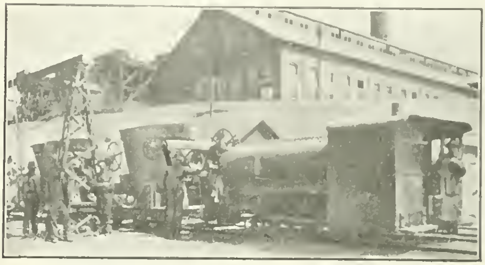


FIG. 26. LADLE CARS FOR COPPER MATTE

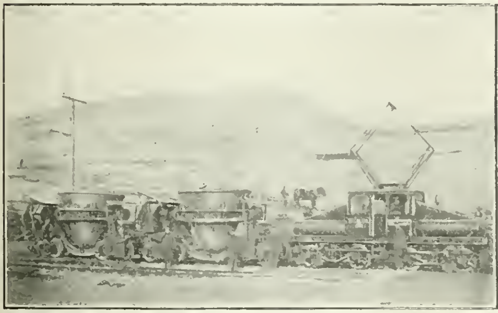


FIG. 27. 30-TON SLAG LADLES

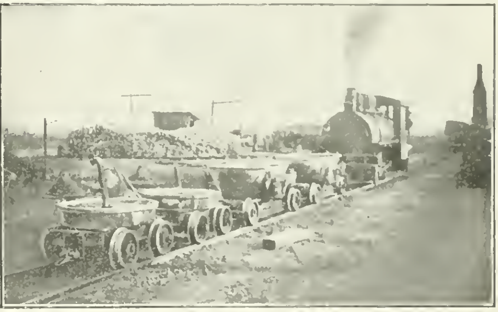


FIG. 28. SMALL BLAST-FURNACE SLAG LADLE

In contrast to this large apparatus are the small pots used at a lead works, which are shown in Fig. 28.

Operating Costs of Actual Installations

There is considerable variation in the cost of tramming a ton of material in different metallurgical works on account of the widely differing requirements of the particular smelting process, as well as the size and relative location of the smelting units. The cost of tramming will always be high in works in which materials are moved in small-sized units unless, as is sometimes the case, the haul is a fixed one with steady continual traffic and little or no switching. In the latter case the work may be so well defined and so free from complications that the operating cost may be even lower per ton than in the case of a much larger and complicated tramming system. Examples Nos. 2 and 5 in Table 1 show the decided difference in cost that results from the specific service requirements of each case. In the case of No. 2 the engine duty is greater per load and per day, the service being well defined, while in the case of No. 5 the service consists of the intermittent hauling in small units of furnace products at a lead smeltery. The latter has the high cost per ton of $0.099, and this is even more accentuated when figured in terms of per ton per mile, which is $0.196. A Utah copper-smeltery tramway, on the other hand, performs the previously mentioned service of disposal of furnace products for a cost of $0.0181 per ton and $0.0368 per ton-mile. Electric locomotives are used, and the material is handled in much larger units and in daily quantity about ten times as large as that of case No. 5, Table 1. These two cases probably illustrate the extremes that may be found in operating costs.

The cost of operating a gasoline-motor system in a metallurgical works could not be obtained by the authors. The cost account of a mining plant that had one gasoline locomotive in service was available, however, and some figures have been taken from it to show the haulage cost per ton-mile as given in Table 2. The figures given

TABLE 2. GASOLINE LOCOMOTIVE COST DATA

Gage of tracks, ft	3
Weight of locomotive, tons	7
Approximate cost of locomotive	$3,900
Number of locomotives in service	1
Number of cars in train	6
Weight of empty train including locomotive, lb.	25,400
Weight of loaded train including locomotive, lb	47,000
Average tons of material hauled per day	421
Average ton-miles of material hauled per day	105
Grades on haulageway, %	2 to 9
Scale of wages for train-operating labor, for 3 men	$10.80
Length of working day, hr	8

	Cost per Ton of Material	Cost per Ton-Mile Material
Actual train-operating labor	$0.0256	$0.1024
Repairs to locomotives, cars, tracks, etc.	.0060	.0240
Gasoline @ $0.21 per gal	.0064	.0256
Lubricating oils @ $0.28 and $0.50 per gal	.0021	.0084
Other operating supplies	.0012	.0048
Totals	$0.0413	$0.1[illegible]

indicate a fair tramming cost, especially so when one considers the small size of the loads and the severity of the grades.

As previously stated, tramming conditions are different at all metallurgical plants, and for that reason not only is it difficult to discuss comparative efficiency of the haulage systems in use, but also it is difficult to find costs that are fairly comparable. In concluding this paper, however, the best obtainable comparison of costs will be presented. Three plants, all of which are large Western copper smelteries employing quite similar metallurgical processes, have been selected for cost comparison. These three employ different tramming systems—one the steam locomotives, one the electric and the other the compressed-air. The first plant is in Nevada, the second in Arizona and the third in Montana. The comparative figures are given in Table 3.

TABLE 3 COMPARATIVE COST DATA OF HAULAGE SYSTEMS

	Steam	Electric	Comp. Air
Gage of track . .	Standard	Standard	Standard
Weight of engines	Largest, 17 tons	Small 13 to 17 tons, large 26 tons	15-17 ton 2-22 ton
Weight of train loaded	11-car train, 150 tons	20-car train, 75 tons	Average 90 tons
No. of engines in daily service	Six	13 small, 2 large	12 small, 1 large
Approximate cost of one engine . .	Large $4,000	Small, $3,500; large, $8,000	Small, $4,500; large, $6,000
Source of power . .	Coal	250-volt current from steam-driven generators	900 lb. compressed air by steam and electric engines
Durability of engines.	General overhauling once per two years	General overhauling once per two years	General overhauling once per year
Total tonnage hauled per day	3,955	3,120	14,124
Total tonnage per mile per day. . . .	2,530	1,773	7,570
Cost of engine upkeep per day. . . .	$6 84	$9 86	$3 60
Power cost per engine day	$0 80 (coal)	$4.52 (electricity)	$14.25 (comp. air)
Total tramming cost per ton	$0 0551	$0 0526	$0 0640
Cost per ton-mile.	$0 086	$0 0926	$0 1194

Copper Queen Reduction Works

The present equipment of the Copper Queen Reduction Works, situated about a mile west of Douglas, Ariz., includes 10 blast furnaces, 3 reverberatory furnaces, 9 converter stands of the 12-ft. vertical type, and 16 MacDougall 18-ft. multiple-hearth roasters. The plant is built on a flat site, making easily possible the large additions which are contemplated. The present capacity is nearly 4,000 tons of ore or 4,500 tons of charge per day, and about 1,000 men are employed.

The average charge is made up of ores, 72.7%; concentrates, 9%; limestone, 1.5%, and secondaries, 16.8%; the mixtures being made in pits, from which the charge cars are loaded by means of steam shovels. On a basis of 4,146 tons of charge smelted per day by the entire plant, the average charge smelted per furnace day was 374.8 tons, yielding an average of 229.57 tons of bullion per day, or 20.84 tons per furnace-day. The movement of charge was at the average rate of 6.1 tons per man per shift.

The blast furnaces, of which 5 are 240x44 in. and 5 are 216x44 in., take a charge made up of approximately 82% of ore, 16% of secondaries and 2% of flux. To the charge is added 12% of coke, carrying 79.7% of fixed carbon and 18.2% of ash. The flue dust produced represents but 3.84% of the charge, the values carried being Au 0.031 oz., Ag 1.44 oz., Cu 7.30% and S 10.1%, as against Au 0.026 oz., Ag 1.25 oz., Cu 6.97% and S 12.8% average in the original charge; while the slag carries but 0.46% copper and 0.06 oz. of silver per ton. The matte produced contains Cu 37.6%, Fe 31.7% and S 25.6%, with Au 0.165 oz. and Ag 6.80 oz. per ton.

The roasters handle material consisting of concentrates 55% and crushed ore 45% of the charge; while the reverberatories treat a mixture of calcines, blast-furnace flue dust, converter flue dust and ores for fettle, comprising respectively about 80%, 19%, 0.4% and 0.6% of the total.

Oil fuel is employed to the extent of 76 bbl. per ton of charge, the feed being introduced at a temperature of 175° F. and at a pressure of 75 lb. per sq.in. The converters are basic-lined and average 43.23 tons of matte per blow, with a yield of 13.11 tons of bullion. The blast pressure employed is 13 lb. per sq.in., the consumption of air being 268,146 cu.ft. per ton of bullion.

The average analysis of ore treated by the plant is as follows: Cu, 9.13%; SiO_2, 56%; Fe, 8.1%; CaO, 1%; Al_2O_3, 8.4%; S, 6.1%; with Au, 0.075 oz. and Ag, 3.46 oz. per ton. The bullion produced assays 99.24% copper, with 0.387 oz. gold and 19.47 oz. silver per ton.

American Pig Lead

The accompanying table gives a series of analyses from authoritative, original sources, of representative American brands of pig lead at the present time. It is not, however, considered advisable to identify the brands, but simply to group them according to class.

The first class, which we have designated as "extra-fine" is a grouping of our own, including lead that is 99.97% fine or better. In certain cases these leads are produced by extra-refining, including electrolytic refining; in other cases they owe their high purity to the excellence of the ore from which they are smelted. These leads are sold for corroding, but also they fill some special needs for which lead as nearly chemically pure as possible is required.

Ordinary corroding lead is about 99.95% fine.

Ordinary desilverized lead ranges from about 99.85 to 99.91% Pb.

Common Missouri lead (southeastern) is rather uniform with 99.90 to 99.92% Pb, or about the same as ordinary desilverized. The main differences between these classes of lead are the higher copper in the Missouri and in some cases the higher antimony in the Missouri lead, which renders it slightly harder and especially adapted for the rolling of sheet that is to be used in chemical work.

RECENT ANALYSES OF AMERICAN PIG LEAD

	Extra Fine						Ordinary Corroding	Ordinary Desilverized			Common Missouri			
Silver . .		0.0008	0.0004		0 0005		0.0003				0.0006	0.0106		0 0070
Arsenic .		none	none	0.0050	none	0 0010	0 0006		0.0003		0 0008	none		trace
Antimony .		0.0130	0.0028	0.0040	0.0077	0.0100	0.0045		0.0046	0.0060	0.0056	0.0132		0 0030
Tin. .														
Bismuth. . .	0 0080	0 0032	none	0.0025	0.0040	0.0100	0.0500	0.0800	0.0794	0.1200	0.0750	none		0 0030
Copper . .		none	0.0002	0.0010	none	0.0015	0.0006		0.0010		0 0006	0.0600	0.0800	0 0600
Iron.		0 0010	0.0007		0.0010					0 0045		0 0060		0 0015
Zinc . . .		0 0019	0 0005		0.0014			0.0040	0.0008	0 0040		none		
Cobalt and nickel. . .		none	none		none							trace		0 0080
Lead.	99.9700	99.9801	99 9941	99.9875	99 9890	99.9775	99.9440	99.9050	99.9135	99.8655	99.9174	99.9102	99 9032	99.9175

Comments and Speculations on the Metallurgy of Zinc

By W. R. Ingalls

SYNOPSIS—A discussion of the details of zinc metallurgy and some of the improvements that may be realized. Zinc burning and fume collecting are touched upon, and the merits of roasting furnaces are considered. Improvements in distilling furnaces and in retort making are suggested.

This article is aimed to be a commentary on some things that are and a speculation respecting some things that are not—yet—but may be. I am expressing myself quite frankly about a good many things and quite positively about some, and I anticipate that there will be many metallurgists who will hold different opinions. If I succeed in directing thought in certain directions, even to be contradicted and disproved, I shall at least have done all I intended.

Electrolytic Zinc

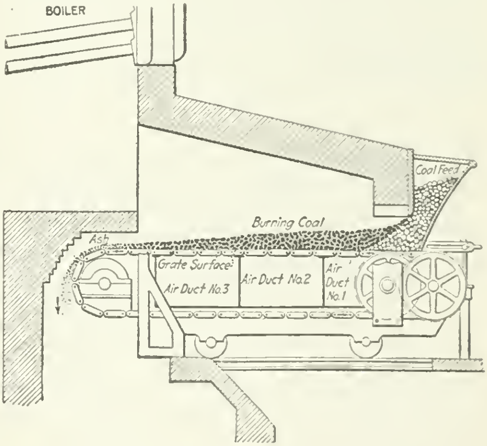
The new thing that is most engaging attention now is hydrometallurgical-electrometallurgical extraction. I believe that this new process has come to stay—that some of the concerns committed to it will be able to meet the smelters on the severest terms. But it is not going to be revolutionary. It is not going to put the smelters out of business, for it is only under favorable conditions that the process is going to be commercial. These conditions are chiefly cheap power, high silver and lead contents of the ore and good extraction of the zinc. No one company is likely to have all these at their maxima, but there will be a fair number that can strike a good general average. I put less emphasis upon direct zinc extraction than I used to, for it has become clear with progress in the art that undissolved zinc may be burned out of the residue from lixiviation, but that adds to the cost of the process as a whole, and high zinc extraction by direct leaching is to be aimed at as much as ever.

Zinc Burning

The treatment of this residue is an interesting problem that nobody has yet worked out, simply for the reason that it has had to be put aside amid more pressing problems. Given an ore that is yielding 83% of its zinc, the residue may assay about 20% Zn, but will be, perhaps, only about one-third of the weight of the original ore. The first idea is to dry this mud, mix it with fine coal and burn off the zinc on a Wetherill grate. This will give a fume that will go back into the electrolytic process and a sinter that will go to the lead-smelting furnace, the silver content going partly with the fume, partly with the sinter. Another idea is to smelt directly in a reverberatory furnace, cooling the gases therefrom and collecting the zinc fume. Still another idea is to smelt in an electric furnace, which is easy if the zinc is to be collected as oxide. With an electric furnace the volume of gas to be filtered would be at the minimum and cooling flues and filtering bags would be much smaller than in other cases. Any of these things can be worked out. It is simply a question of what is the cheapest.

Speaking of Wetherill grates, there is being a good deal of attention given to the use of them for burning off zinc simply as a method of concentration. This is an easy process where no attempt is made to collect the zinc oxide of the requisite whiteness for pigment. Our zinc smelters are doing this to win zinc from the residues discharged from their distilling furnaces. Those residues contain so much unburned coal, which is utilized on the Wetherill grates, that it is a cheap process and one that is commercially worth while. Yet it is rather a severe reflection on our distilling that it is worth while. It is something like building a fine dressing works and having a lot of scavengers recovering mineral by buddling the tailings downstream.

The weak point of the Wetherill grate is the manual labor required in running it. It is about the same now as 50 years ago, except that its dimensions have been altered to more favorable measures and in some works it has been elevated, so that less labor is needed in handling the residuum. I wish that someone would try mechanicalizing the Wetherill grate. The process is nothing more than the burning of fine coal with a partly volatile ash. The burning of fine coal is done on several forms of traveling grate. One is shown in the accompanying illustration. I can readily imagine something of that sort being used for zinc burning.



SECTION OF STEAM-BOILER STOKER SHOWING A CONTINUOUSLY MOVING GRATE

Fume Collecting

The first thing is to cool the gases. When done as commonly, by passage through iron pipes, they have to be very long to get the necessary superficial area. Why not pass through steam boilers or arrangements like fuel economizers and recover much of the heat in useful form, besides doing the job in a more compact, more efficient plant? I understand that the River Smelting and Refining Co. is working this out at Florence, Colo. Of course there will be problems in preventing deposition of the dust and fume in the coolers, especially around the pipes, but they can be solved.

After the gases have been cooled, the next thing is to filter them. The baghouse is the conventional thing, and there is no doubt respecting its economy and efficiency. This is not to say that it cannot be beaten. Even now Simon, Buhler & Baumann are introducing an automatic, mechanical bag-filtering machine, which is being tried at Palmerton, Hillsboro and Bartlesville. It is much more compact than the ordinary baghouse and is claimed to be much more economical in operation, as certainly it ought to be if the upkeep be not too high.

Who can say what part the Cottrell system may not play? What is the reason for the difference of opinion about it at present? At the International smeltery at Miami, Ariz., it works with as near perfection as anything can. At Florence, Colo., where it is being used in connection with the zinc burning, it is an object of "cussing," I understand. Someone—I have forgotten whom—has told me, on the other hand, that for settling zinc-lead fume it is fine; that even the lead and the zinc fume can be precipitated separately. I am inclined to think that at Miami they know what they are doing, and that in other places where the Cottrell system is not acting well, probably it is not being managed properly. I believe the Cottrell system will be a useful thing in the metallurgy of zinc.

Roasting Furnaces

Our zinc smelters ought to show some enterprise about roasting furnaces. Where acid is not being made, they use the Brown, Ropp and Zellweger—all dating back nearly 20 years in design and all wasteful of fuel, although fairly economical mechanically. Where acid is being made, the Hegeler furnace is the one idea, barring a few recent examples of the Spirlet. The Hegeler furnace is nearly the same now as it was when it was introduced (about 1882). It is built larger and more substantially, but otherwise the improvements are only in minor details. It is clumsy and only semimechanical. Its intermittent rabbling is a bad feature if the ore that is being roasted has any tendency to sinter. In that case there may have to be a considerable gang of men all the time on the job of chiseling off the hearths, which is not good either for the hearth or for the gas-strength or the cost sheet. The furnace is of rather staggering first cost. A complete unit—gas-producer, furnace, house, dust-catcher, chimney, etc.—costs about $125,000. This roasts about 50 tons of ore per day if it be good; maybe only 40 tons if it be sintery.

The Spirlet is a good furnace, well worth trying. It comes in small units, which often is an advantage. It is economical of fuel and gives a strong gas and continual rabbling of the ore. However, it also is costly; that is, in proportion to its capacity.

The Merton is a furnace that has not received the attention it deserves. In principle it is all right, but there may be some mechanical details that will have to be tested by experience. So far as I know, only one set of Merton furnaces has ever been erected at a zinc works on this continent, and at it they were run only a few days, after which the works failed; but Mr. Jones has put them in at the new smeltery in Siberia. This ought to be a particularly good furnace for those smelters who do not want to make acid.

Another furnace that should receive very respectful attention is the Wedge, which is illustrated elsewhere in this issue. The Wedge is one of the most successful of all furnaces for roasting copper and lead ores. It is now being used widely for roasting zinc ores as preliminary to lixiviation. The task asked of it for that purpose is not quite so severe as roasting preliminary to distillation, but I fancy the latter can be done and the Wedge furnace people, who know their business, would be glad to help the thing along and would see it through. Some of our zinc smelters ought to have the nerve to try it and stay with it.

The ideal blende-roasting furnace has continuous rabbling, low hearths, thick walls, air-cooled stirring mechanism and a return of the hot air to the lowest hearth. If heat can be recuperated from the chimney gases and returned to the furnace, so much the better perhaps. The correct theory is to conserve heat in the first place, and in the second place to take it away from parts of the furnace where there is a surplus and put it back in parts where there is a deficiency. I have seen Hegeler furnaces operated with preheated air and getting too hot on some of the hearths, so the preheating had to be cut out; but manifestly the system was radically wrong when that had to be done and when coal to the amount of 20 to 25% of the weight of the ore still had to be burned. I believe that the correctly designed blende-roasting furnace will desulphurize ore to 1% S with the use of only 5% coal, perhaps less. Even now the Delplace and Spirlet furnaces do it with less than 10%. Of course I have good coal, 7,000 calories or upward, in mind. When lump blende is burned in a stall, the combustion ceases in about 48 hr. It is not sufficiently active to overcome the insweep of excess air and the loss of heat generally. The old Gerstenhöfer kilns used to burn fine blende down to about 5% S autogenously. They were built in blocks and had only one side and a small top exposed, so conservation of heat was good and air supply was well controlled.

Distillation Furnaces

In the matter of distillation furnaces there is as much uniformity among American smelteries as there is with respect to roasting furnaces. At Pueblo, Colo., there are some Overpelt-Rhenish furnaces. At Peru and Depue, Ill., the furnaces are Siemens-Belgian. At Palmerton, Penn., are the only examples of counter-current recuperative furnaces, the design of their laboratory and superior structure being along Belgian lines. Everywhere else the furnaces of the United States are Hegeler-Belgians[1], designed either for producer-gas or natural-gas firing, with the necessary modifications according to the fuel. With the Hegeler-Belgians fired by producer gas, in most cases the products of combustion are conducted through properly designed steam boilers on their way to the chimney. When there is a demand in the plant for a great deal of power, as at Peru, La Salle and Donora, this is a very good method of heat recuperation. When the furnace is credited with the coal equivalent of steam generated, the consumption of coal for smelting is reduced to a relatively low figure, but I question the validity of some of the phenomenally low figures that are talked about. In order to dispose of the combustion gases by means of a chimney, a certain minimum temperature is required. If in reducing them to that minimum temperature the surplus heat is recuperated either in the form of steam or in the form of preheated air to be returned to the furnace itself, assuming losses by radiation, etc., to be the same in each case, the thermal balance is the same; that is, one method is as good as the other and the determinative factors will be first cost of plant and other things. As a general principle, however, it is best to get the maximum work out of a particular furnace, machine or process and not to try to do two or three different things imperfectly at the same time.

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[1] Except, of course, some relicts of the old simple Belgians that survived before the outbreak of the war and those that have since been built for ephemeral operation.

In Europe the Rhenish furnace of one variety or another is becoming the predominant type. The sharp cleavage between European and American practices in distillation furnaces is remarkable. The Europeans have never been interested in our Hegeler-Belgians, while we have never built any Rhenish furnaces except those at Pueblo, which were erected by Overpelt engineers, the firm of Beer, Sondheimer & Co. being at that time interested in the Pueblo plant. Some of our most experienced metallurgists who have been connected with the administration of the Pueblo plant have conceived a strong prejudice against its furnaces. Nevertheless, I am convinced that the Rhenish furnace should receive more respectful consideration by some of our smelters who are operating plants where conditions are favorable to it. Among other things, we ought not to be so complacent about a loss of 2% of zinc, or so, because the taking off of prolongs for our three daily drawings of spelter does not comport with our labor conditions.

The dream of a good many zinc metallurgists for 50 years was to manage to smelt zinc ore in a blast furnace. We are pretty sure now that it cannot be done—that it involves things that are contrary to a law of nature. The next best thing, probably, would be to smelt in vertical retorts; that is, to turn the retorts of our present furnaces from their approximately horizontal position to the vertical. This would greatly reduce the labor of the maneuver—the discharging and charging of the retorts—which is the principal part of the labor requirement in distillation. Instead of ore having to be thrown into a small cylinder, a job that requires extraordinary dexterity, the charge would simply be dropped in; and similarly the residue would be dropped out instead of having to be raked or blown out.

Vertical retorts were the very prototypes of our furnaces (see the primitive Chinese furnaces, the early English furnaces and the Carinthian furnace, the last being a contemporary of the first Silesian furnace). A good many metallurgists tried to modernize the Carinthian furnace, increasing the size of the retorts, improving the arrangement, etc., but nothing useful was accomplished. The charge gave trouble by hanging in the retorts, the gas and vapor could not escape properly, etc. The old difficulties have been completely overcome and, moreover, the reduction of charge has been made a continuous process by the Roitzheim-Remy furnace at Hamborn (Westphalia) if we may rely upon Mr. Liebig[2], and certainly he is a high authority. Unfortunately his article does not give a drawing of the furnace. He describes mechanical features and the method of gas firing, general operation, etc., but not the thing we should most like to know about; namely, the connection of the condenser to the retort. In some of the Roitzheim patent specifications a series of side outlets from the retort by means of upwardly slanting holes—an entirely logical arrangement—are shown. Is this a feature of the furnace at Hamborn? Anyway, it may be accepted from Mr. Liebig that the continuous smelting of zinc ore in a vertical retort is an accomplished fact, and the development of the Roitzheim-Remy furnace should be watched carefully.

BRIQUETTING

One of the great problems that confront the zinc smelter is the distillation of excessively fine ore, such as he gets from the flotation mills. Excessively fine stuff is not the best material with which to fill a retort. It is bulky, reducing the retort capacity. The gas and vapor cannot readily get out of it. The heat is checked in getting into it. The time is coming when flotation concentrate will be the smelter's main supply of ore, and then he will have to master the problem of it. (Incidentally, this thing does not bother his electrolytic rival, except in the matter of roasting, which is common to both.)

One of the things that ought to be thought about is briquetting. Parker C. Choate has lately been doing some work on this subject, especially with a view to the direct decomposition of zinc sulphide by lime. The chemistry of that reaction is not new. Prost long ago showed that lime decomposition of zinc sulphide took place about as easily as carbon reduction of zinc oxide. This idea does not, however, appeal favorably to the zinc smelter. In the first place he wants to free his sulphur in the easiest possible way for sulphuric-acid manufacture, and in the second place he wants to smelt his retort residue for silver and lead and does not want to have it messed up with calcium sulphide. But Choate's main idea is to make a very dense briquette under great pressure, making a mechanical compound of ore and carbon that will have practically the physical properties of an artificial mineral, which he does by a process of his invention, and there may be something in that which is worth trying. The intimate contact of ore and reduction material, the good heat-conducting property of the compound and the ability to get a suitable granularity of charge, even out of excessively fine material, embody principles that are correct.

The preparation of briquettes merely for charging in the form of cartridges, the revival of an ancient idea that is now having some vogue, is an entirely different affair. There are some good features about the notion of charging in that way, but the difficulty is to get the charges into the retort after it has crusted up with slag.

RETORTS

American smelters should give much more attention than they do to the manufacture of their retorts. Consider first the matter of clay supply. Everybody uses the St. Louis clay. Good clay is getting scarcer and scarcer and the quality of what is available is running down. Who is doing anything to find new clay supplies? Surely there are in this great country deposits of other clays that are suitable for retort manufacture, and probably there are a good many that are better than the St. Louis clay if somebody would only try to find them. The St. Louis clay is not such a wonderful product anyhow. We keep on using it because it is plastic, because all the pottery men are used to it and because it has been proved by long experience to be well adapted to making retorts for relatively gentle use. But if we should drive our furnaces up to 1,550° C., as the Europeans do, our retorts would fall down (and maybe our furnaces also), wherefore we conduct operations more moderately and are now thinking about turning the retort residues over to Wetherill grate burners to expel the zinc that the distillers have failed to do.

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[2] "Metall und Erz," Mar. 22, 1916.

But taking the clay that we have, we are not very careful in the making of the retorts. Nowadays everybody of consequence uses the Dor hydraulic press (or one of its derivatives), which we borrowed from Europe. The standard installation comprised a pug-mill, a hammering machine and the press. Some of our smelters, in their desire to cut out "unnecessary frills," have discarded the hammering machine. They cut off a sausage from the pug-mill and dump it into the press. The sausage is not dense, it may be decidedly imperfect, but in it goes with its included air, which within the confines of the press is bound to concentrate, under the pressure, in bubbles and blisters. Nobody is going to make good retorts in that way. The hammering machine, or its equivalent, the kneading machine (preferred by some), is an essential part of the plant, in order to make dense blocks of the proper shape for the press.

In the seasoning rooms, heated by steam pipes under the grated floor, there is moisture to be gradually eliminated. For this there is required a certain supply of air and there must be means for the exit of what is introduced, the moisture going with it. Some of the more modern potteries are designed with a recognition of this simple idea, but a good many exist that are constructed on the principles of a barn. A thermometer for temperature control is generally to be observed, but rarely a hygrometer for control of the humidity. Yet the cigar and tobacco men use them. We shall see the time when we shall make and use our retorts without so much guesswork.

PREREDUCTION

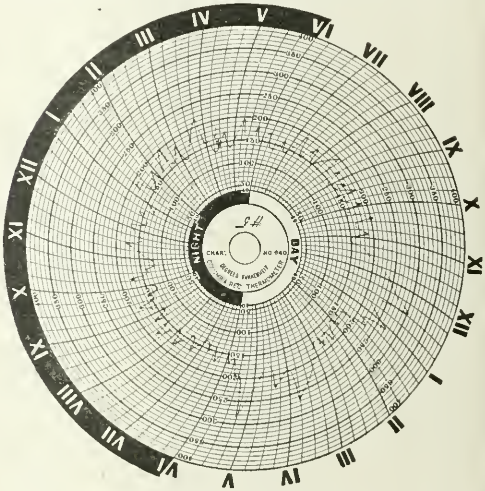
It seems to me that Mr. de Saulles struck an important line when he tried prereduction of his charge before putting it into the retort. The distillation of zinc ore is a stage process. First come off the hydrocarbons of the coal, then the metallic oxides other than zinc begin to be reduced, giving off carbon dioxide as a reduction product, which reoxidizes zinc when the reduction of zinc oxide begins. This is a powerful influence in the formation of blue powder, which occurs chiefly in the early period of distillation. It is not so fatal in the ordinary method of smelting, just by reason of its intermittency, as it is in any continuous process. In the latter it is essential that the preliminary reduction be performed in a separate furnace if excessive blue powder is to be avoided, and electric zinc smelters found that out, just as Salgués indicated they would many years ago. Also, let it be noted that in the Roitzheim-Remy continuous furnace, to which reference has been made, the charge is said to be preheated, by which I assume that prereduction is meant. Now, while that is not so crucial a matter in ordinary, intermittent smelting, it is nevertheless a matter of considerable moment, as Mr. de Saulles has shown. This idea is worth following.

I have elsewhere discussed the troubles that zinc smelters have been experiencing with regard to the sampling of their spelter slabs. By reason of the nature of their process they cannot insure uniformity of product when they draw spelter into small kettles and cast directly from them. European smelters use large mixing kettles. We have got to do something like that or else remelt the spelter in a reverberatory furnace, as the sheet-zinc rollers do, and recast from that. This is a subject to which American zinc smelters are bound to give attention. The electrolytic producer is free from this problem, for he has to remelt his cathodes anyhow.

The Regulation of Blast Furnace Feeding

By L. D. Anderson*

In the feeding of practically all types of blast furnaces regularity is a *sine qua non* if good work is to be obtained. This is particularly true of silver-lead furnaces. There is considerable temptation for feeders to fill up furnaces quite high and then sit or lie down for a good long rest. In order to prevent the irregularities resulting from this practice, many expedients have been resorted to by various superintendents.



A TEMPERATURE RECORD SHOWING THE VARIATIONS CAUSED BY FEEDING

Perhaps as common a means of watching the furnace work as any is the observation of the blower revolutions when the blowers are steam-driven and pressure is maintained by speed variations. If furnaces are allowed to get unduly low, the blowers will speed up, and vice versa. Hourly or half-hourly records of blower revolutions are often enlightening as to what is going on at the furnaces. As a measure of the regularity of feeding, however, they are not quite satisfactory, for a change in the character of the charge from coarse to fine will slow down the blowers, and so on. Knowing that the charge columns are maintained at the correct heights, the blower revolutions are then really indicators of the character of charge being fed.

When the charge cars are electrically propelled, a recording ammeter on the tramway circuit will show just how frequently charges were delivered. Electrical devices have been used that make marks on revolving charts every time charges are dropped. One of these on each furnace is better than the ammeter on the whole circuit, as with such an installation each individual furnace can be kept track of.

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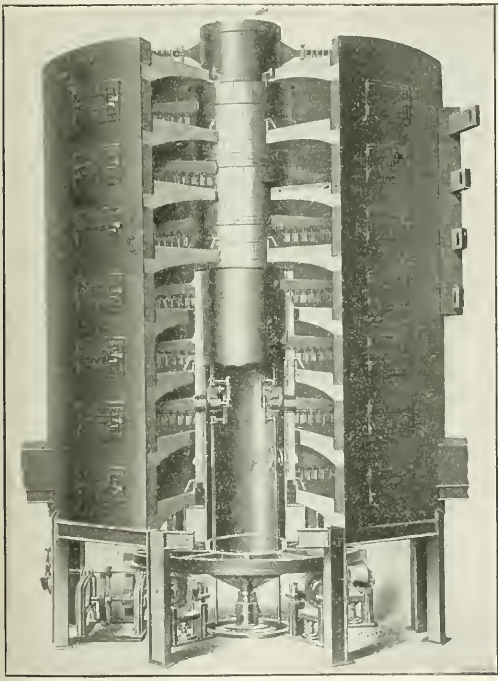
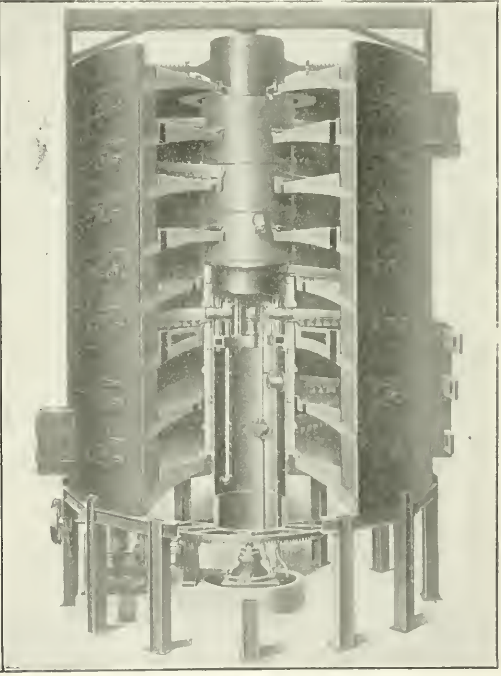
*Superintendent, United States Smelting Co., Midvale, Utah.

One drawback to these devices is that they do not give feeders proper opportunities for exercising their judgments. In the effort to make regular records the slow or the fast running of the furnaces may be disregarded, and instead of charges being dropped as needed by the furnaces, they may be dropped at such times as will appear well on the recording charts.

To overcome the objections to the systems of recording furnace feeding described, a new one has lately been devised. This is the use of a recording thermometer in the blast-furnace downtake. Every time a charge is dropped, there will be a sudden drop in the temperature of the downtake gases. These drops will make sharp indentations on the curve of temperature. With such a chart before him, the blast-furnace superintendent will have a clear record of exactly when charges were dropped and whether they were put in at the proper times as indicated by the general temperatures of the furnace tops. In addition the temperature record sheds much light on the actual performance of the furnaces themselves. "Hot tops" and "cold tops" are at best rather vague terms. Far better are true records of actual temperatures. If to these are added also records of blower revolutions, slag and matte analyses, and tonnages, the experienced blast-furnace man should have close control upon his operations.



WEDGE LEAD ROASTER



WEDGE ZINC ROASTER

Wedge Roasting Furnaces for Lead Matte and Zinc Ores

In the last five or six years, besides the general use to which multiple-hearth furnaces of the Wedge type have been applied, two new fields have been invaded—the preroasting of lead matte and of zinc ores. The following information regarding these applications is supplied by the manufacturers, the Wedge Mechanical Furnace Co., of Greenwich Point, Philadelphia, Penn.

Avoids Fusion of Lead Matte

Prior to the use of the Wedge roaster, lead matte was roasted either in hand furnaces or in mechanical furnaces of the single-hearth type. Both the hand and the mechanical furnaces required the use of fuel, from 10 to 12% being average practice. In the Wedge multiple-hearth lead-matte roaster the heat units are conserved, but the temperature is kept within control and fusion is avoided; in consequence, lead matte is pre-roasted in this furnace without the use of extraneous fuel, the operation being finished on the Dwight & Lloyd sintering machine.

Close Temperature Control Needed for Zinc Ores

In 1910-11 a modification of the Wedge furnace was tested for the roasting of zinc ores and concentrates. This did not prove satisfactory either to the operator or to the manufacturer. However, work on the problem was continued, with the result that today there are about [illegible] Wedge roasters, either in operation or being constructed for the purpose of roasting zinc ores. In the zinc roaster the manufacturer utilized the experience gained by [illegible] lines—having to do with high temperatures, also with the conservation of heat units, and maintaining at the same time all conditions under control. As has been known, a large percentage of zinc ores and concentrates will, under proper furnace conditions, auto-roast to a certain sulphur content. This content will vary with the ore being roasted, but averages around 3 to 5%. To eliminate this last 3 to 5% of sulphur, where it was desired to use all the sulphur gases for acid production, naturally resulted in the use of various muffle-fired furnaces. Since greater economy in fuel can be obtained by direct firing, it seemed desirable to avoid, as far as possible, the use of muffles. This idea has been carried out in the Wedge zinc roaster.

In the five upper hearths the ore is auto-roasted. Between the fifth and sixth hearths there is one muffle which assists in eliminating the sulphur for the production of acid to what appears to be the lowest commercial point. In addition to this muffle, provision is made for direct firing on the sixth and seventh hearths. The gases of the five upper hearths are up-drafted, and the gases of the two lower hearths are down-drafted, suitable automatically luted dropholes preventing the passage of combustion gases from the lower part of the furnace to the upper. The arms of the five upper hearths are air-cooled, and the warm air from these arms is used for drafting the upper part of the furnace. The arms of the two lower hearths are water-cooled, permitting direct firing on these hearths, without any serious mechanical difficulty with the arms. The furnace is also built without a muffle, and direct-fired on the two lower hearths, for use in districts where the sulphur gases are wasted. In this roaster the combustion gases pass up through the furnace, being taken off at the top.

Since conditions obtaining in the roaster, with control over the quantity of air admitted, and with reasonable control of temperatures, do not favor the formation of any large percentage of sulphates, the excessive temperature required for breaking up the sulphate, as experienced in other types of roasters, is avoided, being another factor tending toward economy of fuel.

GENERAL FEATURES OF FURNACE CONSTRUCTION

The accompanying illustrations show in part-sectional elevation the two types of furnaces under discussion. So many descriptions of the Wedge multiple-hearth roasting furnaces have been published from time to time that little need be said regarding general construction. The striking characteristic is the central shaft, which is hollow, open at top and bottom, about 5 ft. in diameter and insulated with fireclay tile, the construction being similar to the brick-lined shell of the roaster. This construction is desirable, for several reasons. Primarily it eliminates a disturbing cooling medium in the heart of a furnace; it makes possible the fastening of the arms on the inside of the shaft, where the locking device is not exposed to the heat or gases of the furnace, and is accessible, even in a hot furnace; further, it permits of providing independent air- or water-pipe connections to each arm, with positive control over the quantity of air or water admitted to each arm, thus making it possible to have some of the arms water-cooled and some air-cooled. The entire construction lends itself readily to various modifications which practice has indicated are desirable for roasting ores of different character.

Among the various applications to which the Wedge multiple-hearth furnaces have been adapted are: Roasting of gold ores for cyaniding; partial roasting of copper ores for reverberatory treatment; drying and preheating of concentrates for reverberatoy furnaces; sulphatizing copper ores for leaching; roasting cupriferous pyrite for the production of a rich gas to be used in the production of sulphuric acid for the leaching process (furnaces of this type are in commercial operation, delivering a sulphur gas that will average above 13% SO_2, with a negligible quantity of SO_3); roasting of pyrrhotite ores without the use of fuel; dead-roasting iron ores; roasting in connection with the chloridizing treatment of silver ores and of copper ores. In fact, there is hardly any type of roasting plant in which these furnaces have not found application.

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Blast-Furnace Slag Shells

By CURTIS PIGOTT*

One of the recent noticeable changes in practice of American lead smelters is the abandonment of the use of slag shells on the charge. Practically ever since the beginning of lead smelting in the United States, the best practice has been to allow the filled slag pots to cool for a few minutes before being tapped and then to return to the charge all or a large portion of the shell of slag that remains in the pot after the molten slag has been run to waste.

There are three distinct and separate reasons for this return of slag shells to the blast-furnace charge. In the first place these shells are coarse and keep the charge more open. Secondly, they have been smelted once and are more easily fusible than any similar mixture of unsmelted ore and flux. Thirdly, and most important of all, the shells and bottoms, which are left in the slag pot, contain any small shots of matte or lead that have escaped the settler, besides containing a considerable amount of metal that has been carried into the slag and is combined with the slag, but tends to concentrate to a greater or less degree in the shells.

The physical nature of blast-furnace charges has a most important bearing upon the speed of smelting and the condition of the shaft of the furnace. Until within a few years blast-furnace charges were composed of rather fine carbonate ores and a fine-roasted ore from hand reverberatories or other roasters that were only able to roast the ore, but could not sinter it and make a product that was coarse enough not to tend to make a charge that was very fine physically. Thus it was necessary to add some coarser material to the furnace to make the charge more permeable to the blast and so to increase the speed of smelting. Slag shells accomplished this work very well, as they were broken to any desired size and were easily melted again in the furnace. With the use of Dwight-Lloyd sintering machines the majority of smelting plants have been able to produce a roast that is as coarse as slag shells and almost as easily melted, owing to the incipient fusion of the sinter on the machines.

As to the carrying off of drops of matte and lead in the slag, it is rare today to find a large smeltery that is exposed to the loss of matte and lead through the carrying away of shots in the slag. This has been accomplished by the use of larger forehearths and a more careful handling of slag and matte. It has been generally agreed, however, that the shells from the slag pots will contain about half again as much value as the slag from which they came, and this fact has been one of the determining factors in favor of the use of slag shells.

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*Metallurgist, in charge of blast furnaces, United States Smelting Co., Midvale, Utah.

The idea of running lead blast furnaces without the use of returned slag shells on the charge has been considered in several different ways by the managements of different companies. One of the large producers started its smeltery with the assumption that the use of slag shells was not economical. Another plant spent several months determining the effect of eliminating slag shells from the charge. The management of this smeltery finally discontinued the use of slag shells after it had doubled its settler capacity, putting in two forehearths where there had been but one before. With better settling arrangements this smeltery could save enough fuel and value to more than pay for the loss in the shells and the added expense of the extra forehearth. This plant found that the use of slag shells called for about 1% more coke.

Another large smeltery in the West deliberately took the shells off the charge of one furnace and then sampled and assayed the shells from this furnace and compared the results with the assay of shells from furnaces using slag shells on the charge. The results were a great surprise, as the shells from the furnace using no slag shells contained very little more value than the run of the slag, while the shells from the furnaces using shells contained two or three times as much metal as the run of the slag. This experiment, after being tried repeatedly, convinced the management that the shells contained somewhat higher values than the wasted slag, but that these values were not reclaimed by resmelting but ran through the furnace unaltered, and in fact, tended to concentrate in the shells. It was concluded that, with the use of slag shells the shells reclaimed would undoubtedly seem to be very valuable, but that when the shells were taken off the charge, the shells in the slag pots immediately lost their comparatively high metal content and contained very little more metal than the molten slag in the pot. Each of the experiments was continued for several weeks, so that the results would give a normal average and eliminate any peculiar condition or freak sample. In the first experiment the shells from the furnace with no shells on the charge assayed 0.65 oz. Ag, 0.23% Cu, 0.75% Pb and 1.9% S. At the same time shells were sampled from the other furnaces that carried shells on the charge. These shells assayed 1.8 oz. Ag, 0.25% Cu, 2.33% Pb and 1.7% S. The second experiment gave shells as follows:

COMPARISON OF SLAG SHELLS

	Ag Oz.	Cu, %	Pb, %	S, %
No shells on charge	1.0	0.15	1.60	1.3
Shells on charge	3.4	0.50	2.40	1.7

The third experiment was conducted with the idea of assaying the bottoms of the shells separately from the sides and the samples assayed as follows:

VARIATIONS OF SHELLS AND BOTTOMS

	No Shells on the Charge			
	Ag Oz.	Cu, %	Pb, %	S, %
Shells	1.1	0.20	1.5	1.4
Bottoms	1.6	0.30	1.6	1.4
	Shells on the Charge			
	Ag Oz.	Cu, %	Pb, %	S, %
Shells	3.8	0.32	3.6	1.3
Bottoms	2.0	0.40	3.3	1.5

These three experiments all point to the fact that the values in the shells are not released by smelting, but tend to concentrate in the shells if they are charged back to the furnace again.

In conclusion it must be borne in mind that there is a considerable saving to be effected by the abandonment of the use of slag shells. In the first place the labor of breaking up the shell and then feeding it back to the furnace is quite an item and in some large smelters requires three or four men a shift for four furnaces. Also the saving in fuel is fairly large. Contrary to the old idea that a certain percentage of shells can be added to a charge and not increase the fuel requirements, the specific heat required to melt the shells certainly does consume fuel. In other words, it is found that furnaces that require 13% coke with shells on the charge do better work with 12% coke and no shells. This point of 1% less coke has been mentioned, but to some readers it may not be clear that it is the difference between 12% and 13%, or an actual final saving of about 8% fuel.

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Ferromanganese Smelting in Electric Furnaces

By Henry O. Marcy*

"What is believed to be the first lot of commercial electric-smelted ferromanganese ever produced has been turned out by the Alabama Power Co., by the new hydroelectric furnace." So read a dispatch from Anniston, Ala., to the *Boston Evening Transcript* of Aug. 16. As a matter of fact, William H. Rowe, of New Hampshire, has been producing electrically smelted ferromanganese, tungsten and other alloys at Tacoma, Wash., for about a year. Since the manganese deposits of western Washington are little known, an account of them is of interest.

They occur near Stair Case on the Skokomish River, in Mason County, where the southeasterly flowing stream has cut through the foothills bordering the Olympian Range of mountains to the north. Here the discovery of native copper in minute seams had been made in many places, the assay rarely exceeding 2 to 3% copper. In the belief that the assays would show improved copper content with depth, prospecting has been carried on in places to a depth of about 200 ft. In this the mine owners were disappointed, but assays revealed the chief ore constituent to be a silicate of manganese and iron with traces of copper, the manganese running from 20 to 50%.

In spite of preliminary discouragement, Mr. Rowe experimented with an electric furnace in which a temperature of 4,000° F. is easily reached and eventually this solved a difficult smelting problem. Having contracted for cheap hydro-electric power at Tacoma, east of the ore deposits, a $50,000 furnace was erected there at Tidewater, where the ore is delivered at econominal rates.

The Olympian manganese deposits are now said to be capable of the production of immense quantities of high-grade ore, the demand alone limiting production. Mr. Rowe has also obtained tungsten ore in considerable quantities for electric smelting. His first sale brought $16,000 per ton, and since then the works have been steadily producing under long-time contracts. I believe that to Mr. Rowe belongs the credit of first reducing the refractory silicate ores of manganese, iron and copper and producing commercial quantities of metal in the electric furnace using hydro-electric power.

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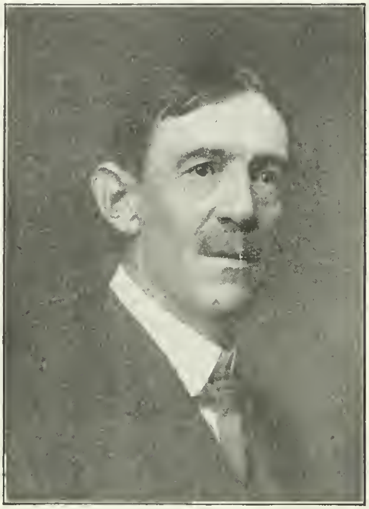
*180 Commonwealth Ave., Boston, Mass.

Distinguished American Metallurgists

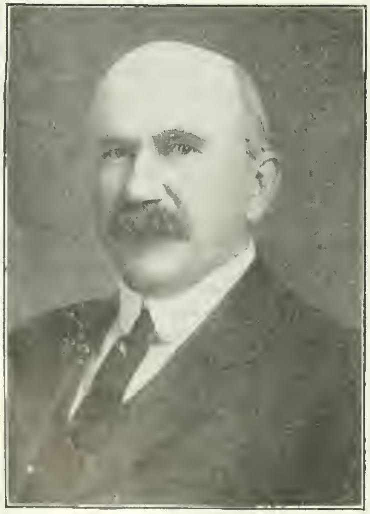


LOUIS D. RICKETTS

"Arizona's most distinguished citizen." Beloved by everybody. The great builder of smelting works. A metallurgist with imagination, who blazes new trails

DAVID H. BROWNE

If not the father of coal-dust firing he was distinctly the doctor who made the idea live and grow into a major improvement in the art of metallurgy, especially copper-smelting



EDWARD P. MATHEWSON

General manager of the Washoe works, who boldly showed what great economies could be effected in copper smelting in gigantic furnaces, both blast and reverberatory

FREDERICK LAIST

Metallurgical manager of the Anaconda. A leader in the development of Anaconda's new and marvelous metallurgy and pioneer in making electrolytic-zinc extraction a real art

Distinguished American Metallurgists

W. H. PEIRCE

Vice-president, Baltimore Copper Smelting and Rolling Co. One of the metallurgists who developed the art of basic copper converting—one of the major improvements in the metallurgy of copper

E. A. CAPPELEN-SMITH

Metallurgical director, Chile Copper Co. He collaborated with Peirce in developing basic copper converting and subsequently evolved the metallurgy of Chuquicamata in an original and brilliant way

ARTHUR S. DWIGHT

The dean of lead smelters. Famous also as a copper smelter. One of the inventors of the system of blast-roasting and sintering by which extraordinary savings have been effected in the treatment of lead and copper ores

RICHARD L. LLOYD

A keen and experienced copper smelter with original ideas, and an efficient manager. A co-inventor of the Dwight-Lloyd system of blast-roasting and sintering, which has proved important in many ways

The Smelting of Mercury Ores

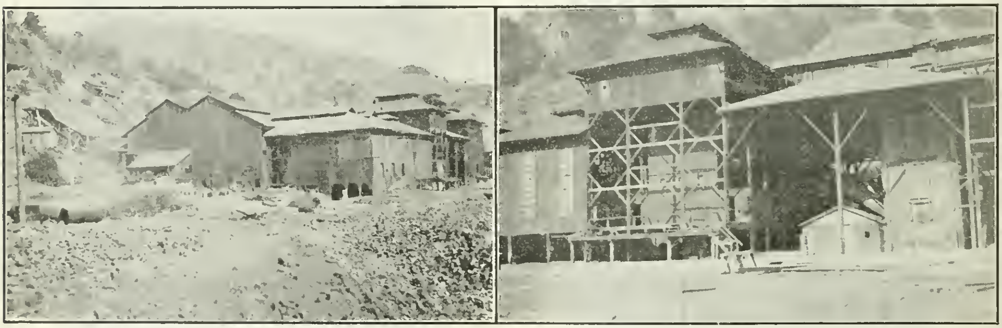
By W. H. Landers*

SYNOPSIS—Little improvement has been made in the metallurgy of mercury since the invention of the Scott tile furnace in 1876. The yield of the ores is diminishing, that for the last five years being less than 1%. New methods are being devised now and concentration, possibly flotation, is used to supply a rich product for smelting. A wet process is desirable to avoid the difficulties of smelting.

Of the many rare metals that the great war has brought into prominence, there is none more interesting than mercury. Being a necessary ingredient of detonators for small-arms ammunition as well as for torpedoes, floating mines, high-explosive shells and for the larger guns, where it is used in the form of fulminate of mercury, its price rose $37.50 per flask of 75 lb. net just prior to the opening of hostilities to $300 per flask in February, 1916. Like many others of the rarer metals, its market has been greatly abused by irresponsible speculators, and operators now realize that had the price been held down to lower figures, many users of the metal in this country would not have sought substitutes elsewhere or discontinued its use altogether. Habits of a business lifetime, however, are not easily broken, and the present price of $75 per flask is re-creating a normal demand and there is every prospect of a rise in the price in the near future. Stocks are low, and British quicksilver is selling at a much higher figure.

No new mines of any consequence were developed from the high prices, but many of the better-known producers seized the opportunity of rebuilding their somewhat dilapidated plants and have done extensive development work as well as added equipment such as furnaces and concentrating mills. It can safely be assumed that up to 1915 no improvements of any importance had been made in the method of extracting mercury from its ores since the development of the Scott tile furnace in 1871-76. The increased activity in this branch of the metallurgical industry has attracted some of the younger engineers, and the shortcomings of the old and recognized system are being brought out and corrections attempted.

Statistics indicate that for the last five years the yield from mercury ores in the United States (of which cinnabar is the only one of commercial importance) has been less than 1% of mercury per ton of ore. Ores running under 1% as recently as 1895 were not considered of sufficient value to mine. At New Almaden alone in the years 1869 to 1870 the mercury content of the ores ran as high as 5%, and it was during this period that the necessity of making use of the tierras, or fine ores running smaller than 1½ in. in size, caused the accomplishment of the Huttner-Scott furnace for fine-ore treatment. Prior to this time the richest ores were made into dobe bricks and burned in the regular shaft furnaces or kilns. Of the older methods of extracting mercury from cinnabar ores, many of which are still in use, there are retorts, intermittent furnaces and tile furnaces of various types. Up to 1915 no mention of mechanical furnaces can be found, nor was the successful commercial operation of any wet method of obtaining mercury attempted.


General plant at Hacienda — Scott furnaces at New Almaden

VIEWS OF TWO MERCURY SMELTING INSTALLATIONS IN CALIFORNIA

So far as is known, up to this period for a great many years, none of the operating companies has maintained assay offices or has made any attempt systematically to sample the ores going into its furnaces, the value of the ore being based on the yield in flasks from the number of tons smelted. This lack of adequate sampling may be attributed to the fact that the coarse ore (that is, ore running from the size of a man's fist up to pieces weighing several hundred pounds) has been charged directly into coarse-ore furnaces, and as these furnaces have been satisfactory in their operation, it has never been considered advisable to crush this coarser ore down to such a size that reliable samples could be taken. There has been, however, no excuse for the lack of sampling and assaying such ores as have been and are still being treated in the tile furnaces, and no doubt this is now being done to a more or less complete degree at all the mines. The advent of the younger engineers can be directly "blamed" for this, as the modern science of engineering, or really of operating any business, requires a knowledge of the losses sustained in its operations.

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*Chief engineer, New Almaden Co., Ltd., New Almaden, Calif.

Assaying of mercury ores is most commonly done by the dry method, and while the chance for loss in this method is considerable, if carefully performed the results are found to check fairly well with those obtained by the volumetric methods. In this general discussion of the metallurgy of quicksilver it would take too much space to detail the various wet and dry methods of assaying mercury, as they can be found in some of the better-known chemical handbooks.

Lately the water concentration of cinnabar ores has been successfully developed in California, and the trend of the time seems to be to concentrate low-grade mercury ores before charging into the furnaces. As will be shown later on, the vapor losses from any of the furnaces are much less when treating high-grade ores than when running the lower grades, and the vapor is the one loss which it seems impossible to prevent by any means yet discovered.

THE FIELD FOR A WET PROCESS

There is a decided field for a wet process for extracting mercury from concentrates or from the richer ores. Water concentration of cinabar has come to our attention as being used by the Manzanita Mine in Colusa County, California, where a small plant consisting of a Huntington mill and some bumping tables was installed several years ago, principally to try to save the gold that was in the ore. It was quickly noticed, however, that cinnabar was easily concentrated, but the commercial state of the industry was such that prior to its present revival money was not available for the purpose of experimentation along these lines. Many concentrators are in operation now in California, and more are being built. The Oceanic, Kings Consolidated, New Almaden, Cloverdale, Aetna and New Idria are all using them, varying from 50 to 300 tons per day capacity. As an adjunct to water concentration, many experiments have been made in the use of flotation, but so far as can be determined, none of the mines has actually installed working units, although it is expected that the New Almaden will have one in operation soon. Extractions as high as 86% have been obtained by crushing and tabling the ore, but there are undoubtedly some ores in which the cinnabar occurs in an almost amorphous state, where the extraction by tabling alone cannot be brought much above 60 to 70%. Careful tests have indicated that the losses here occur almost entirely in the fines that are apparently in suspension in the pulp; and as flotation results have shown that, so far as cinnabar is concerned, it can be successfully applied only to the fines, no doubt a total extraction of over 90% can in most cases be economically obtained. Other sulphides, notably pyrite, are almost always present in cinnabar ores, and this pyrite can be concentrated out with the cinnabar, proving a valuable addition to the succeeding furnace operation and cutting down the amount of fuel necessary to smelt the ore. Concentration has one other great advantage, which is that it eliminates the asphaltum products and other carbonaceous materials that are nearly always found in the ores and are among the chief sources of difficulty in the proper collection of the mercury after smelting. It might be well to mention here that all fire methods of reducing cinnabar call for subsequent condensation of the mercury vapors and that any hydrocarbon distillates that may be condensed with the vapors add greatly to the difficulty of collecting the metallic mercury.

Briefly, such concentrators as have been installed recently consist of rock crushers, ball mills and various types of tables. Jigs have been tried in one place and no doubt should be given a more general trial elsewhere. The coarser the concentrate that can be made, the more favorable it is for roasting in the furnace, and if retorts are excepted, none of the present furnaces would work very long on typical flotation concentrates.

THE METHODS OF MERCURY REDUCTION

In a more detailed discussion of the older methods of reduction that are still being used, that of the simplest as well as cheapest to install, namely, retorts, will be taken up first:

Retorts are made of cast iron, either of round or D-shaped cross-section, and have capacities varying from 50 to 300 lb. per charge. This very small capacity, together with the comparatively large amount of fuel necessary, has forbidden their use except at the very smallest mines and for the final treatment of mercurial soot from other furnaces. When improperly cared for, the losses in a retort plant are very large, but no doubt retorts will again be considered in the treatment of concentrates from wet concentrating mills. Intermittent furnaces other than retorts are seldom used and undoubtedly will disappear entirely, as too much time is lost in heating up and cooling off after the different charges.

Tile furnaces of the Scott type may be accepted as still the standard for cinnabar reduction, in spite of the fact that Mr. Scott has made practically no changes in their design since the original furnace was built at New Almaden in 1876. The weak points of the Scott furnace are: Their first cost; the great amount of brick used in their construction, with the resultant absorption of quicksilver; lack of control of the descending charges, with the occurrence of channels and rushes of ore; blocking of the tiles by wet ore and by clinkers, necessitating periodical shutdowns for cleaning out; plugging of the pigeonholes by ore dust and their consequent slagging near the fires; their inability to burn safely high-sulphide ores, due to the danger of the furnace getting afire from bottom to top, or as it might be expressed, lack of heat control; and also their inability to handle ores in which metallic mercury is present, as this mercury has been found to drop through from the top of the furnace to the ashpit without volatilizing, regardless of the temperature at which the furnace was operated. These furnaces have worked very well on freshly broken ore from the mines, but are found to give a great deal of trouble when highly oxidized materials such as old dumps and oxidized ores are charged into them.

Continuous furnaces of several types for coarse ore are in daily use and give complete satisfaction. They are all more or less on the lime-kiln order. The success of coarse-ore furnaces suggests the practicability of briquetting the finer ores or concentrates, and this no doubt will be attempted when a suitable binder is found. This binder must not in itself be a great heat absorber nor must it give off hydrocarbon vapors, which will afterward condense with the mercury in the condensing system. This naturally precludes the use of such materials as tar or asphaltum.

Up to the present writing, only two mechanical furnaces are known to be in operation, both [illegible] Herreshoff roasters—one at New Almaden and [illegible] Nevada about 35 mi. from Winnemucca. [illegible] erected last fall and can hardly be said to have passed the experimental stage. They are especially adapted to the burning of high-sulphur ores or for ores that contain some metallic mercury, which on this account cannot be roasted in any of the shaft furnaces. They have proved to be economical of fuel and can be erected for about half the cost of the regular tile furnace. They have the advantage of being able to control the temperature on each hearth and will find their greatest application in the smelting of large tonnages of cinnabar concentrates where the sulphur content is sufficiently high to reduce materially the amount of external fire necessary. Such concentrates cannot, by themselves, be roasted in any of the tile furnaces or course ore furnaces now in use. The problem here remains for someone to invent a continuous muffle furnace where the temperature can be controlled at any point to prevent fusion of high-sulphur ores.

The Fuel for Mercury Reduction

The best results in all types of furnaces have been secured through the burning of wood for fuel, but the cost of wood in some localities has made necessary the substitution of fuel oil. Wood requires less air for complete combustion, and the alkaline ashes, which to some extent are mixed with the gases leaving the furnace, are a decided advantage in the ultimate recovery of the quicksilver. Fuel oil, such as is used in California, needs a great amount of air for complete combustion and has the disadvantage of making a very greasy soot that is carried over into the condensers and greatly retards the collection of the mercury. To prevent this, it is necessary to have large fireboxes in which the combustion of the oil can take place, allowing only the hot gases to escape into the furnace; although in the case of the burning of coarse ore this feature is not so necessary, as the whole mass of the ore gets sufficiently heated to collect the soot and tarry products from the oil, preventing their escape with the gases. The action in this case is similar to that of the gas producer in which fuel oil is sprayed against a checkerwork of brick.

The drying of ores prior to their introduction into the furnace, while increasing the capacity of the furnace and having a tendency to minimize hangups, is not in general use in California, most operators preferring the simpler method of charging their ore directly into the top of the furnace and letting it dry out there. At first thought it would appear as though the proper procedure would be to convert the first condenser into a drier and have the raw ore serve the double purpose of cooling the gases and drying the ore; but as the first condenser generally collects a considerable amount of ore dust and as it is a difficult matter to separate this dust from the condensed quicksilver, this plan has been abandoned.

Before discussing the various types of condensers in use, it will be well to consider the composition of the ore. This varies considerably according to the locality from which it is mined, but as a rule, outside of a small percentage of cinnabar usually present, there are large quantities of calcite and dolomite and often quartz. Asphaltum and carbonaceous material is frequently present and in most instances varying quantities of iron pyrite. At New Almaden it has been found that a cubic foot of raw ore weighing 102 lb. when charged into the furnace, weighs only 70 lb. after roasting. It will be seen at once that the gases coming from the furnace and out of which the mercury has to be condensed will consist in a large measure of H_2O, CO_2, SO_2, SO_3 and CO in addition to the usual products of combustion.

Tars, pitches and other volatile hydrocarbons are mixed with the gases, some of which afterward condense with the water and mercury. In order to secure the decomposition of the cinnabar, it is necessary to subject it to a temperature in excess of 670° F. This temperature must be maintained in the gases coming out of the furnace for a sufficient length of time to permit the elimination of ore dust, and then must be cooled as rapidly as possible to force the condensation of the mercury. As this condensation takes place in the form of a mercurial dew, the velocity of the gases must be as low as possible consistent with maintaining the furnace draft and enough space provided for this fog to settle out of the gas passing through the condensers. The possibility of great loss is here apparent, owing to the fact that the entire volume of gas leaving the furnace must be saturated with mercury vapor at the temperature of exit and will continue to be so saturated until after it is finally delivered into the atmosphere.

The present problem is to reduce this gas volume in the furnace as much as possible and to have the gases leaving the condenser system as cool as is commercially possible. As the necessary draft cannot be secured under these conditions without having the final temperature too high and the resulting vapor loss too great, some mechanical means is necessary to maintain the movement of vapors through the condensers. Low-speed fans have been found best suited for this purpose. As this discussion is not intended to enter into such technical subjects as vapor densities, specific heats, vapor tension, etc., the products of the condensers will next be mentioned.

Products of the Condensers

In the first condenser after the furnace, the product is largely dry-ore dust and little mercury; the next condensers will show varying amounts of condensed water and mercury, this water carrying considerable oil and other hydrocarbons of a tarry nature, as well as sulphuric acid. Varying amounts of what is called mercurial soot are present in all these condensers, and it is the separation of the metallic mercury from this soot that offers the greatest difficulty in securing an adequate clean-up. Present practice is to mix this soot with wood ashes or lime and, after drying, to work the mercury out of it by manual or mechanical means. The ashes containing wood lye or the lime have a tendency to brighten the mercury and give the minute globules a chance to run together.

No matter how this soot is worked over, a large proportion of the mercury still remains entrapped in it in the form of microscopic globules, and it is customary in the larger plants to charge this residue back into the furnace. Some plants, however, retort this soot and in this way get out practically all the mercury, but such a retorting process is long, tedious and subject to considerable opportunity for loss. Up to the present no other means has been devised for separating the mercury from this soot.

Condensers are usually built of brick, stone, cast iron, glass or wood. Lately concrete and hollow tile have been used successfully. The cooling of the gases in these condensers is often assisted by the introduction of what are known as water-backs, or coils of pipe either of iron or terra cotta, through which cold water or air is circulated. Air flues either of iron or terra cotta pipe are also used, mainly for cooling the gases in the first condensers, and water sprays have been introduced for the same purpose, although open to the objection of carrying away floured mercury, which is very difficult to save.

All condensers constructed of brick, stone or concrete have the serious defect of absorbing great amounts of mercury, largely from the vapors that permeate into the walls, and their necessary thickness greatly decreases their efficiency as coolers.

Wooden condensers, either vertical or horizontal, are now being used to a considerable extent and have been found satisfactory where the temperature of the gases permits their use at all. They are less subject to attack by acid waters than either masonry or cast iron, and have the added advantage of low first cost. Ironwork of any description lasts very well in the construction of condensers where the temperature does not fall below the boiling point of water, but are rapidly attacked at lower temperature.

Glass and wood condensers were formerly quite extensively used at New Almaden, but were abandoned on account of their rapid deterioration during shutdowns of the furnace. Various plasters or cements supposed to be acid-resisting have been tried on the walls of condensers with the idea of rendering them less porous and less subject to attack by acids, but as yet have not proved entirely satisfactory for these purposes.

PRINCIPAL FORMS OF MERCURY LOSSES

In roasting mercury ores losses occur principally in the following forms: Cinnabar or metallic mercury remaining in the furnace residue. This can be taken as low and should be almost negligible with good furnace work.

Absorption of mercury by the brickwork of the furnaces and condensers previously referred to. This is a loss that cannot be very well estimated, and while it may not be considered as an ultimate loss, it remains a practical one as long as the plant is in operation. In one instance the tearing down of a furnace and condenser system to my knowledge produced over 1,000 flasks.

Air leaks in the plant will cause loss or not, according as to whether care is taken to always have an in draft. Stack, or exit, losses are easily the most serious of all, as before mentioned. The large volume of gas coming out of the final condenser is saturated with mercury at the temperature of escape, and no means has yet been devised for preventing this loss. In terms of the mercury recovered, assuming that only twice as much air went into the furnace as was necessary for theoretical combustion, this loss has been measured to be as large as 2% of the mercury recovered when treating a 1½% ore, and with an exit temperature as low as that of the outside atmosphere. Double that amount has been shown on an ore of 0.7% mercury. As most of the quicksilver furnaces in California are treating ore of less than ½ of 1% mercury, it can readily be understood that the loss under the conditions cited might reach as high as 5% of the recovered mercury when the excess air is kept down to double the theoretical quantity. It is seldom found by measurement that double theoretical air can be maintained, and it is more likely that at least four or five times as much air as is necessary for combustion finds it way into the system. This loss then may reach as high as 10% of the mercury in the ore and may be considered as a fixed loss. In addition to this vapor loss there is the mercurial mist, or fog, which is present in the gases leaving the condensers. This has been estimated to amount to several times the fixed-vapor loss, dependent on the number of condensers used and the velocity of the gases through the system.

Another source of loss is that in floured mercury in the water leaving the condensers. It has not been possible to measure this, but it is known to be considerable. Washing of condensers in cleaning-up operations undoubtedly has caused great loss in this respect.

THE ABSENCE OF CAREFUL SAMPLING

In summing up the losses in the treatment of mercurial ores by the apparatus now in general use, it is to be regretted that careful sampling of the ores over long periods of time has not been commonly done. At at least three plants with which I am more or less familiar, sampling has been done at stated times with the object of discovering what this loss is, and in no case was it shown to be less than 20%, and that on a comparatively high-grade ore. In all probability the losses in fine-ore furnaces exceed 25% and may even reach as high as 40% on extremely low-grade ores and with too much air. Coarse-ore furnaces, on account of the small amount of draft necessary do not incur so great a loss when proper attention is paid to control of the air admitted into the furnace, and the smallest losses of all should be met in properly operated retorts or muffle furnaces.

A thorough knowledge of the losses, mechanical and metallurgical conditions leads one to forecast that the future will either bring out a successful wet method for reducing mercurial ores or will develop the yet concentration of these ores until a saving in excess of 90% will be made on a commercial scale. Furnacing of the ores will probably always be the cheapest in per ton costs on tonnages greater than 25 per day and on ores in excess of 1% mercury content. The losses sustained in treating low-grade ores in furnaces will in all probability be greater than that of wet concentration plus a proper retorting of the concentrates.

Mines having large investments in furnace plants will continue to use them up to capacity, but will build concentrating plants for their lowest-grade ores, mixing the resulting concentrates with the ore going to the furnace. The low per-ton cost of a concentrating plant together with its necessary retorts will probably preclude the erection of more large furnaces, although in the case of the installation of a large concentrator the quantity of concentrates obtained will necessitate the construction of some type of furnace with greater capacity than can be secured from retorts. This will bring in mechanical furnaces having little or no application of external heat, the concentrates containing sufficient sulphur to provide their own fuel. Such a condition would be ideal for the distillation of mercury, as the volume of furnace gases with attendant vapor loss could be kept down to a minimum. The price of mercury may influence the choice of process.

Landers Mercury Furnace

A new quicksilver-distilling apparatus comprising a roasting furnace, a dust settler with the gas outlet communicating with the furnace, a condenser communicating with the dust settler, a stack to which the uncondensed gases from the condenser are delivered, and means for subjecting the condenser to a cooling medium, together with means for conducting the cooling medium, with its absorbed heat, into the stack to increase the draft through the apparatus, has been designed by William H. Landers, of New Almaden, Calif., to whom U. S. Pat. No. 1,195,236 has been granted. The features of the furnace are shown in the accompanying drawings.

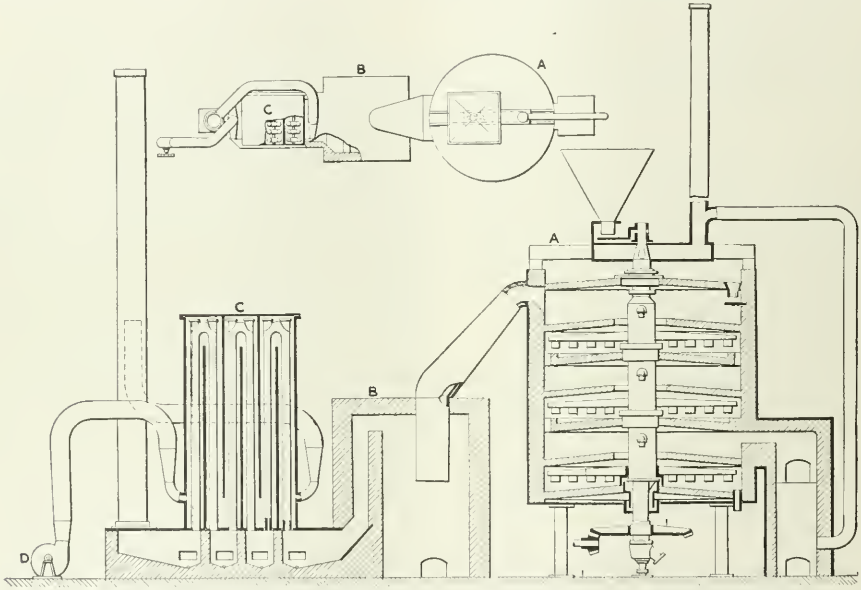
In the accompanying illustration a vertical sectional elevation of the apparatus, and a plan of it are shown. The furnace is shown at *A*, and may be of any suitable type adapted for the distillation of quicksilver from its ore. The best form is considered to be that known as the multiple-hearth furnace and is thus illustrated here. The dust settler is shown at *B* and the condenser at *C*, the fan that supplies the cooling medium for the condenser being shown at *D*.

Circulating air is admitted and passes through and cools the shaft and arms of the furnace and is discharged into the stack, from which it may be diverted through the return pipe, in a heated condition, to the furnace grate for the combustion of fuel and the oxidation of the ore, the furnace grate communicating through a flue with the lower roasting hearth of the furnace. The air and products of combustion pass through the flue into the furnace and over the hearth in a direction opposite to the flow of ore, going to the vapor and gas outlets.

The settler is made of brick or concrete or any material that will sufficiently conserve the heat, and for a similar purpose, the vapor- and gas-outlet flue from the furnace is best covered with heat-insulating material. The dust settler has two objects: First, to keep the vapors and gases sufficiently hot to prevent any precipitation or condensation of the quicksilver in the settler; second, by its large dimensions compared to the inlet, to reduce the velocity of the vapors and gases, allowing the dust to separate and settle more effectively.

The condenser comprises a number of collecting chambers, or trays, in a base, successively connected by a number of standpipes, the last chamber communicating with the stack. Between and around the standpipe are baffles which form the space for the circulating cooling medium. This medium is supplied by the fan, which connects by a pipe with the baffle space, and this space communicates at the outlet end of the complete path of circulation with a pipe that is carried to and enters the stack. The air serves the double purpose of a cooling medium for the condenser and, in its heated condition, due to the interchange of heat in the performance of its first function, it serves the further purpose of increasing the draft and creates a suction in the entire system, inducing a current of vapors and gases away from the furnace, thus taking them away from the roasting ore.

The ore in crushed condition, say from ¾-in. mesh down, is roasted in the multiple-hearth furnace. The gases are then driven off, together with dust from the furnace, passing over into the dust settler. Here the gases will remain hot enough to prevent precipitation of quicksilver, but the current will be slow enough to provide for the settling of all the dust. The gases then pass into and through the condenser, and the quicksilver settles in the collecting boxes. The condensation is due to the current of air from the fan passing through the baffle spaces of the condenser. This quickly cools the pipe and the gas, when liberated, is still heated and is discharged into the stack, thereby increasing the draft and creating effective suction throughout the apparatus.



PLAN AND SECTIONAL VIEWS OF THE NEW LANDERS MERCURY-SMELTING FURNACE

Changes in Smelting Practice of Anaconda Copper Mining Co.

By Frederick Laist*

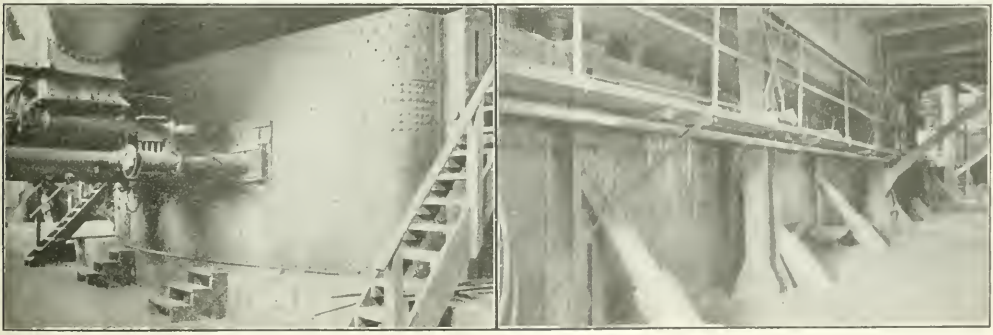
SYNOPSIS—Recent changes in smelting practice of the Anaconda Copper Mining Co. have materially improved the results obtained. Pulverized coal is largely used in the reverberatory furnaces, greatly increasing the charge smelted per ton of coal. Great Falls type converters have replaced the old barrel-shaped ones. Cottrell fume-treatment system has been installed. The changes were made necessary by the increased tonnages required to be smelted.

An extensive program of reconstruction and new construction at its plants in Anaconda and Great Falls was decided upon by the Anaconda Copper Mining Co. in December, 1914. Considerable experimental work had been done prior to this date and had demonstrated that the recovery of copper from the Butte ores could be greatly increased by the use of the flotation process of concentration. The high recovery possible by this process made it seem desirable to concentrate all the ore instead of sending part of it to the blast furnaces. It was also felt that concentrating operations had best be confined to Anaconda in order to avoid transportation charges on ores that had hitherto been sent to Great Falls. This made it necessary to increase the concentrating capacity at Anaconda and this, together with the treatment by concentration of ore that formerly had been smelted direct, together with the increased concentrate production resulting from the higher saving, caused a tremendous increase in the amount of material requiring treatment in the reverberatory-smelting departments.

Prior to this time one furnace in the reverberatory plant had been equipped with coal-pulverizing machinery and burners. The results of this experiment had been so satisfactory that it was decided to equip the entire plant in the same way. This, we knew, would result in a largely increased capacity, and in order to provide the additional capacity needed it was decided to enlarge the furnaces from 19x125 ft., to 25x113 ft. The converter plant at Anaconda was in a decidedly run-down condition and consisted of 13 barrel-shaped converters. It was decided to replace these with seven 20-ft. upright converters of the Great Falls type. The increased reverberatory-smelting capacity, of course, necessitated additional roasters, and it was decided to construct a new roasting plant containing twenty-eight 25-ft. furnaces.

With regard to Great Falls, it was determined to adopt reverberatory smelting exclusively for that plant and to supply it with concentrates to be shipped from Anaconda. The coal burned at Great Falls is of rather poor quality, and gas-fired furnaces had been used up to that time. A furnace had been constructed with a large firebox which worked somewhat on the gas-producer principle. This was not very successful, and it was decided, after making preliminary tests at Anaconda, to adopt coal-dust firing at Great Falls also.

This entire program has now been completed, and the results obtained from the changes have fully met our expectations. The concentrator is treating 15,000 tons of ore per day and is making a recovery of 96.5%. All the jig and table concentrates are collected in bins, from which they are distributed by means of trains operated by air locomotives, part of the concentrates going to the No. 1 roaster plant (which is the old plant, consisting of sixty-four 16-ft. MacDougall furnaces), part being shipped to Great Falls and part going to the new No. 2 roaster plant. All the flotation concentrates are collected in a centrally located Oliver-filter plant and conveyed by means of belts directly into the hoppers feeding the furnaces in the No. 2 roaster plant.



THE REVERBERATORY FURNACES AT GREAT FALLS, MONT.

The quantity of flotation concentrates going into this plant averages 1,700 tons per day, with which is mixed about 500 tons of concentrates from the bins and about 200 tons of fine limerock. This amount of material is being treated at the present time in 24 furnaces, as four of the 28 furnaces are being used for roasting zinc concentrates. On account of so large a proportion of the charge being excessively fine, these furnaces were designed with a view to producing a minimum of dust and the operated with a minimum of draft. It was realized, however, that in spite of anything we could do, we would probably have considerable dust to contend with, and therefore, in addition to equipping the plant with a dust chamber and flue of ample proportions, a Cottrell treater, capable of handling 400,000 cu.ft. of hot gas per minute was installed. This treater is not in operation at the time of this writing, but will probably be running early in September. The course of the gases through the treater is vertical, but instead of being filled with pipes, the inside of the treater is divided into rectangular spaces by means of plates of corrugated iron. The plates are 12 in. apart. Chains are hung at intervals of about 6 in. midway between the plates and form the positive electrodes. The treater is referred to as being of the "box type" and is considerably less expensive per unit of capacity than the "pipe type" of treater.

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*Metallurgical manager, Anaconda Copper Mining Co., Anaconda, Mont.

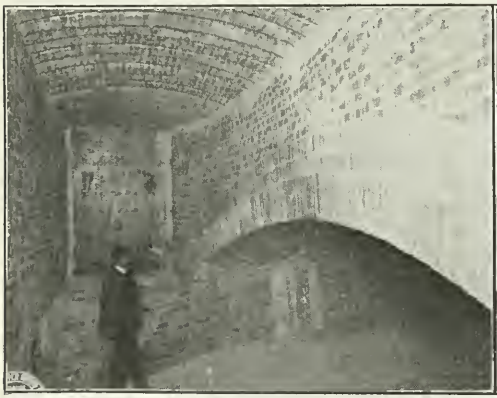
The furnaces in the No. 2 roaster plant contain as a principal distinguishing feature, the large brick shaft, originally introduced and patented by Utley Wedge. This shaft is 5 ft. in diameter and contains in its interior all the pipe connections and the fastenings by which the arms are held in place. This feature is undoubtedly valuable in that repairs to the water system or the arms can be made without cooling off the furnace, which is a rather serious matter with furnaces of so large a size. The furnaces are water-cooled, as air cooling has proved itself inapplicable to concentrates containing as much iron pyrite as those made from Butte ores. The center shaft runs on a button bearing. This has been designed and installed to take the place of a roller bearing with which the furnaces were first equipped and which gave considerable trouble. Each furnace is driven independently by a 15-hp. totally inclosed motor, drawing its cooling air from outside the building. A train of gears running in oil in a tight gear case transmits the power to a large pinion which meshes with a crown gear near the lower end of the shaft. The calcine hoppers are partitioned off from the rest of the building, so that the dust and gases evolved in loading the trains are confined. The loading chambers extend the length of the building and are about 25 ft. wide. They are connected with a 12-ft. brick stack, so that a current of air keeps the dust and gases moving always in one direction and away from the men loading the cars. It was our intention to equip this stack with a treater for catching dust that might escape, but measurements have shown that the quantity of dust getting out is too small to make it worth while.

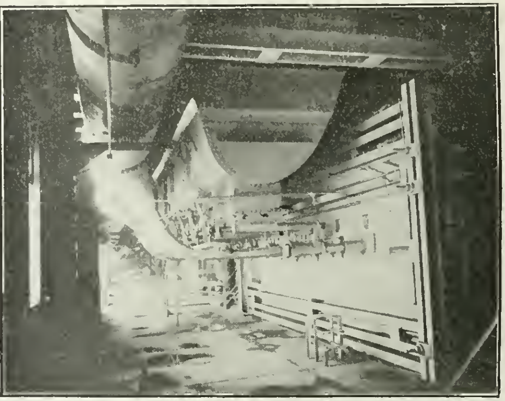
REVERBERATORY FURNACES FIRED WITH COAL DUST

The reverberatory plant takes the calcine from both No 1 and No. 2 roaster plants, as well as flue dust from all the various dust chambers. It consists of eight reverberatory furnaces of the dimensions already given. These furnaces use pulverized coal from the Diamondville mines of the Anaconda Copper Mining Co. and are capable of smelting as much as 650 tons of charge per 24 hr. The fuel ratio for a period of six months has averaged 6.8; that is, we smelt 6.8 tons of charge with one ton of coal. The furnaces operate continuously, and slag runs in a steady stream from a hole in the front end. The matte is also tapped at the front of the furnace. The latter change was made necessary by the use of the side-charging system. Contrary to former practice, these furnaces contain only an inconsiderable bath of matte, although of course they contain quite a large body of molten slag. The remodeling of the reverberatory plant has more than fulfilled expectations, and besides giving us almost 2½ times the former capacity in the same building and with the same number of furnaces, has greatly decreased our reverberatory-smelting costs.

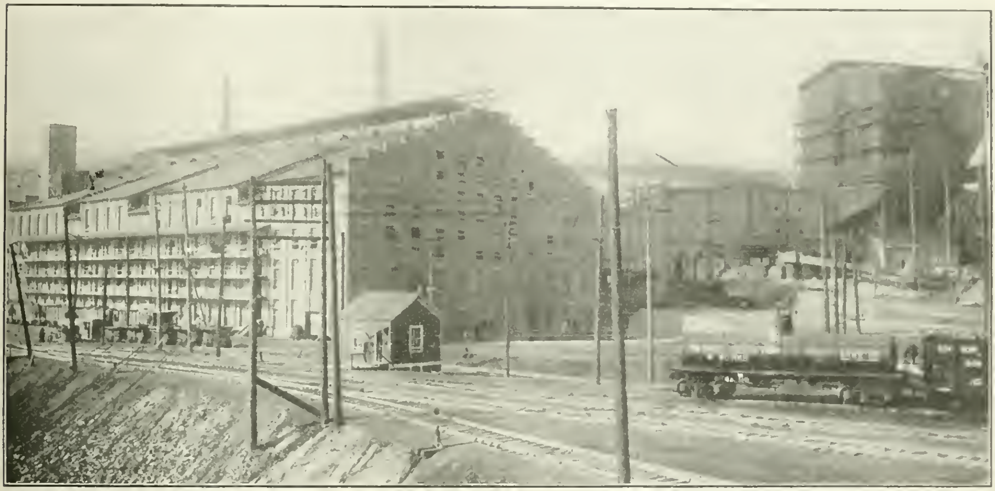
The results obtained at Great Falls have been equally gratifying. At this plant the furnaces are somewhat smaller- 20x125 ft. The coal used contains 23% of ash, and when burned in the gas-producing firebox with which one of these furnaces was formerly equipped, smelted only 225 tons of charge per day with a fuel ratio of about 2.25. The same coal used in the pulverized form now smelts nearly 500 tons of charge with a ratio of 4.8 tons of charge per ton of coal.

Owing to the abnormal demand for copper and the high price obtained, the blast-furnace plant at Anaconda is still operating at maximum capacity. This, however, is only temporary, and the plant will be closed with the exception of one small furnace to be used for smelting coarse and high-grade material, such as a small amount of exceptionally high-grade ore, matte and slag cleanings and barrings from the roasting furnaces.


INTERIOR OF FLUE END OF REVERBERATORY FURNACE


COAL-DUST BURNERS OF REVERBERATOY FURNACE

In order to take care of the converter slag under these new conditions, a reverberatory furnace, 25x150 ft., was constructed in a portion of the converter building that had formerly been used as the lining department when the siliceous linings were still being used in the converters. This furnace, also, is heated with coal dust and is provided with three spouts for introducing the molten slag. The furnace is completed, but has not yet been put into regular operation for the reason that as long as the blast-furnace plant continues in operation the converter slag is needed there as a flux. It is intended to operate this furnace on a siliceous charge high in sulphur so as to provide the silica necessary to combine with the excess iron in the converter slag and thus produce a furnace slag running about 37% SiO_2. At the same time a rather low-grade matte will be made, which can be tapped into ladles and poured back into the converters. The slag will run out at the front of the furnace in a continuous stream into a jet of water, which will granulate it and convey it down a launder to the slag dump.



GENERAL VIEW OF NO. 2 ROASTER PLANT, SHOWING FLUE AND COTTRELL TREATER

ARRANGEMENT PROVIDING FOR SLAG DISPOSAL

In this connection it might be interesting to note that within the past year the space originally provided for the dumping of slag has been practically filled up. At the time the Washoe Reduction Works were built, it seemed as though the dumping ground for slag was practically inexhaustible, and up to about six months ago the disposal of slag required little attention beyond granulating it and flushing it down launders by means of water. After investigating various methods of disposal, it was decided to allow the slag to accumulate in small ponds at the ends of the launders. From these ponds it is excavated by means of a large electrically operated locomotive crane and loaded into dump cars holding about 30 tons each. The cars are operated in a train of six, by means of an electric locomotive. They are equipped with compressed-air cylinders for dumping, and the whole train can be dumped at once by the engineer on the locomotive. This method of handling has proved to be effective and cheap. Instead of sloping downward from the ends of the slag launders, the new dump now slopes upward with a 2% grade and it is estimated that dumping room for a period of at least 30 years has been provided.

The large amount of extremely fine flotation concentrates that has to be handled has given rise to no serious smelting problems. As far as we can see, the dust losses from the reverberatories are inconsiderable. The most serious difficulty at first seemed to be the handling of the calcines from the roasting plant into the reverberatory furnaces. The calcine produced from flotation concentrates is not only inconceivably fine, but on account of the gases contained therein, is possessed of almost the properties of a fluid. It runs out through the smallest cracks and holes, and its angle of repose is practically zero. The reverberatory furnaces are equipped with trough-shaped hoppers about 60 ft. long. Calcine dumped at one end of these hoppers will flow to the other end, the surface being almost horizontal. Of course clouds of dust are evolved whenever a car is loaded from a calcine hopper or whenever the calcine is dumped from the car into the reverberatory hopper. We directed considerable effort toward the construction of some sort of arrangement by which a tight joint could be made between the car and the hopper. Our efforts in this direction, however, have proved fruitless. It seems almost impossible to construct a device sufficiently tight and at the same time sufficiently quick-acting to answer our requirements. It is, moreover, necessary to provide some sort of vent on the cars for allowing the escape of the gas and air contained in the car. Screens for this purpose are useless as no screen seems to be fine enough to hold back the dust. We tried asbestos cloth, but this did not allow the gases to escape with sufficient rapidity.

We finally came to the conclusion that the best method of overcoming the difficulty was to load or unload in a sealed-off chamber or tunnel which is connected at one end to a stack or fan so as to create a draft away from the workmen. The men are thus out of the dust, and the dust is, moreover, discharged at a point where it can be re-collected if its amount is sufficient to make it worth while. We find, however, that the quantity of dust actually lost is a very small percentage of the whole, although to see a car loaded one would think that the loss must be serious indeed. One of our reverberatory furnaces is being equipped with unloading tunnels just large enough in cross-section to admit the calcine cars, only about 6 in. of clearance being provided. A comparatively small volume of air will thus suffice to keep the dust moving toward the far end of the tunnel. Doors are provided at frequent intervals along the sides, so that ready access can be had to any car in the train.

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Steam Power from Waste Gases*

At the Arizona Copper Co.'s smeltery at Clifton, Ariz., the waste gases from the three reverberatory furnaces are led to seven 712-hp. Stirling boilers for the utilization of their heat in power production for the plant.

The reverberatories are oil-fired and burn from 240 to 365 bbl. of California crude oil per furnace day. This variation covers a one-furnace schedule when hand firing for high tonnage is required or covers the requirement for two furnaces under light firing and correspondingly low tonnages smelted.

The gases leave the furnaces at temperatures of from 1,800 to 2,000° F. and, after passage through the steam boiler plant, exit at temperatures ranging from 471° to 588° F., depending on the number of reverberatories fired and the number of boilers in service. The gases from one furnace are passed through five boilers, but when two furnaces are in commission, six or seven boilers are used.

When smelting in one furnace, three direct-fired boilers are in continuous service to supply the power requirements, but the night load is light, therefore the boiler efficiency is low. The pounds of water evaporated per pound of oil averaged 11.98 over a period of eight months. The oil averages around 15° Bé. and 18,200 B.t.u.

With two furnaces in operation, there is sufficient waste heat to generate all steam requirements for the night load, but oil must be used to carry the day load. Under these conditions, rather than keep the oil-fired boilers under steam over night, the three oil-fired boilers are not used. Instead, oil is burned under the waste-heat boilers. The oil so burned is measured and credited with evaporating 11.98 lb. of water, in the same manner as under oil-fired boilers on a one-furnace basis.

All boilers contain Foster superheaters, and deliver steam to the mains at 175 lb. pressure. The temperature of steam delivered at the power house is about 475° F. The net steam delivered to the power-house engines is credited to the boiler plant. Steam used in heating and atomizing oil and for other miscellaneous purposes, as well as steam wasted, is absorbed in the furnace-oil costs.

Under one-furnace conditions, the waste-heat boilers averaged over a period of eight months, 7.71 lb. of water evaporated per pound of oil burned in the furnace.

The furnace-boiler division receives credit from the power house varying from 36 to 56% of the oil burned in the smelting furnace.

The indicated horsepower from the waste-heat boilers per ton of solid charge smelted on a one-furnace basis over a period of nine months averaged 98.71 i.hp.-hr., whereas on a two-furnace basis over a period of seven months the average was 114.34 i.hp.-hr. from waste heat only.

Reverberatory dust caught in all the boilers does not exceed 5 tons monthly when running one reverberatory. The net steam delivered to the engines is credited to the boiler plant. Steam used for heating, atomizing oil and for other purposes is absorbed in furnace-oil costs.

Furnace gases leaving the waste-heat boilers at temperatures varying between 471° and 588° F., are conducted through 6-ft. diameter steel pipes into a flue connecting with the main chimney. The temperature of gases in the flue ranges between 400° and 500° F. at different points, and at these temperatures the average velocity of gases is 10 ft. per second when running one furnace. An average analysis of this gas is SO_2, 0.3%; CO_2, 5.9%; O, 1.92%; CO, 0.4%; N, 80.5%; SO_3, not determined. When the flue was cleaned recently, 100 tons of dust was removed that had accumulated during two years' furnace operations.

The composition of this dust was as follows: S_2O_2, 17.4%; Al_2O_3, 6.3%; total Fe, 11.8%; CaO, 2.3%; S, 10.3%; Cu, 9.65%; free H_2SO_4, 3%; H_2O, 9.5%.

The flue roof, originally made of No. 14 steel plate, was so pitted and eaten through that repairs were necessary after eight months' service. Concrete slabs reinforced with wire netting were laid on top of the steel plate and all joints filled with asphalt.

The following table shows the amounts of power absorbed in the various operations of each department:

AMOUNTS OF POWER ABSORBED IN EACH OPERATION

Divisions	Kilowatt-Hours One Furnace	Kilowatt-Hours Two Furnaces	Kilowatt-Hours per Ton New Material One Furnace	Kilowatt-Hours per Ton New Material Two Furnaces
Sampling:				
Receiving, h.p. air converted to kw.-hr.	1,813	2,590	0.10	0.11
Crushing, electric	10,501	21,548	0.59	0.95
Sampling, electric	1,146	2,351	0.06	0.10
Bedding, electric	3,819	7,836	0.22	0.34
Reclaiming, electric	22,576	22,843	1.28	1.00
Total	39,855	57,168	2.25	2.50
Roasting:				
Roaster furnaces, electric	7,692	7,495	0.43	0.33
Calcine cars, electric	3,140	5,093	0.18	0.22
Total	10,832	12,588	0.61	0.55
Reverberatories:				
Reverb. furnaces, electric	3,013	3,303	0.17	0.14
Reverb. furnaces, h.p. air converted to kw.-hr.	453	647	0.03	0.13
Reverb. furnaces, l.p. air converted to kw.-hr	37,339	72,774	2.11	3.19
Slag railway, electric	4,420	10,451	0.25	0.46
Boilers, h.p. air converted to kw.-hr	1,813	2,590	0.10	0.11
Boiler feed-water pumps, electric	31,220	20,553	1.77	0.90
Oil pumps, electric	4,030	2,009	0.23	0.09
Total	82,288	112,327	4.66	4.92
Converting:				
Converters, electric	5,263	5,674	0.30	0.25
Converters, l.p. air converted to kw.-hr.	218,235	206,802	12.34	9.07
Cranes, electric	22,790	19,635	1.29	0.86
Bullion casting machines, electric	2,340	2,920	0.13	0.13
Total	248,628	235,031	14.06	10.31
General Works:				
River well, electric	6,760	8,001	0.38	0.35
Boiler and machine shops, electric	2,900	2,730	0.16	0.12
Boiler and machine shops, h.p. air converted to kw.-hr.	4,986	7,122	0.28	0.31
Yards, electric	1,313	1,439	0.07	0.06
Laboratory, electric	2,807	3,077	0.16	0.13
Total	18,766	22,369	1.05	0.97
Total, all divisions	400,369	439,483	22.63	19.25
Dry tons new material treated	17,687	22,793		

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*Excerpt from "Smelting at Arizona Copper Co.'s Works," a paper presented at the Arizona meeting of the A. I. M. E., September, 1916, by F. N. Flynn, superintendent of the smelting department, Arizona Copper Co., Clifton, Ariz.

Tuyere Connections for Copper and Lead Blast Furnaces

By Richard H. Vail

SYNOPSIS—A presentation of the leading types of tuyere connections used at the North American smelting works, together with brief comments on the designs by the plant managers or superintendents.

Tuyere connections used at important North American smelting plants are illustrated on the succeeding two pages. While tuyere service at the various plants is practically identical in its general aspects of supplying air to the blast furnace and removing locally trapped slag, yet there are numerous refinements that may improve the practice—depending on the local conditions at different works. An examination of the accompanying drawings will show that nearly every smelting plant has made some improvement, these improvements varying with the predominant condition that was to be remedied at the individual plant.

Summarizing generally and briefly, it will be noted that at Anaconda, where slagging is comparatively infrequent and large tonnages predominate, a special effort has been directed toward the saving of power expense by reducing air leakage; Copper Queen and Boston & Montana have tried multiple-tuyere boxes, presumably with the intention of reducing construction cost; Detroit's tuyere box—of more recent design than most of the others—presents some refinement especially in the matter of the cover, which is easily removable when the tuyere has slaggd; the Traylor tuyere represents an eclectic equipment embodying the wide experience of its makers, incorporating ball-and-socket joints to expedite repairs, slag-drainage and air-conserving features, as well as an automatic safety valve for the lead-furnace tuyere connection; the automatic cutoff is also a feature of the Eilers tuyere box long in use at a number of the American Smelting and Refining Co.'s plants; the Midvale tuyere box provides against air leakage by using adjustable capscrews to hold the tuyere cap close to the face of the tuyere box, and also represents other improvements over the original design used by the United States Smelting Co.

Comments on the Tuyere Designs by the Works Managers

Some brief comments on the designs used at the various plants have been made by the managers or superintendents, who point out the particular features that have been developed to meet the predominant necessity at each plant. Commenting on the Anaconda tuyere connection, E. P. Mathewson says:

"An advantage of the Anaconda style of tuyere connection is the extremely short space between the downcomer and the jacket. Where the bustle pipe will admit of it, this space can be made still shorter; the shorter it is the better. Another feature is the tuyere-box cap with the peephole and plug to close same. This gives a very tight joint, so that air leaks about the tuyere box are practically unknown. Leaky tuyere pipes and boxes are a source of great waste about a smelting plant. This is little appreciated by the furnaceman or the blast-furnace foreman, and it is up to the superintendent to see that all these fittings are tight."

The Copper Queen tuyere box is of the duplex type, provided with slag-drainage hole and a quickly removable cap, fastened with swinging lugs. A particular feature of the Copper Queen tuyere connection is the stop-cock or Corliss type of valve in contradistinction to the gate-valve type used by most smelting plants. An advantage of the stop-cock valve is that it works more easily than the gate-valve type and may be closed air-tight. It has a slotted flange on one end, so that by simply loosening the holding bolts, the tuyere pipes may be quickly removed to facilitate repairs or change of jackets. This type of valve is used by several of the smelting plants in the Southwest.

Tuyere Box Used by Detroit at Morenci

The tuyere box used by the Detroit Copper Mining Co. at Morenci, Ariz., is of interest as presenting a refinement of the tuyere cap originating at the Shannon works in the same district. The finger principle is used for holding the tuyere cap in place, but in the Shannon tuyere box the cap revolves on the bolt of the finger; when a tuyere slags, the cap must slide over a face of solidified slag, which is sometimes difficult. In the Detroit design the cap is free to drop out of the way as soon as the finger is lifted. The tuyere cap is attached at the bottom by a loose-fitting hinge. The faces of the cap and tuyere box are machined; when in use they are held together by the revolving finger, which intercepts a wedge on the outer surface of the cap and makes a tight joint. There is a raised ring left on the inner surface of the cap, so as to center it on the tuyere box in case the hinge becomes very loose from wear; this insures a tight joint at all times, and while slightly more expensive at the start, it has the advantage of not wasting compressed air. A slag escape is provided in the bottom of the tuyere box which is attached to the furnace jacket with slotted flanges so that, by loosening the nuts of the holding bolts, the tuyere box and blast pipe may be quickly removed when it is desired to change a furnace jacket. The blast pipe is simply thrust into the stuffing-box of the tuyere box and packed with asbestos.

The tuyeres shown in Fig. 4 are used on the 48-in. by 40-ft. copper blast furnaces of the Calumet & Arizona Mining Co., at Douglas, Ariz. Supt. H. A. Clark writes regarding these tuyere boxes as follows: "They have a taper connection to fit the tuyere thimble in the jacket and an adjustable ball-and-socket connection for the blast pipe. These connections, which are self-seating, make a very simple and air-tight joint and allow of quick removal or replacement. The cleaning door is held with a steel spring latch, and the slag hole is filled with a fiber plate or wooden plug. The tuyere boxes are simple and most serviceable and after several years of operation required absolutely no repairs."

At the Boston & Montana reduction department of the Anaconda company at Great Falls, Mont., Supt. J. H.

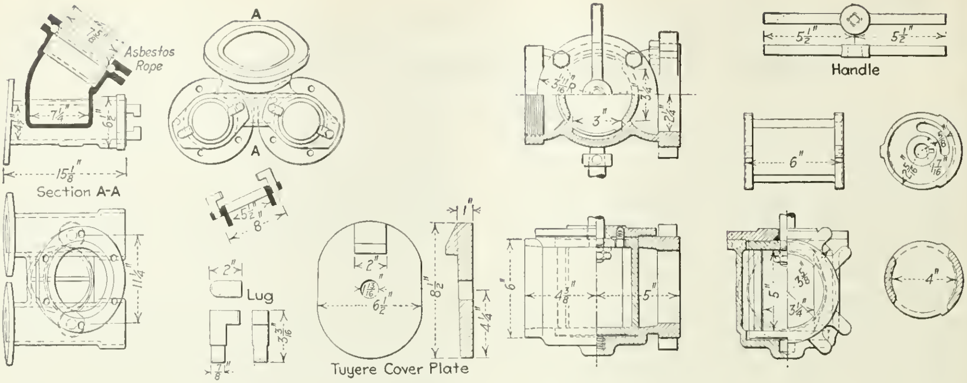


FIG. 1 COPPER QUEEN DUPLEX-TUYERE BOX AND STOP-COCK VALVE

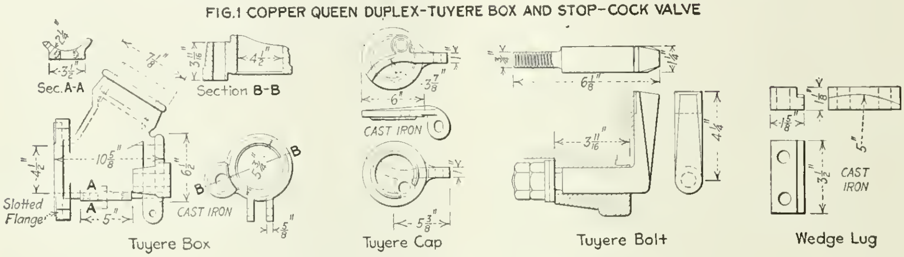


FIG. 2 DETROIT COPPER MINING CO.'S TUYERE BOX

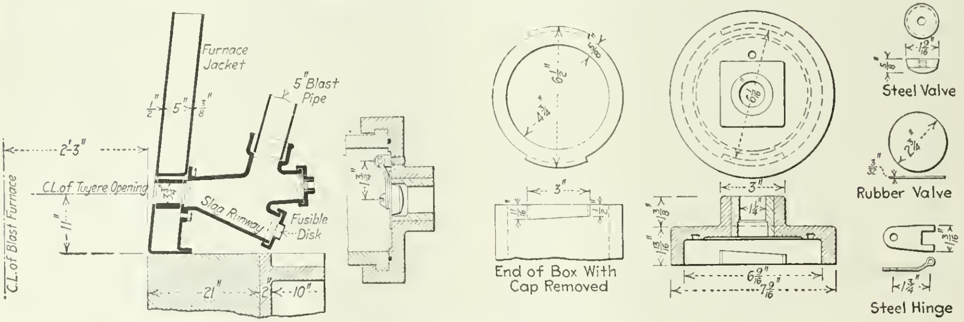


FIG. 3 BOSTON & MONTANA STANDARD TUYERE

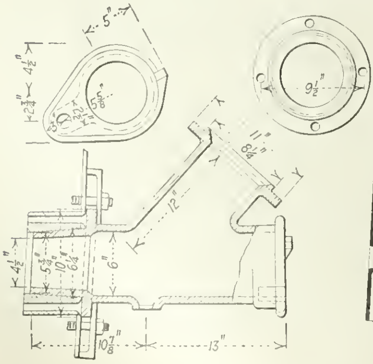
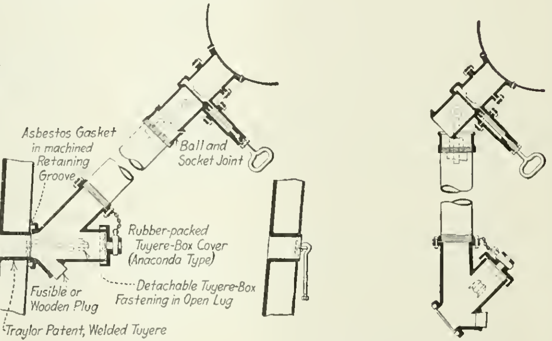


FIG. 4 CALUMET & ARIZONA TAPER-FIT TUYERE

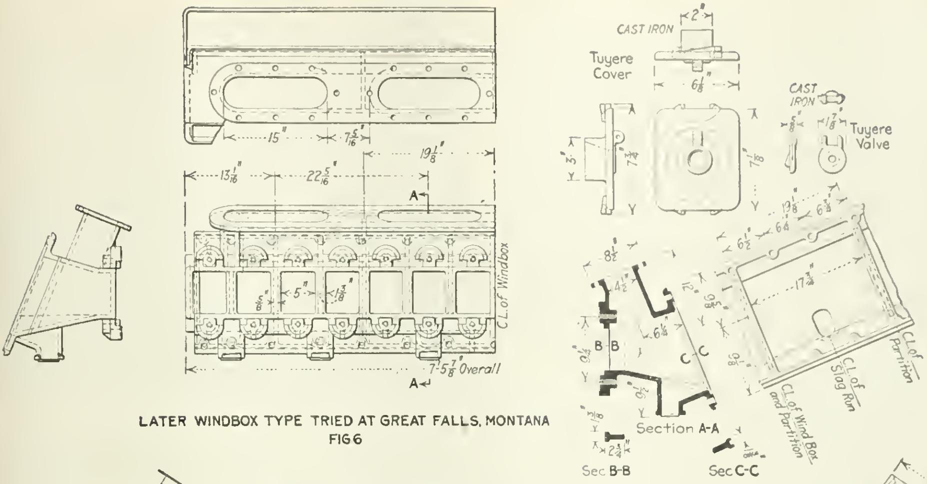

Asbestos Gasket in machined Retaining Groove
Ball and Socket Joint
Rubber-packed Tuyere-Box Cover (Anaconda Type)
Detachable Tuyere-Box Fastening in Open Lug
Fusible or Wooden Plug
Traylor Patent, Welded Tuyere

Working Position

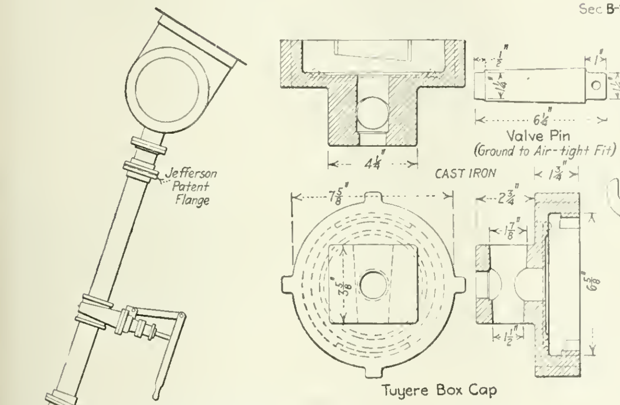
Swung Back to Remove Jacket

FIG. 5 TRAYLOR STANDARD COPPER TUYERE USED AT TRAIL, B.C.

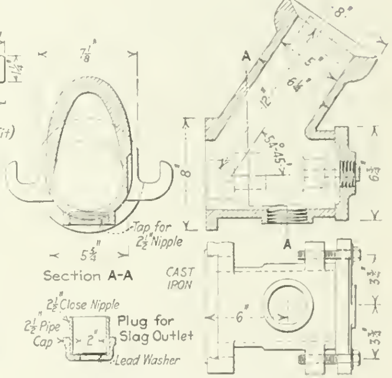
LEADING TYPES OF TUYERE CONNECTIONS AT IMPORTANT COPPER



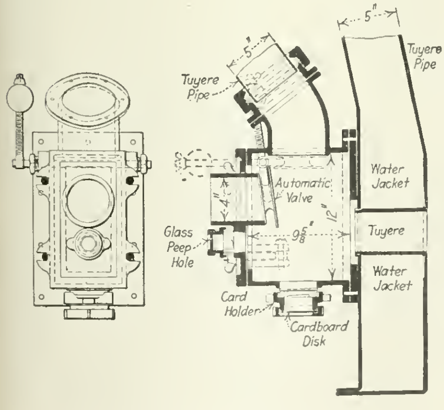
LATER WINDBOX TYPE TRIED AT GREAT FALLS, MONTANA
FIG 6



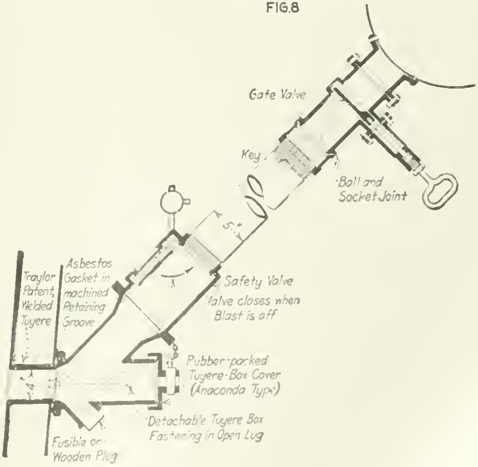
ANACONDA STANDARD TUYERE
FIG. 7



U.S. SMELTING COMPANY'S LEAD FURNACE TUYERE BOX
FIG. 8



EILERS AUTOMATIC-CUTOFF LEAD TUYERE USED AT MANY A.S. & R. CO. PLANTS
FIG. 9


Gate Valve
Key
Ball and Socket Joint
5"
Asbestos Gasket in machined Retaining Groove
Traylor Patent, Welded Tuyere
Safety Valve
Valve closes when Blast is off
4"
Rubber-packed Tuyere-Box Cover (Anaconda Type)
Detachable Tuyere Box Fastening in Open Lug
Fusible or Wooden Plug

TRAYLOR STANDARD LEAD TUYERE FOR BUNKER HILL & SULLIVAN'S NEW PLANT AT KELLOGG, IDAHO
FIG. 10

AND LEAD BLAST-FURNACE SMELTING PLANTS IN THE UNITED STATES

Klepinger writes that "on account of the curtailment in the use of blast furnaces at this plant and the probable ultimate discontinuance of their use entirely, not much has been done in the last few years in the way of developing apparatus and attachments for the blast-furnace tuyere connections. The type of connection considered as standard and of which the greatest number are in use at Great Falls is shown in Fig. 3. In this form there is a separate tuyere pipe for each tuyere, with its independent connection to the bustle pipe. It differs from the older forms used at this plant in that it has a device for freeing itself of slag by burning or melting out the fusible disk at the end of the branch on the lower side of the tuyere box. This has been found to be a decided advantage over the old straight-bottom tuyere pipe, which would sometimes become filled with slag before trouble would be observed.

"Another and later type of windbox and tuyere connection at the Boston & Montana works is shown in Fig. 6. This has been tried out to a limited extent only and consists essentially of a windbox built in compartments, each compartment having a single connection to the bustle pipe. Each compartment serves three or four tuyeres and is equipped with slag escape at the bottom, covered by a fusible cap to indicate promptly the flow of any slag into the windbox. Owing to the discontinuance of blast-furnace work at Great Falls, this box was not tried out for a sufficient period to determine whether it possesses any particular advantages over the old type. Personally I cannot see that it has any advantages and think that there are some disadvantages in that it might become necessary to renew a whole windbox in case of any serious damage to any part of same."

TRAYLOR STANDARD TUYERE CONNECTIONS

The Traylor standard tuyere connections shown in Figs. 5 and 10 are used respectively on the copper furnaces of the Consolidated Mining and Smelting Co. of Canada, at Trail, B. C., and on the new Bunker Hill & Sullivan lead-smelting plant now being constructed at Kellogg, Idaho. These tuyeres are also used by many other smelting plants, being made by the Traylor Engineering and Manufacturing Co., of Allentown, Penn. By reason of its extensive experience in the construction of smelting equipment, the Traylor company has been able to incorporate in its tuyere connections the results of the experience of many engineers, and these connections may be said to represent the approved constructional details adaptable to general smelting conditions in America. The tuyere proper is incorporated by autogenous welding with the inner sheet of the water jacket—a patented feature—and presents less opportunity for water leakage than most of the tuyeres in use. The tuyere-box design embraces a fusible-plug escape for slag, and the Anaconda type of tuyere-box cover with tapered plug in the peephole. The ball-and-socket connection of the blast pipe permits of quick removal of the tuyere connection in the event of the removal of a blast-furnace water jacket. A feature of the Traylor standard lead tuyere connection, adopted by the Bunker Hill & Sullivan and the Northport lead-smelting plants, is the safety valve shown in Fig. 10. This valve is automatic and obviates the necessity of removing the tuyere-box covers in case the blast is cut off, and eliminates automatically the danger of explosions which have occasionally caused much damage at lead smelting plants.

The automatic-cutoff valve is a feature of the Eilers tuyere box used at a number of the American Smelting and Refining Co.'s lead-smelting works. Fig. 9 shows the tuyere box used at the works at Murray, Utah. Supt. W. W. Norton, discussing this feature of the furnace equipment, writes as follows:

TUYERE BOX WITH AUTOMATIC-CUTOFF VALVE INVENTED BY ANTON EILERS

"In considering the subject of tuyere boxes, or tuyere connections of any sort, the designer should have in mind adequate mechanical means for preventing the passage of furnace gases up into the tuyere pipes during periods when the blast is off. All who have operated blast furnaces are familiar with the danger incident to an explosive mixture of gas and air within the bustle pipes, this hazardous condition being brought about by shutting off the air blast and at the same time failing to guard against the back pressure from the furnaces. Disastrous explosions have thus occurred.

"Early-day galvanized-iron tuyere nozzles, which connected flexible canvas sacking with the tuyere holes, were safe provided the operators would 'pull the pipes' when a sudden irregularity caused the blast to quit. With larger furnaces and higher blast came rigid steel tuyere pipes and the necessity for a tuyere box of some sort, these 'boxes' being of various shapes and serving to decrease air leakage, also embodying other desirable features. A slide valve operated by hand, either just above the box or up in the tuyere pipe, was usually provided.

"The Murray plant now uses a tuyere box containing an automatic valve as invented by Anton Eilers many years ago. The design has been improved in several respects, but the essential idea of Mr. Eilers is still retained; namely, a valve that automatically prevents a backing-up of gases into pipes and eliminates dependence upon a valve operated by hand.

"The main features are shown in an accompanying sketch. A simple cast-iron box is screwed directly on the jacket. The pressure of the blast entering at *A* holds a disk of the valve firmly against the hole *C*. If the blowing engine stops or the blast suddenly ceases from any other cause, a counterweight forces the valve to change position and the disk firmly closes the hole *B* instead of *C*. Any back pressure of gases out of the tuyere *D* is thereupon immediately permitted to pass out into the open air through *C* instead of up into the tuyere pipes through *B*, and danger of explosions is automatically avoided. So far as my information goes, all other types of tuyere boxes depend upon the human factor in so far as valves at the tuyeres are used to guard against hazards just mentioned.

"The Eilers automatic tuyere box allows freedom of working space in case of an unfortunate necessity to bar out slag from tuyeres. Hinged bolts with thumb-nuts permit the square covers of the boxes to be readily removed, thus affording ample play for bars used in any sort of a cleaning-out operation, a feature that does not exist in tuyere boxes of a more restricted design. Another good feature, although this is a common adjunct of most tuyere boxes of today, consists of a hole at the bottom of the box, closed by a bit of cardboard. If slag runs into the box, the cardboard burns, the slag flows out the hole and the furnaceman at once 'gets busy.'"

The latest form of tuyere box developed at the United States Smelting Co.'s plant at Midvale, Utah, is shown in Fig. 8. Supt. L. D. Anderson, in commenting on this, writes: "I cannot say that there is anything particularly brilliant or meritorious about this tuyere box, other than that it has been found satisfactory and serviceable. The original tuyere box was provided with a cap which clamped on the face. In the present design this cap is held on by two capscrews. The reason for this change was that in the case of slagging in the old tuyere box the face against which the cap fitted sometimes became scarred, permitted air leakage. As the cap was held on by clamp lugs, there was no way of cleaning up this face, and the old box would have to be discarded in order to avoid leakage of air. With the present design, if the face becomes scarred it is a simple matter to put the casting in the lathe and turn off the face so that the box can be put back into service. There has also been added an opening for slag escape, which has proved very useful. The drawing calls for a lead washer. As a matter of fact, pieces of pasteboard are plenty good enough for this purpose and are regularly used at this plant."

⁂

Basic-Lined Converter Practice

Basic converting in the Southwest was probably first attempted in 1907 by the late Charles F. Shelby at the reduction works of the Cananea Consolidated Copper Co. Having replaced the acid lining of an 8x12-ft. barrel-type converter with one course of magnesite brick, he blew only 21 taps (about 180 tons) of matte to white metal before the brick gave out along the tuyere line. The lining cost $700, and the experiment was abandoned as impractical. No further effort to bessemerize copper mattes in vessels equipped with more or less permanent linings of basic brick were made by any of the large companies in the Southwest until some months after Messrs. Peirce and Smith had proved basic-lining a metallurgical and financial success by their work at Baltimore and Garfield.

The year 1911 is noteworthy as the one in which many companies did their first successful work with basic-lining. The Cananea Consolidated had several converters in operation with basic lining in this year and in the 18 months following blew 50,000 tons of copper with them. The Consolidated Kansas City Smelting and Refining Co. installed two 10x26-ft. Peirce-Smith converters in September at its El Paso plant. In March, 1913, one standard Great Falls type converter was added. At its Hayden, Ariz., plant, two 10x25 Peirce-Smith converters were added in 1911, followed in 1913 by one Great Falls converter.

It was during 1911 that the Anaconda Copper Mining Co. proved the worth of the so-called Great Falls converter. It was to this type, now recognized as standard, that the Copper Queen company turned in 1912 when it was decided to equip the Douglas reduction works with basic-lined converters.

In October, 1911, the Arizona Copper Co. first used the basic-lined converter at the old Clifton plant and continued the use of small basic-lined converters until October, 1913, when the new smeltery was equipped with three stands of electrically operated Great Falls converters.

The Old Dominion company installed a 12-ft. Great Falls converter in January, 1913, supplemented when necessary by two small basic-lined converters. The Detroit Copper company has never considered it advisable to adopt the large basic-lined converter, but instead ha equipped its 7x10-ft. converters with basic lining. A record has been made in converting over 3,100,000 lb. of copper with one lining before any patching of the brick was necessary. The Consolidated Arizona Smelting Co. at Humboldt has likewise continued the successful use of small basic-lined converters, but now contemplates the purchase of a large unit.

Both the International Smelting Co. at Inspiration and the United Verde, at Clarkdale, have installed the standard Great Falls electrically operated converters in their new plants, which went into operation in 1915.

There is no question about the superiority of [illegible] acid linings or, where the output of copper is sufficiently large to insure efficient operating, of the st[illegible]

TABLE 1. OPERATING DATA OF BASIC-LINED CONVERTERS IN SOUTHWEST

	1	2	3	4	5	6	7	8	9	10
Blast pressure in pounds	13	13.2	14	12	12.4	12–15	10–14	14	11.3	13
Cu.ft. air per minute per converter	5,445	7,691	10,600	4,283	6,054	7,250		8,181	4,033	4,117
Cu.ft. air per ton bullion produced	152,449	178,411	141,000	228,116	271,577	137,582	118,328	225,674	245,975	370,566
Cu.ft. air per ton iron and sulphur oxidized	96,145	142,224	156,000	98,847	139,361	112,950	118,328	119,475	240,937	123,583
Oxygen efficiency, taking into account total iron and sulphur oxidized	84.0	54.1	57.2	76.8	56.3	74.0	81.0	50.6	69.8	59.0
Total tons iron and sulphur oxidized per stand per month	2,075	1,610		1,647	1,903	2,868	1,991	2,576	768	1,440
Punchers used per shell per shift	2	2	2	2	2	2	2	1	1.5	2
Tons bullion per puncher per month	221	204	522	119	478	392	255	137	129	240
Tons iron slagged per puncher per month	192	153		169	533	251	171	156	147	
Average time of blow, hours and minutes	4–00	4–11	3–09	6–44	9–20	8–00	8–30	7–12	4–51	10–00
Average time to blow one ton bullion, minutes	28	23	14	54	45	19	28	28	51	90
Average tons bullion per blow	8.5	10.8	13.3	8.22	12.7	25.3	18.0	15.6	5.8	6.7
Average weight of matte per charge, tons	21.9	26.0	25.9	33.9	40.5	60.0	50.0	51.2	19.7	26.6
Tons ore charged per ton of matte	0.23	0.20	0.155	0.201	0.17	0.25	0.30	0.21	0.286	0.283
Tons iron slagged per ton of available slica		2.44		2.45	3.85	1.75	1.80	2.36	2.03	2.60
Size of converters	12 ft.	12 ft.	12 ft	12 ft.	12 ft.	10 x 26 ft.	12-ft. Gt Falls 10 x 26 ft P.-S.	12 ft.	7 x 10½ ft.	9 x 7½ ft
Number of tuyeres	28	24	24	24	24	35	24 Gt Falls. 35 P.-S	22	12	12
Size of tuyeres, inches	1¼	1¼	1½	1½	1¼	1¼	1¼ Gt Falls 1½ P.-S	1½	1½	1¼
Thickness of brick used on tuyere line, inches	24	30	30	14	30	18	18	24	18	15
Average slag analysis:										
SiO_2	19.6	21.7	17.2	17.4	15.6	23.6	25.7	29.2*	22.2	23.8
FeO	68.2	67.9	69.1	70.7	67.3	66.2	60.0	62.1	63.1	61.5
CaO	0.8	1.1	0.6	0.8	0.4			1.6	0.9	
Al_2O_3	3.4	3.0	3.7	3.0	2.9				2.8	
Average matte analysis:										
Cu	37.7	43.37	51.2	28.22	34.7	43.7	42.8	31.9	35.21	25.0
Fe	32.5	29.2	21.6	30.9	34.9	28.0	27.4	28.8	36.1	46.0
S	27.4	23.5	24.5	25.3	24.9	25.1	25.6	18.7	25.0	25.0

1. Arizona Copper Co., Clifton, Ariz.
2. Old Dominion Copper Mining and Smelting Co., Globe, Ariz.
3. International Smelting Co., Inspiration, Ariz.
4. Calumet & Arizona Mining Co., Douglas, Ariz.
5. Copper Queen Mining Co., Douglas, Ariz.
6. Consolidated Kansas City Smelting and Refining Co., Hayden Plant, Ariz.
7. Consolidated Kansas City Smelting and Refining Co., El Paso Plant, Texas
8. Cananea Consolidated Copper Co., Cananea, Sonora, Mex
9. Detroit Copper Mining Co., Morenci, Ariz
10. Consolidated Arizona Smelting Co., Humboldt, Ariz.

* Insoluble.

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*Abstract from "The Basic-Lined Converter in the Southwest," a paper presented at the Arizona meeting of the A. I. M. E. by L. O. Howard, Globe, Ariz.

over the smaller basic-lined converter. The inability properly to control the temperature of the charge in the small vessel, and the resulting destruction of the brick lining, are the most serious difficulties with which the operator using a small basic-lined converter has to contend. Throughout the Southwest, the preference has been for the standard upright rather than for the horizontal converter. The greater flexibility of the former and the greater ease with which repairs may be made strongly recommend it.

TABLE 2. OLD DOMINION COPPER MINING AND SMELTING CO.

Campaign of basic-lined converter No. 2	December, 1915
Put in operation	June 27,1913
Removed for initial patching	Dec. 7, 1915
Total hours blowing	13,734
Total number blows made	3,288
Average time of blow	4 hr. 11 min.
Total number taps matte	9,316
Total tons matte charged	85,578
Average weight of matte per charge	26 tons
Average copper content of matte	43.37%
Total tons bullion produced	35,431
Average time to blow one ton copper	23.2 min.
Average tons copper per blow	10 80
Average blast pressure	13.2 lb.
Average air used to blow one ton copper	178,411 cu ft.
Average air used per minute	7,691 cu.ft.
Average air used per ton iron slagged	242,502 cu.ft.
Total ore fed	17,097 tons
Tons ore fed per ton matte blown	0.200
Magnesite used for repairs	None

Average Slag Analysis Cu, 2.1%; SiO_2, 21.7; Fe, 52.2; CaO, 1.1; Al_2O_3, 3; S, 1.8.
Average Matte Analysis Cu, 43.37%; Fe, 29.2; S, 23.5.

The operating data in Table 1 will give an idea of the working conditions and the results obtained at some of the large smelting plants in the Southwest. It is to be regretted that replies to questions pertaining to power consumption were at such variance that it was thought best to omit them entirely, as no reconciliation seemed possible.

Separate operating data for the Peirce-Smith and Great Falls converters at El Paso could not be obtained, so the figures in column 7 are a combination of results obtained in these different types. The figures in columns 9 and 10 are for former acid-lined shells now operating with a lining of magnesite brick. All figures are for periods of a month or more. Those in column 5 are for 1915. The data in column 2 cover a period of 29 months' operation—the life of one original lining to the time of first patching.

Data relating to a campaign of a lining at the works of the Old Dominion are given in Table 2. The tabulated results contrasted with those of the first experimenters fairly measure the advance of the art in a few years time.

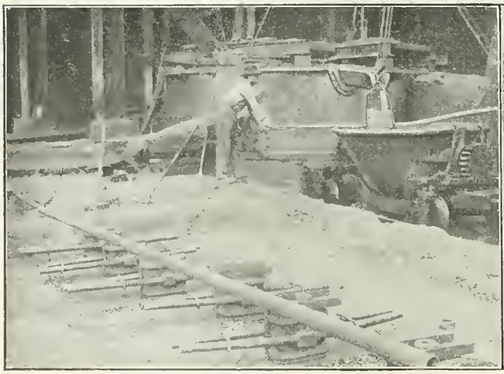
Slag Lining for Launders

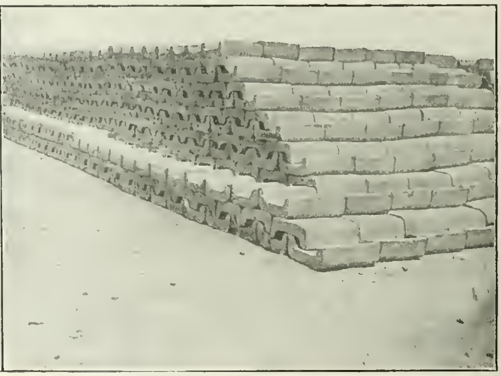
By W. A. Leddell*

Acid water in concentrator work in some parts of the country is the direct cause of high repair costs on launders, pumps, screens and grinding equipment. On launders that carry coarse material erosive action is particularly heavy. Iron or glass liners are frequently used to prevent this action. Where acid water is encountered, the iron is attacked and the grinding action of the pulp materially assists the rapid destruction of the liner. Glass is more permanent but expensive—especially where freight rates are high.

Attempts have frequently been made in times past to utilize blast-furnace slag by casting it into large bricks. These, however, have been unsuitable for lining launders for various reasons, but particularly because of excessive weight on the framework and supports when long, elevated launders were required. This objection would of course not hold if the slag were cast into liners from 1 to 2 in. in thickness; a 12x12x2-in. liner would then weigh less than 40 lb. This may be successfully used, provided the block thus cast will withstand a reasonable amount of handling.

A liner sufficiently substantial to fulfill these requirements was suggested and developed[1] by me at Morenci, Ariz., for the Detroit Copper Mining Co. These liners are now in use at that plant and also I believe at that of the Old Dominion Copper Co., of Globe, Ariz. The former plant now has in service upward of 25,000 ft. of this type of lining.


CASTING LEDDELL SLAG LINERS


CHANNEL-SHAPED LINERS FOR LAUNDERS

Slag, to be serviceable for this work, must be both reinforced and annealed. The reinforcement used is common poultry netting, 1-in. or 1½-in. hexagon mesh, 26- or 28-gage wire. The casting is done in a metal mold. This enables one to use common labor for producing the slag liners. The castings are made on end; that is, the mold is open at both ends and stands on a cast-iron floor plate which closes the bottom. The top is covered with a plate with a hole in the center of a short riser, which forms the gate through which the slag is poured.

Two pieces of reinforcing mesh are placed in the mold before pouring, one piece near each side; that is, not on the neutral axis of the casting. The wire then acts as reinforcement. As soon as the slag chills slightly, in fact while the center of the casting is still in a fluid state, it may be removed from the mold. It is then laid on the ground and covered with a thin layer of some nonconducting material such as sand, lime, etc., after which another casting is placed on top with another covering of sand. This is done in order to retain as long as possible the heat in the casting, thus reducing shrinkage strains. At this point it might be well to mention that channel-shaped liners should be, as nearly as possible, of uniform thickness.

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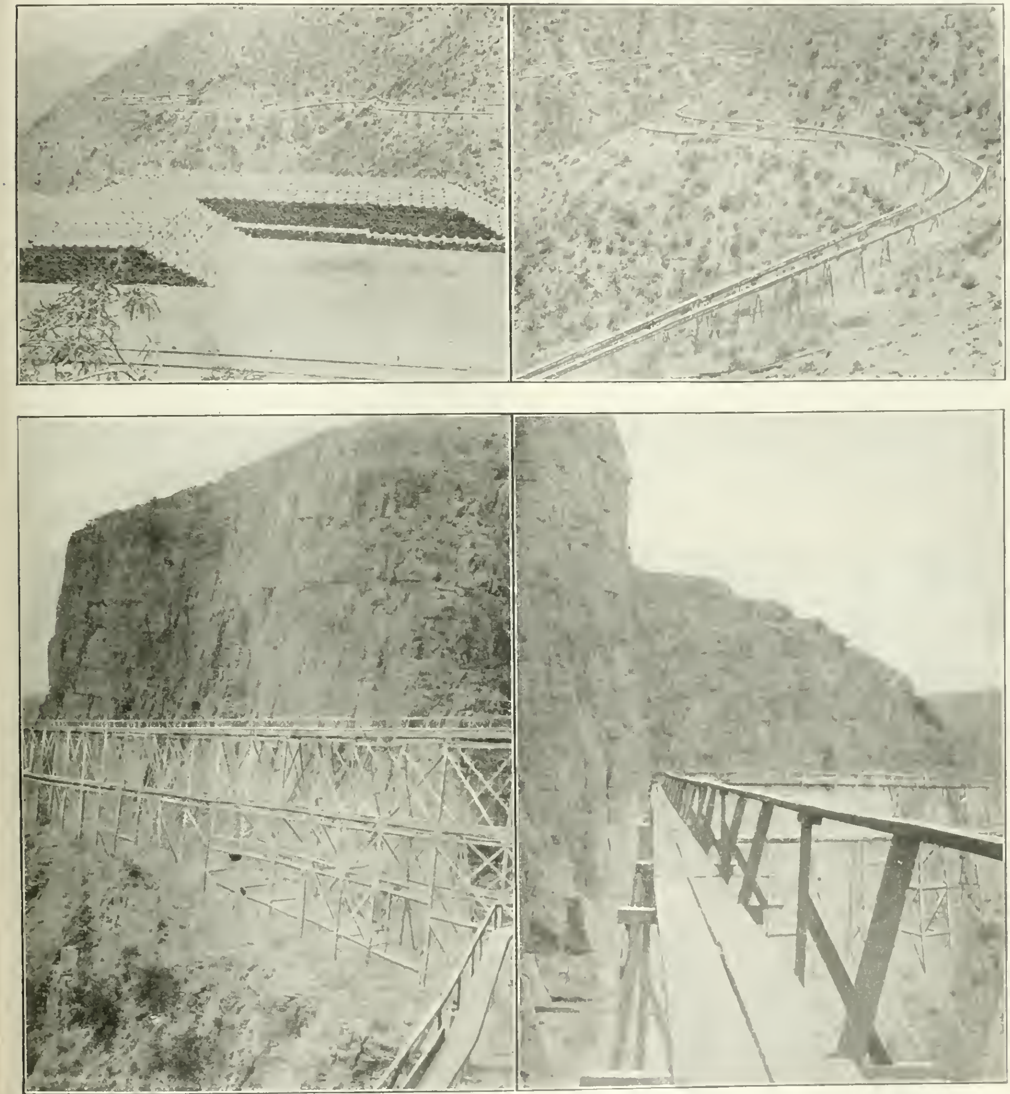
*Engineer, United States Smelting, Refining and Mining Co., 920 Newhouse Building, Salt Lake City, Utah.

[1] U. S. Pat. 1,189,842, July 4, 1916.

The cost of this type of lining is only a small fraction of that of cast-iron or glass lining. Slag lining per foot should not cost more than 12c., while the iron lining will cost from 90c. to $3, depending on the thickness, price of iron, freight, etc.

Comparative costs at Morenci on the slag and cast-iron liner is obtained over a period of 2½ years show a saving in the 1,500-ton concentrator of upward of $6,000 per year. In addition to the concentrator work proper the company later lined the tailings flume with slag. This was an expensive piece of work since it was inaccessible except from either end of the 2-mi. flume. The completed



TWO TAILING FLUMES OF THE DETROIT COPPER MINING CO., AT MORENCI, ARIZ., ARE LINED WITH SLAG

Each flume, about 10,000 ft. in length, is protected with Leddell slag liners, which are calculated to wear six years, as against yearly renewal of 2-in. plank lining. In all about 25,000 lin.ft. of slag liners are in use by the Detroit company work, however, effects a large yearly saving in addition to that already produced in the concentrator. A report, dated July, 1915, in regard to the slag liners, which had then been in use about one year, says:

> The following is a record to date of slag lining in comparison to cast iron:
>
> | | |
> |---|---|
> | Year 1912—Cast-iron, only........ | $7,015.00 = 0.01397 per ton |
> | Year 1914—Cast-iron and slag, both. | 1,873.50 = 0.00407 per ton |
> | Jan.-July, 1915—Slag only......... | 498.13 = 0.00197 per ton |
>
> Cast-iron liners from rolls to elevator, average life, 90 days; slag liners for same service, 180 days. Cost per foot of cast-iron liners, $0.90, as against $0.12 for slag.
>
> Cast-iron liners, feed launders to Wilfley tables wore 60 days, against 240 days (and still in service) for slag. Slag liners put in July, 1914, on finer material, still in service and good for several months yet. Life of cast iron, same service, 180 to 210 days.
>
> The very satisfactory result that we have obtained from slag liners has resulted in our lining two tailing flumes 10,000 ft. in length each with slag. On this service we figure the slag will wear six years as against former yearly lining of 2-in. plank.
>
> Acid water, with which we have to contend, has no effect whatever on slag liners, whereas on cast iron its action is heavy. In all we will have in service when the change is complete a total of 25,000 lin.ft. of slag liners.

Slag lining for chute bottoms has also proven economical where the materials handled were not coarse enough to produce a heavy shock on the slag lining. At Morenci material up to $\frac{5}{8}$-in. was handled successfully with this lining.

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Chilled Conveyor Idlers

At the Nevada Consolidated works at McGill, Nev., it has been found of advantage to use a chilled idler for belt conveyors instead of the softer machine-turned idler supplied by the belt-conveyor manufacturers. The relative values of the chilled idler and the machine-turned idler are clearly shown in the accompanying halftone engravings made from photographs of the two kinds of idlers taken after actual service. Fig. 1 shows a set of all chilled idlers that had been in identical service with the set of all factory-made soft-metal idlers shown in Fig. 2. Fig. 3 shows a combined set with factory-machined idlers on the sides and a hard chilled idler in the center.

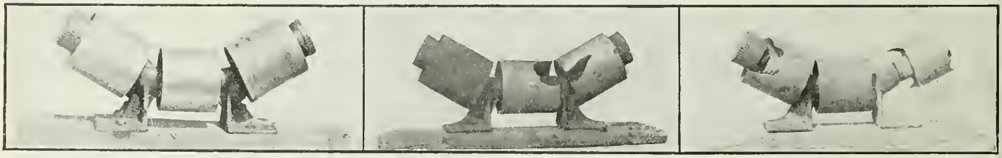
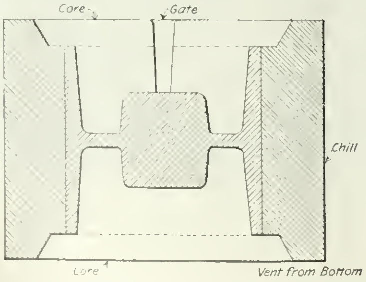


FIG. 1. CHILLED IDLERS FIG. 2. SOFT MACHINED IDLERS FIG. 3. CHILLED CENTER IDLER

Idler sets shown in Figs. 1 and 2 were in service the same length of time and on the same conveyor; note superior wearing qualities of the chilled idlers. This is again demonstrated in Fig. 3, where the chilled idler in the center outlasted the other two soft, machine-finished idlers



METHOD OF CASTING CHILLED IDLERS

The method of casting the chilled idler for the Nevada Consolidated conveyors is shown in the line drawing. The idler is not turned, but is cast smooth enough to require no finish whatever. The casting is put into a lathe, centered and drilled, and is then ready for service.

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Structural-Steel Estimations

By E. R. Rankin, Jr.*

There are three forms in which data for estimating structural-steel work for mining plants are submitted to prospective bidders. These forms may not be called systems, because they partly overlap, and while any purchaser may adopt as general practice one or another of them, all three will in time be utilized. However, two of them are extremes and, as such, offer obstacles to correct estimating or are wasteful of the purchaser's time and money. The various forms are: First, outline diagrams; second, design drawings; and third, shop details.

The outline diagram is no more than a sketch showing horizontal and vertical dimensions of the proposed structure, the columns possibly being located, but with wall openings practically never shown. The adoption of this form necessitates the receipt of tenders in pound prices. It throws the engineering expense where at times it rightfully belongs—outside the purchaser's organization. This course is necessary if the purchaser is represented only by a mechanical-engineering or construction department not qualified properly to handle steel design. However, the outline diagram, meager in data and often vague, leads to wide variations in estimated weights and quotations among the bidders, and sometimes to consequent readjustments of cost budgets.

For one instance of the effect of obscurities, different standard assumptions for maximum wheel loads and length of wheelbase for a traveling crane would, in a runway of not unreasonable length, affect the cost through the design of the supporting girders and columns to an extent comparable to the cost of the crane itself.

Experience and Good Judgment Valuable

Snap-judgment cost estimating is demanded where experience and good judgment would repay better their users. If wide variations in the class and cost of fabrication occur in several structures embraced in one pound-price contract, a disadvantage is worked if, when making final and complete designs, the comparative tonnage of different classes is changed from the proportions originally fixing the average price. This may be obviated by basing the contract on certain agreed estimated weights for each structure, the final variation either way being subject to separate unit prices.

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*Box 85, El Paso, Tex.

The first form improves by taking on the nature of the design drawing. All data, except stresses and sizes of material, transferred to an otherwise clear and definite line diagram, help greatly in figuring approximately correct weights.

Detail drawings ready for the shop are the other extreme. When they are prepared and submitted for bids, a saving in time may possibly be secured if the related engineering-office work is directed with that end in view. However, while general design drawings (not yet discussed) do not interfere with the use of standards in shop practice, detail drawings furnished by a customer may cause extra expense in fabrication, since in details generally appear the distinct standards fixed by the various shops. The purchaser may pay his engineering office for preparing shop details and then pay the fabricator for remaking them.

The adoption of this form often hinders the use of that worthy expedient, "Substitutions of sizes are permitted where clearances are maintained and the strength of members is not materially affected." If changes in the sizes of material specified are advantageous and permissible, the detail drawings may have to be revised.

The chief use of shop drawings so furnished is in the saving of time at the expense of engineering labor. In the matter of drafting-room costs it is impossible to find any mining company able to compete with the responsible structural manufacturers.

It is not, and cannot be, denied that the design drawing with skeleton specifications is the most profitable means of submitting the required information to bidders. The specifications should state no less than the following points: Proper assumptions for dead and wind loads; definite statements of live loads and the conditions of their application; maximum allowable unit stresses; and typical or special details where required. Supplementary to this information should be reasonably well-defined time allowances for supplying or erecting. Mere instructions that bidders should state how soon they can supply and that delivery will influence the award of the work is not sufficient to prevent a bidder submitting a hit-or-miss proposition.

DETAILS REQUIRED FOR ESTIMATES

If erected figures are asked, information is necessary making clear the cost of unloading and handling to sites, also as to the availability of power, air or steam and at what unit cost. The kind of paint should be specified and no discrepancies permitted to obscure the character of field work, riveted or bolted connections, etc. If other materials are to be included with the structural-steel work, as is so often the case, the specifications covering them should be equally complete and definite, or the good work done by one hand may be nullified by the other. Such matters as deciding upon the most satisfactory and economical type and thickness of siding and roof covering, the location and extent of window openings, character of sash and glazing, the form of ventilators and amount of ventilation to be secured should not be put up to prospective sellers unfamiliar with the conditions affecting particular cases.

The purchaser should also assume responsibility for all required arbitrary treatment of design based, not on engineering computations, but on experience—the possible action of molten metal, or radical and repeated changes in temperature, as well as the more obvious corrosive effects of smoke and dust.

Both lost time and multiplied selling expense result from requests for designs with proposals, even when purchasers submit complete and definite data facilitating the bidder's work of preparation. However, the stimulation of this kind of competition, when not used to excess, offsets any hardships imposed upon bidders and should result in direct and obvious economical advantage to the buyer.

When steps taken in coöperation between purchasing and engineering forces result in the saving of time and reduction of selling costs, "scientific buying" becomes a reality and achieves tangible benefits for the user.

"Have you ordered your crane? If so, please send us a sketch of the clearance diagram."

"What is the weight of your ore per cubic foot?"

"Do you not consider it inadvisable to lay a corrugated-metal roof on so flat a pitch?"

"You state the table-floor load is to be taken at 200 lb. per sq.ft. Is this inclusive or exclusive of the weight of the concrete floor slab?"

These typical queries illustrate causes of delay and needless correspondence. Every precaution taken along the suggested lines increases the "personal" power of the buyer. Either metals are low or steel is high, and the need is ever present for the exercise of economical standards of procedure in this and allied transactions.

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International Smelting Co., Operating Data

The following data relative to the operations of the International Smeltery at Miami, Ariz., were presented to the members of the A. I. M. E. during their recent visit to the works.

Miami and Inspiration concentrates are received, sampled and introduced into the drier plant, which consists of five Wedge furnaces used as driers. The gases are treated in a Cottrell dust-precipitating plant. A drier charge consists of 84.9% concentrates, 0.2% crushed ore, 7.1% converter secondaries, 2.1% pyrite and 5.7% limestone; 207 tons of charge is treated per furnace day, with an oil consumption of 5.51 gal. per ton. The charge contains 28.13% copper.

The calcines are treated in three 21x120-ft. reverberatory furnaces. The charge consists of 71.6 to 82.4% concentrates, 0.3 to 0.1% siliceous ore, 7.3 to 8.1% converter secondaries, 0.1 to 0.5% converter flue dust, 2.3 to 2.6% pyrite, 5 to 5.7% limestone and hot converter slag up to 13.1% to fill out the change. Per furnace day 184 tons is treated at an oil consumption of 0.79 bbl. per ton of charge.

The matte from the reverberatories goes to five converters of the Great Falls type operating under a blast pressure of 12 lb. The average weight of matte per charge is 26.9 tons carrying 51.05% copper from which 13.7 tons of copper is produced. From each converter 95 tons of copper is produced per day. The casting machine has a capacity of 259 tons of copper bars per day. These bars weigh 274 lb. each.

The Donora Zinc Works

By W. R. Ingalls

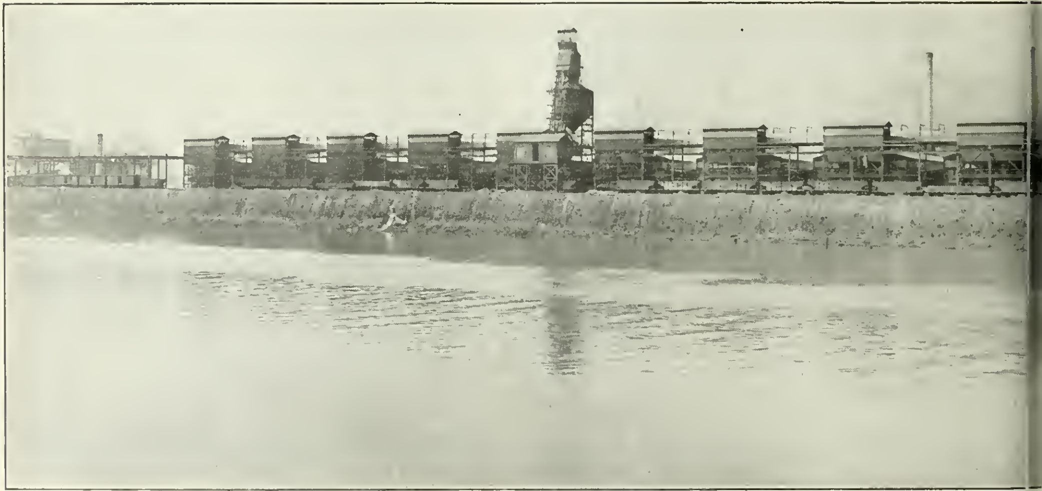
SYNOPSIS—A description of the Donora Zinc Works of the American Steel and Wire Co., built in the Pittsburgh district last year. All records for construction speed were broken, and a highly refined, modern plant has been built. Its location is commercially favorable. Being operated in connection with the Donora steel plant, advantageous coöperation in respect to administration, power, coal supply, etc., is possible.

The Donora Zinc Works of the American Steel and Wire Co. (a subsidiary of the United States Steel Corporation) is the most recent of zinc smelting constructions in the eastern part of the United States, and it is the largest plant in which coal is the fuel. It is remarkable also for the excellence of its construction and the speed with which is was executed. The provision of this plant, together with the smelteries at St. Louis, Mo., and Cherryvale, Kan., previously owned by the American Steel and Wire Co., gives the Steel Corporation the largest part of the spelter that it requires for galvanizing and other purposes.

In the construction of the Donora plant, all records for time of building were beaten. Work was begun on June 22, 1915. The first duty was the removal of a pile of 75,000 tons of iron ore standing where the zinc plant was to be. Some grading had to be done, but the amount was not large in proportion to the size of the plant, the site being on the natural bench forming the west bank of the Monongahela River. In starting a zinc smeltery the determinative factor is usually the construction of the pottery and the manufacture of a stock of retorts sufficiently well seasoned, with which to begin. In the case of Donora this difficulty was overcome by bringing the first retorts from Cherryvale, Kan. This explains the mystery that has exercised zinc smelters of how it was possible to begin the production of spelter in less than four months after breaking ground. With the mystery brushed away, the achievement is none the less remarkable. The first zinc was made on Oct. 20, 1915; the first sulphuric acid on Dec. 23, 1915, the zinc smeltery being operated on calamine in the meanwhile.

The Geographical Location

In selecting the Pittsburg district for the location of its new plant, the officials of the Steel Corporation showed great wisdom. This district is preëminently the great center of spelter consumption in the United States. Also it is a great consumer of sulphuric acid and lead—both of them byproducts of zinc smelting. Moreover, it possesses a great supply of some of the best gas coal, which is obtainable at relatively low cost; from the anthracite fields of eastern Pennsylvania it can draw the best reduction material; and right in Pittsburgh are manufactured some of the best refractory products. With regard to bringing ore to the works, freight rates in the United States are always lowest on such raw material and rise with the products thereof according to their degree. Zinc ore is generally concentrated and contains but little worthless gangue on which freight is wasted. So long as a zinc plant does not overstep the center of gravity of consumption and run the risk of having to pay back freight (that is, western freight) on the spelter, the farther east it can be situated is generally the better, of course assuming that smelting conditions are equal; for it comes to about the same thing whether freight is paid on the ore to St. Louis and thence on the spelter to Pittsburgh or is paid on the ore all the way to Pittsburgh; but the Eastern plant has a superior command of ores,



PANORAMIC VIEW, FROM THE EAST BANK OF THE MONONGAHELA RIVER, OF not only from the United States, but also from foreign countries. The last has been well exemplified by the experience of the Donora works in getting a large supply of Australian ore.

In the case of the Steel Corporation the Pittsburgh district was a logical selection for internal reasons. The subsidiaries of the corporation are themselves large consumers of spelter—in the aggregate their spelter consumption is the largest of the United States. Also they are large consumers of sulphuric acid. Finally, it was possible to build the plant in connection with some other great plant, thus dividing administrative expense, simplifying the matters of power supply, coal supply, etc., and furnishing a use for the large steam power that could be generated from the waste heat of the smelting furnaces. No doubt these factors all entered into the considerations of the officers of the Steel Corporation in locating the Donora zinc works.

E DONORA ZINC SMELTING PLANT OF THE AMERICAN STEEL AND WIRE CO.

The site of the Donora plant comprises about 40 acres, situated between the Monongahela division of the Pennsylvania R.R. and the Monongahela River, which here runs practically north and south. The zinc smeltery is immediately adjacent to and north of the wire and rod mills of the American Steel and Wire Co. at Donora, the two blast furnaces and the openhearth steel plant of the company being farther south, up the Monongahela River. The entire plant of the company at Donora stretches along the river for about three miles.

It will be observed, from the accompanying drawing, that the railway system in the Donora plant is extremely simple, the single line serving to bring in the ore and coal and take out the spelter, nothing else being required of it. Transportation from department to department within the works is done by means of an overhead telpherage system, whereby the ground is kept clear of tracks, switches, etc. This creates a pleasing appearance.

The ore cars are brought in over a railroad track scale of 150-ton capacity. The cars are unloaded into 10 storage bins, each being 70 ft. long, 20 ft. wide and 16 ft. deep and having a storage capacity of about 2,000 tons, or 20,000 tons in the aggregate. These bins are concrete-lined, covered by a commodious and well-constructed shed. The distribution of the ore among the bins, and the reclaiming of it, are done by means of a 15-ton overhead electric traveling crane with a grab-bucket. During the unloading of the cars the ore is sampled by the reservation of every tenth shovelful, which is sent to the sampling mill, where it is cut down in the usual manner.

The ore is picked up from the storage bins as required and put through the crushing plant, receiving a preliminary drying in Ruggles-Coles driers, of which there are two. Otherwise the crushing plant is quite conventional and does not require any special description. The crushed and screened ore goes, of course, to the roasting furnaces.

ROASTING DEPARTMENT

The roasting department comprises six Hegeler furnaces, seven hearths high. Each hearth is 80 ft. by 6 ft. 1 in. In dimensions, design and details of construction, the Hegeler furnaces at Donora are about the same as those at Langeloth.

Each roasting furnace at Donora is fired with gas delivered by a Hughes 10-ft. mechanical producer. The coal consumption is about 11 tons per 24 hr. The combustion gases on their way to the chimney pass through a U-pipe stove, whereby they are cooled down to about 200° C. at the foot of the chimney. The air for secondary combustion passes through the pipe of the stove in the opposite direction and is heated to about 400° C. The air is supplied by a Sirocco fan. In practice in the roasting of Australian ore, however, it has been found that the Hegeler furnace had a tendency to run too hot, and lately the furnace gases have been by-passed directly to the chimney, the arrangement of the flues, etc., in connection with the stove easily permitting that to be done.

In the roasting of Australian concentrates the Hegeler furnaces at first did about 50 tons each per 24 hr., but there has been a good deal of trouble from sintering of the ore, and the furnaces are now[1] down to about 40 tons. The loss of weight in roasting is about one-sixth. The sulphur is reduced to 1½ to 2%. The coal consumption is about 11 tons per 24 hr., being about the same whether 40 or 50 tons are being roasted. The furnace is operated in two shifts per 24 hr., which requires four men per shift. Two extra men per shift are required to bar sintered ore off the hearth. A temperature of 1,000° C. is registered on the second hearth. Raking is done every three-fourths hour.

The furnace gases contain about 4½% of sulphur dioxide. They are raised to about 8% content by the burning of brimstone in the dust-catchers, the brimstone being simply introduced thereinto, taking fire from the heat of the gas and burning with its excess of oxygen. About 10,000 to 15,000 lb. of brimstone per furnace is thus introduced daily.

The roasting gas reaches the Glover tower at a temperature of about 450° C. The fire gases reached the chimney with a temperature of about 200° C. when the stoves were in use, the air of secondary combustion being preheated to about 400° C., but as mentioned, the stoves had to be bypassed, the tendency of the furnaces being to run too hot. Each roasting furnace has its own chimney, which is of concrete construction, 110 ft. high and 5 ft. inside diameter at the top. Each roasting unit is complete in itself, furnace in its own house, with gas producer, air stove, fan, dust-catcher and chimney immediately adjacent. Each pair of roasting units serves one sulphuric-acid unit.

The roasted ore drops into a tunnel running under the row of furnaces in transverse direction. In this tunnel it is received in Neeland buckets, which are used throughout the plant for the transportation of material and are handled by the overhead telpherage system. The roaster gas on leaving the furnace passes through a centrifugal dust-catcher, 30 ft. high and 20 ft. in diameter. In roasting Broken Hill sulphides of about 20-mesh size, the dust here collected is about 2% of the ore roasted.

SULPHURIC-ACID DEPARTMENT

The sulphuric-acid department consists of three units, each comprising a tower building 71x150 ft. and a chamber building 138x440 ft. Each tower building contains 8 towers—2 Glovers and 6 Gay-Lussacs—and 20 lead chambers, this plant being for two roasting furnaces. The gas from each roasting furnace having passed through its set of Glover towers, each tower being 14x14x40 ft., goes through a train of 10 lead chambers the aggregate volume of which is 360,000 cu.ft.

NORTH VIEW FROM MIXER BUILDING, SHOWING ACID DEPARTMENT

The construction of the sulphuric-acid department at Donora is very similar to that at Langeloth. The buildings are of steel with panel walls of hollow brick. This is an excellent and pleasing method of construction. From one of the accompanying engravings the reader can get a good idea of it. The framing for the acid chambers is, of course, of timber. The walks are of timber, and under them, to save men who might accidentally fall over, are the excellent nettings of heavy wire, that were so commendable a feature at Langeloth.

THE MIXING DEPARTMENT

The roasted ore is taken from the roasting furnaces by overhead trolley and Neeland buckets to the storage bins of the mixing house. In other bins of the same house is stored anthracite fines for reduction material. These bins are vast concrete-lined pits like all the other main storage bins of this plant. Overhead the house is spanned by a traveling crane.

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[1] May, 1916.

The reclamation of ore and coal from the main bins is done by a clamshell bucket handled by the crane. This transfers the ore and coal into overhead steel bins at one end of the house. From these bins the charge is drawn as required into a weighing car and from the latter it is chuted into the mixers, whereof there are two. The mixers are hexagonal drums, the heads of which are slanted, so that a cross-section through the shaft is of rhomboidal shape. In the turning of the drum the charge receives therefore not only a peripheral mixing, but also a lateral shifting.

At the time of my visit some trouble was being experienced in handling sintered lumps coming from the roasting furnaces. Probably it will be necessary to introduce some mechanical means of pulverizing these, which may have been done already.

VIEW ALONG SPELTER FURNACES SHOWING GAS-PRODUCER BUILDINGS AND COAL HOIST

From mixing drums the charge is received in the large cars to go to the distilling furnaces. These are pulled up the incline by a winch and upon reaching the level track on the ground surface are pushed down by the ends of the furnaces, each car being shifted to the furnace tracks as required, according to the usual system in American works where the furnaces are arranged side by side.

THE DISTILLERY

The distillation department comprises 10 Hegeler furnaces, each of 912 retorts, 456 per side, arranged in six rows. Longitudinally the furnace is divided into 19 sections per side, each section comprising 24 retorts. The furnaces are set in parallel, 95 ft. apart center to center. Each furnace is covered by its own house, which is 70 ft. wide, of steel construction, roofed and sided with asbestos-coated, corrugated sheet steel. The spaces between the houses are also roofed over.

The distillation furnaces are similar to those at Langeloth, Penn. The combustion chamber is roofed with a flat arch, self supporting from the side walls and independent of the middle wall, the slope of the arch on each side being parallel to the slope of the retorts. The retorts are of the standard cylindrical shape, 8 in. inside diameter and 52 in. long. The furnaces are very heavily ironed. The buckstaves are connected by tie-rods through springs, thus allowing for expansion. The buckstaves footings are fitted with ball-and-socket joints, permitting free movement in any direction. A new feature of the Donora furnaces is the air flues that go under the floor of the combustion chamber, the purpose of which is to afford preheated air to the first section of the furnace. The Donora furnaces are hooded with counterbalanced sheet-iron shields, and of course are provided with all modern contrivances for discharging the retorts, drawing metal, etc. The ash pockets in front of the furnaces are unusually commodious. They discharge into tunnels running longitudinally under each furnace, whence the residues are removed by means of Neeland buckets.

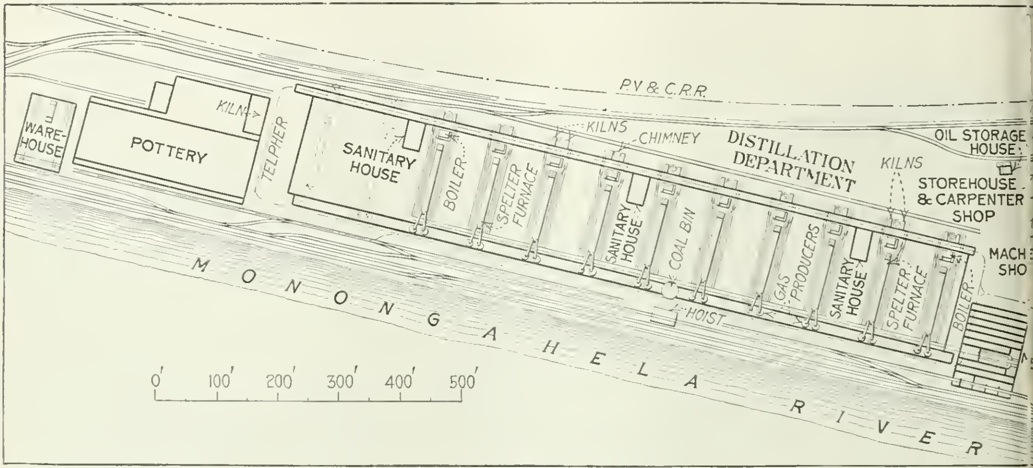
Each furnace is provided with two 10-ft. Hughes gas producers, steam-blown. The gas from the producers enters the furnace at 500° C., there being but little loss of the heat of primary combustion owing to the close proximity of the producers to the furnace. The air for secondary combustion is furnished by a No. 6 Sirocco fan, driven by a 50-hp. motor. At the far end of the furnace the products of combustion pass through a 588-hp. Rust boiler and thence to a chimney of concrete construction.

125 ft. high and 5½ ft. inside diameter, which is lined with firebrick to a height of 30 ft. above the bottom. At the foot of this chimney are the retort-tempering furnaces, one on each side, directly connected with the chimney.

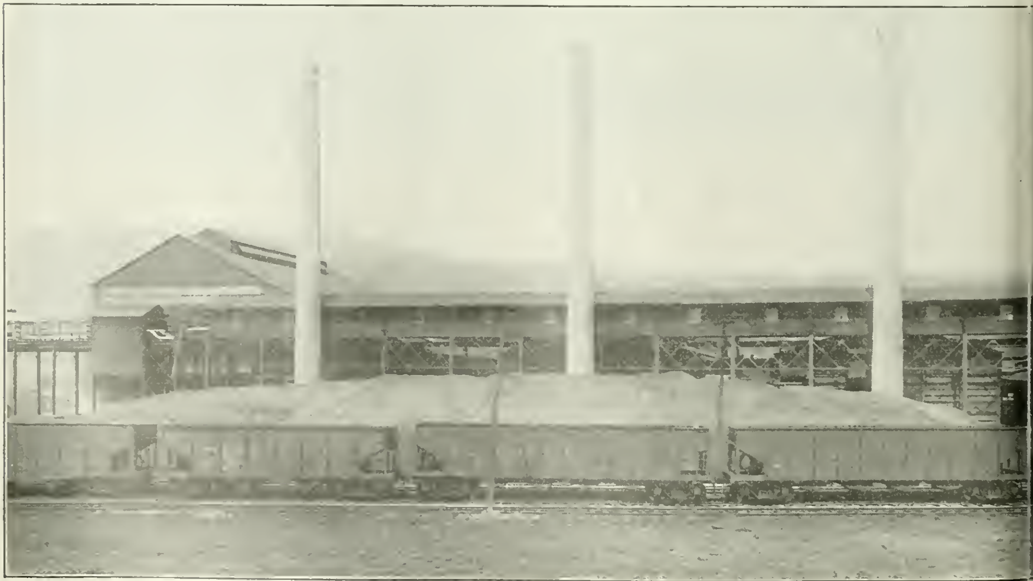
THE POTTERY

The retort- and condenser-making equipment is contained in a brick and steel building 121x289 ft., with an addition 66x128 ft. in which the machinery is concentrated. The main part of the building is devoted to the drying rooms, of which there are 28, whereof 25 are for retorts, each holding 900 retorts, and 3 are for condensers. These rooms are heated by steam piping under their grated floors. The moist air is led away through galvanized-iron ducts passing through the roof. The control of the ventilation is much better in this pottery than it is in the ordinary zinc-smelting pottery of the United States.

In the retort- and condenser-manufacturing department of the Donora pottery, the arrangements is in duplicate; that is, there are two independent sets of machines. The machines are of the standard type. There are two dry pans and two wet pans of the American Clay Working Machinery Co., of Bucyrus, Ohia, two Wettengel pug-mills, two Wettengel hydraulic retort presses, and two Garrison & Whipple pug-mills and condenser machines.



DRAWING SHOWING THE GENERAL ARRANGEMENT OF THE DONO

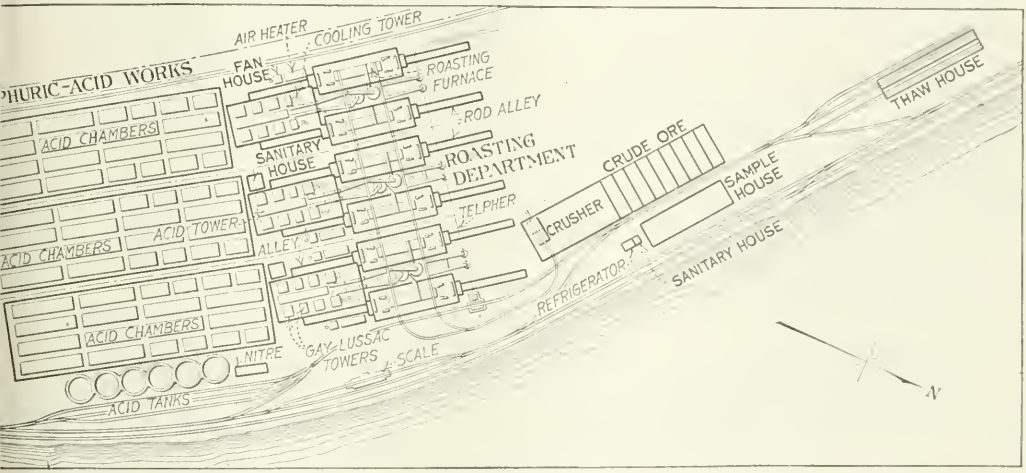


PANORAMIC VIEW OF THE DISTILLING DEPARTME

From the dry pans, in which the clay is thoroughly ground, it is conveyed mechanically to overhead bins from which the several clays used in the batches are drawn in proper proportions for mixing on the mixing platform. The mixed clay is thoroughly incorporated in wet pans, the product of which is conveyed to the rotting rooms for seasoning. The seasoned clay is pugged and molded into condensers in the usual way. The capacity of the Donora pottery is about 1,000 retorts and 300 condensers every 24 hr.

The power plant is comprised in a brick and steel building 57x80 ft. The equipment consists of feed pumps, air compressors, rotary converters, transformers, switchboards, etc. The Donora zinc smeltery being operated in connection with the Donora steel plant, coöperation is possible with respect to power, coal supply, etc., that would not be in an isolated plant. The electric current for runing the zinc smeltery is received from the power house at the openhearth steel works. The steam generated in the waste-heat boilers connected with the zinc-distilling furnaces is piped 3,000 ft. back to the power house of the steel works.

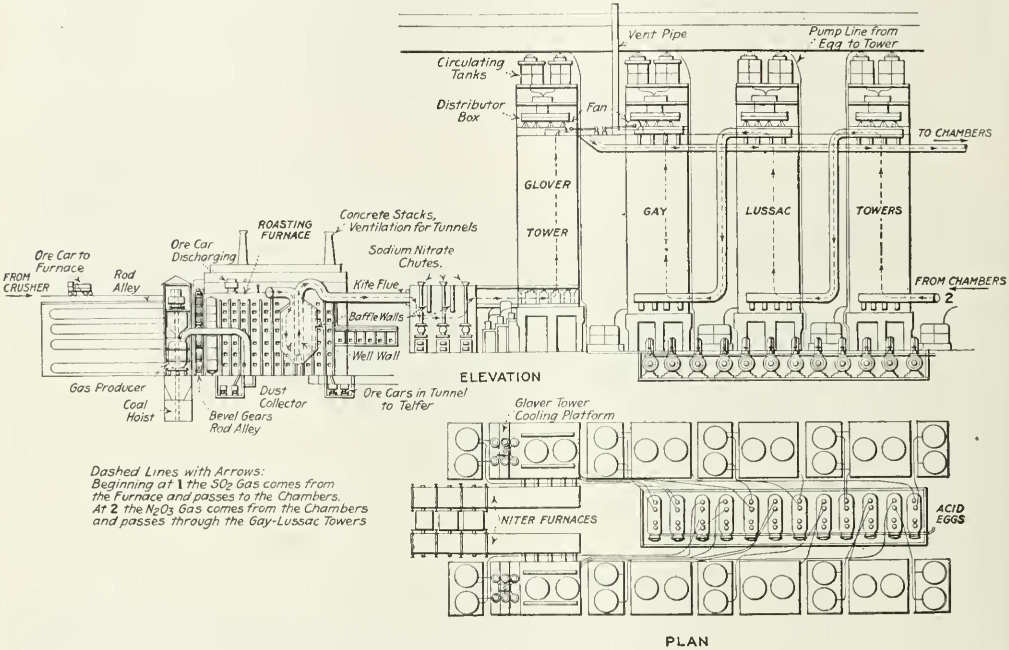
The coal for the zinc smeltery is raised from Monongahela River boats by the coal hoist at the openhearth steel works, whence it is transported to the smeltery in steel, hopper-bottom cars. These cars deliver by skip hoist to an overhead bin, the position of which is shown on the accompanying plan, from which it is distributed to



ZINC-SMELTING WORKS OF THE AMERICAN STEEL AND WIRE CO.

HIMNEY END, AT THE DONORA ZINC-SMELTING WORKS the gas-producer bunkers by a larry. The main bin contains two days' supply. At the main coal hoist of the steel works, however, a much larger supply is kept in reserve.

In the construction of the Donora plant careful attention was paid to the installation of all proper sanitary and safety devices. There are bubbling drinking fountains, lavatories, shower baths and steel lockers. The unusual and commendable arrangements of the houses in the distillery proper have previously been remarked. Machinery throughout the works is adequately protected. Vertical ladders, where such are necessary, are protected by a safety cage. And so on.


Vent Pipe
Pump Line from Egg to Tower
Circulating Tanks
Distributor Box
Fan
TO CHAMBERS
GLOVER TOWER
GAY
LUSSAC
TOWERS
ROASTING FURNACE
Concrete Stacks, Ventilation for Tunnels
Ore Car Discharging
Sodium Nitrate Chutes.
Ore Car to Furnace
FROM CRUSHER
Rod Alley
Kite Flue
FROM CHAMBERS
2
Baffle Walls
Well Wall
ELEVATION
Gas Producer
Coal Hoist
Dust Collector
Bevel Gears Rod Alley
Ore Cars in Tunnel to Telfer
Glover Tower Cooling Platform
Dashed Lines with Arrows:
Beginning at 1 the SO_2 Gas comes from the Furnace and passes to the Chambers.
At 2 the N_2O_3 Gas comes from the Chambers and passes through the Gay-Lussac Towers
NITER FURNACES
ACID EGGS
PLAN

DIAGRAMMATIC ELEVATION AND PLAN OF ROASTING FURNACES AND SULPHURIC-ACID TOWERS OF DONORA ZINC WORKS*

⁂

Health Conservation at Steel Mills

In Technical Paper 102 of the Bureau of Mines, entitled "Health Conservation at Steel Mills," J. A. Watkins, the author, has carried the "safety first" idea a step farther to include "health first." Data in his possession show that approximately nine days a year are lost by the average industrial worker owing to illness. To reduce this in large industrial plants there should be medical supervision over all employees. This should include (1) relief of those injured at work, (2) examination of prospective employees, (3) medical supervision of entire force to detect disease or abnormal conditions among the workers, (4) sanitary supervision of the plant, (5) education in personal hygiene for employees and their families.

In the original plant construction arrangements should be made for the best possible illumination—natural if possible, or if artificial is used, the requirements of the different parts of the plant should be studied and an understanding gained of the effects of diffused lighting and concentrated lighting and the design governed accordingly. Care should be taken in floor construction to permit cleaning where necessary. Ventilation should be provided both in regard to the renewal of air and the removal of products incidental to the process. Locker rooms should be provided and equipped with lockers, wash basins, showers and latrines. Drinking water should be provided of unquestionable purity and at the proper temperature. Uptodate and well-managed restaurants should be provided.

The plant physician should coöperate with the safety and sanitary departments for the furtherance of the health of the workers. Result of work along this line has proved it to be of advantage from an economic standpoint, irrespective of its humanitarian aspects.

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The Mount Bischoff Tin Mining Co., at Launceston, Tasmania, shows an earning of $35,372 for the first half of 1916. Interest to the amount of $1,168 brings the total credit to $36,540. Dividends to the extent of $21,870 were paid. A total of 49,632 tons of ore were produced from the various surface faces. No underground work was carried on during the half-year. The total ore reserves consist of 1,616,000 tons—the majority of which is in surface faces. Plans are under consideration for the addition of 20 stamps in the mill and experiments in concentration on glass-topped tables, which is expected to be of benefit in the treatment of the slimes. The working costs for the period were $1.91 per ton, 1,538.8 tons of concentrate were smelted yielding 1,059.75 tons of tin. The product had a purity of 99.89%.

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*Redrawn from a drawing in "Metallurgical and Chemical Engineering," by courtesy of that paper.

Van Buren Smelting Plant

By F. W. Bocking*

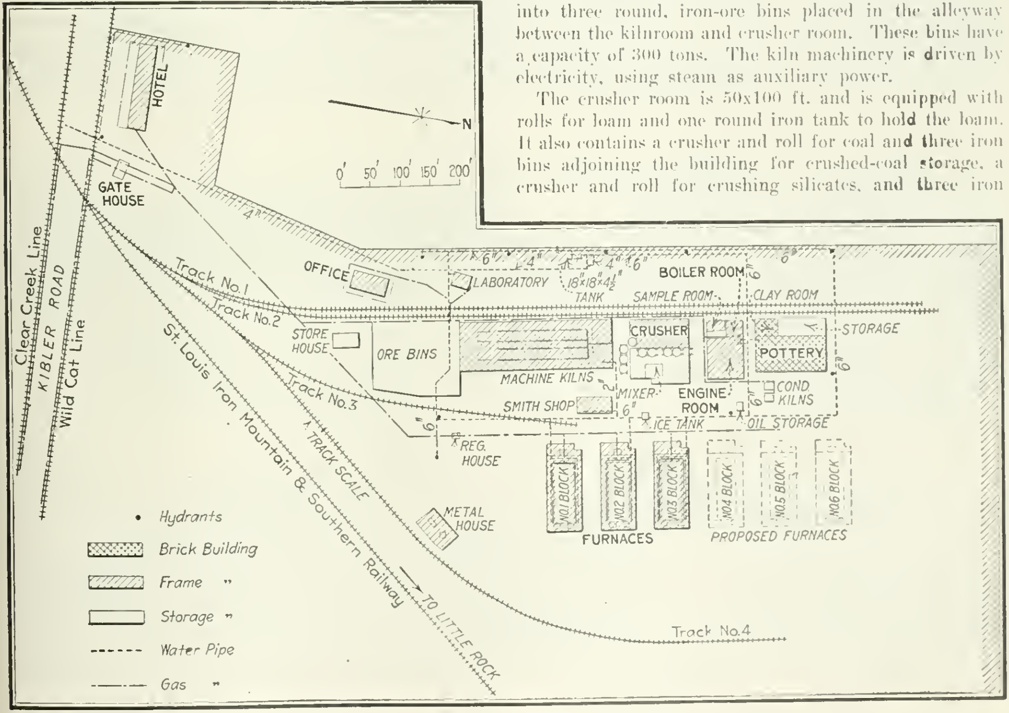
SYNOPSIS—The Van Buren plant is exceptionally well provided with railway facilities and is in good position to handle its tonnage of zinc ores. Equipment includes kilns, crushers, a pottery and the requisite furnaces and other necessities of a well-equipped zinc-smelting plant.

The Van Buren smelting plant of the Arkansas Zinc and Smelting Corporation is situated about a mile east of Van Buren, directly between that city and the Kibler gas field. It is between the St. Louis, Iron Mountain & Southern Ry. and the St. Louis & San Francisco Ry., but at present is connected only with the former. Tracks No. 1 and No. 2 are connected with a switch so as to be able to handle cars to and from the silicate storage and crusher, pottery and coal crushers without interfering with the placing of cars or unloading sulphide ore on track No. 2 and vice versa. Tracks No. 2 and No. 3 are used for unloading sulphides into large ore bins. The space between tracks No. 3 and No. 4 is used for coal and coke storage. Track No. 4 is used also for weighing ore, loading spelter and loading out waste residues and residues carrying precious metals. Besides the storage room for coal between tracks No. 3 and No. 4, there is ample storage for silicate ore and coal opposite the pottery, engine room and crusher building.

The sulphide-ore bins are between tracks No. 2 and No. 3. The outside walls and floor are of concrete, and the partitions are of wood. The floor is lower than the tracks, the outside walls coming just high enough to be level with a box-car door, which makes it possible to unload directly from the cars, dumping into the bins. The 20 bins have a capacity of about 4,000 tons and adjoin the kilnroom.

The kilnroom contains two Ropp-type kilns, 175 ft. long with 20-ft. cooling hearths, which have a capacity of from 20 to 25 tons each of roasted ore per day, according to the class of ore roasted. The ore drops into tramcars and these are elevated to the top of and are dumped into three round, iron-ore bins placed in the alleyway between the kilnroom and crusher room. These bins have a capacity of 300 tons. The kiln machinery is driven by electricity, using steam as auxiliary power.

The crusher room is 50x100 ft. and is equipped with rolls for loam and one round iron tank to hold the loam. It also contains a crusher and roll for coal and three iron bins adjoining the building for crushed-coal storage, a crusher and roll for crushing silicates, and three iron bins adjoining the building for crushed-ore storage. Next to this building is an extra storage room, 50x100 ft., for coal and ore, with a mixing room in the center. All silicate ore is put through the crusher and roll and is sampled by an automatic sampler. The mixing room is equipped with a No. 61 Ransome mixer. The charge is mixed an elevated into a short screw conveyor. Here the mix i wet. After the requisite mixing, the conveyor deposits it into the charge cars.



GENERAL LAYOUT OF THE VAN BUREN WORKS OF THE ARKANSAS ZINC AND SMELTING CORPORATION, VAN BUREN, ARK.

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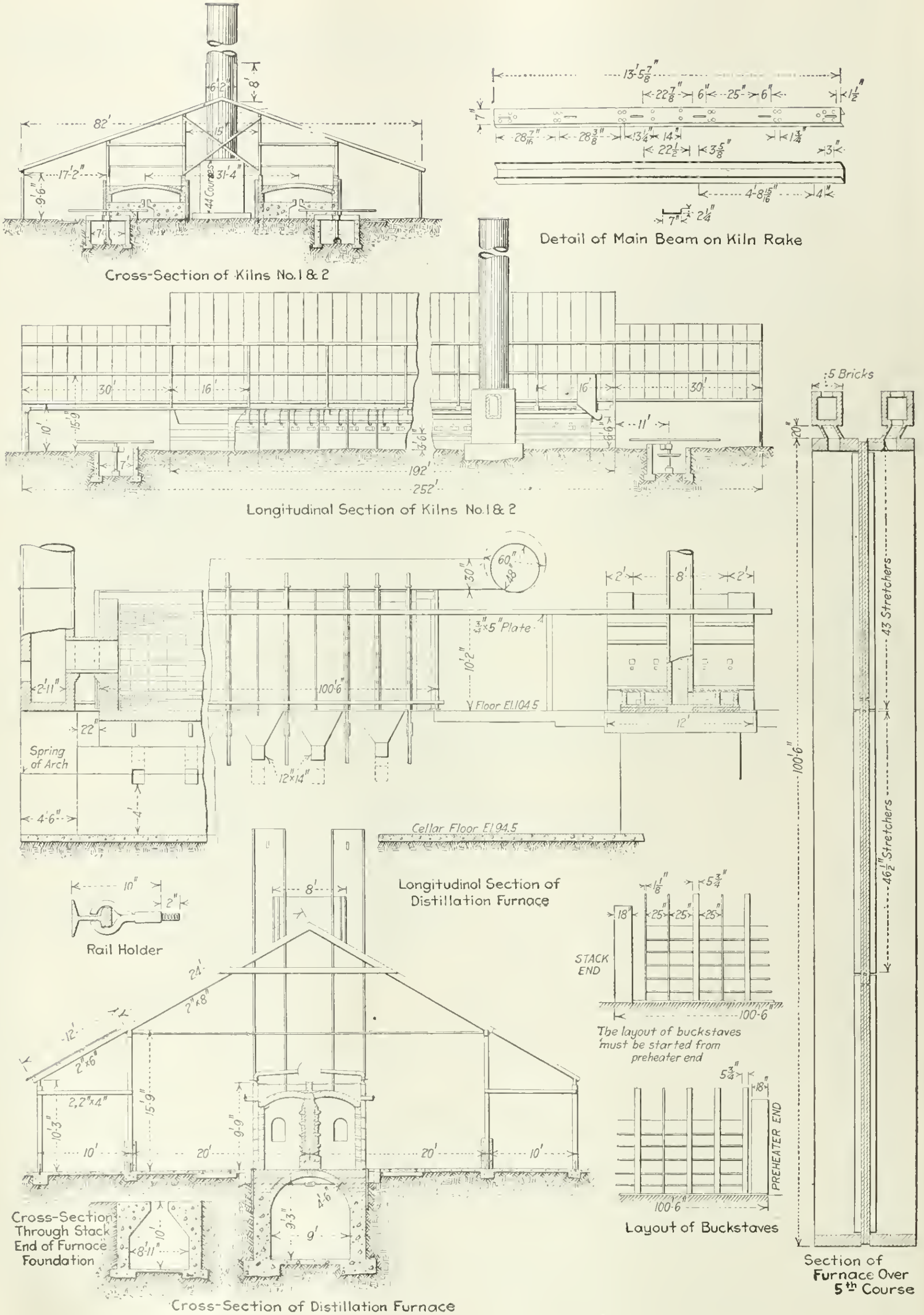
*General manager, Arkansas Zinc and Smelting Corporation, Van Buren, Ark.


Cross-Section of Kilns No. 1 & 2

Detail of Main Beam on Kiln Rake

Longitudinal Section of Kilns No. 1 & 2

Longitudinal Section of Distillation Furnace

Rail Holder

Cross-Section Through Stack End of Furnace Foundation

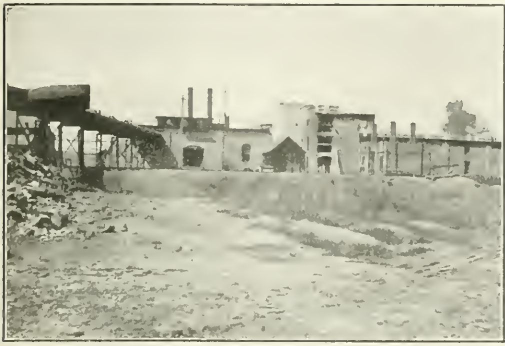
Cross-Section of Distillation Furnace

Layout of Buckstaves

Section of Furnace Over 5th Course

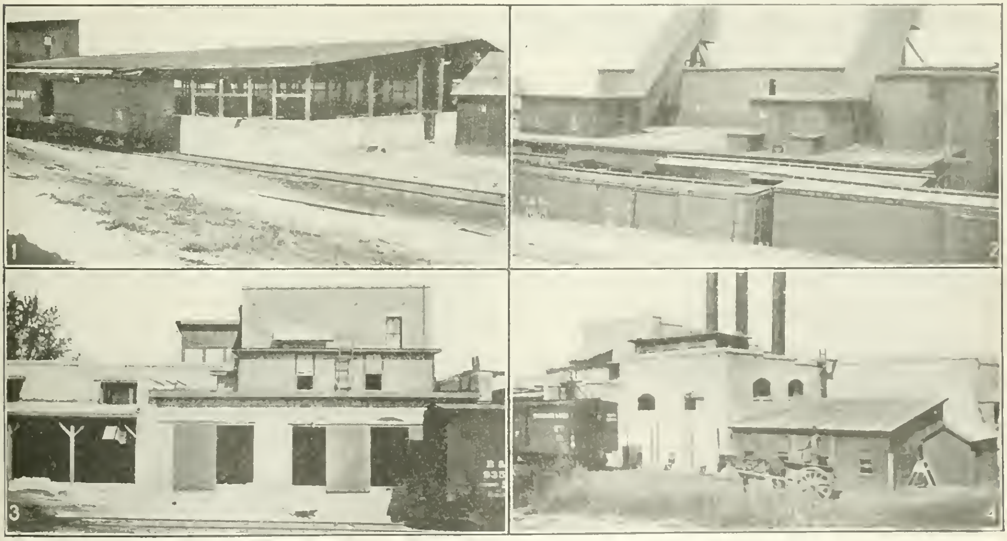
GENERAL DRAWINGS AND DETAILS OF THE VAN BUREN KILNS AND DISTILLATION FURNACES

The engine room is in a brick building 60x100 ft. Its equipment includes three 125-hp. boilers, one 200-hp. corliss engine and one 125-hp. generator. In addition to this there is a second unit for emergency purposes, consisting of one 125-hp. corliss engine and one 100-hp. generator. A lineshaft runs through the engine room, extending through the crusher room and pottery and transmitting all the power for the pottery and crusher room. The 60-in. blowers are connected with two 50-hp. engines. Only one is required, however, and the other is held for emergency.



EAST VIEW OF POTTERY AND ENGINE ROOM

A VIEW OF THE EAST END OF THE FURNACES



SOME VIEWS OF THE VAN BUREN SMELTING WORKS, VAN BUREN, ARK.
1—The ore bins. 2—The crushing department. 3—The pottery. 4—The engine and boiler rooms

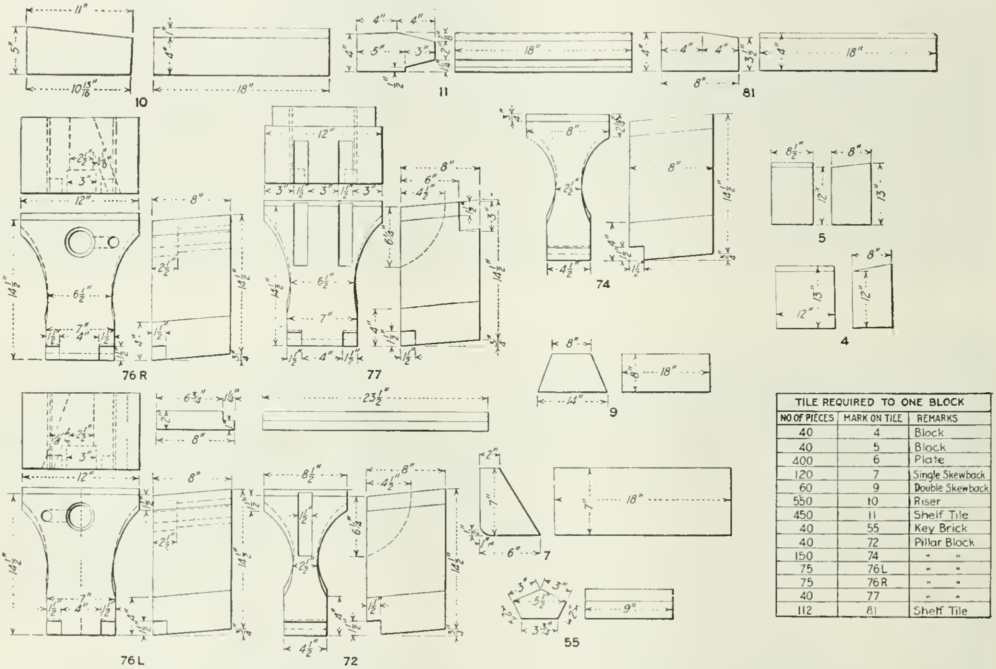
The pottery is contained in a two-story brick building 90x120 ft., equipped with the usual crushers and rolls for crushing clay and dobies, and pug mill and tile machine for making retorts, with a ball mill and condenser machine of the Garrison & Whipple type. Adjoining the pottery are two large condenser kilns.

There are now completed three blocks of 800 retorts each, which are five rows high. Underneath the foundations and extending over the entire cellar floor is a 6-in. concrete slab, and the walls of the cellar are concrete also. At the end of each block and in the furnace building is a retort kiln. To one side and at the end of the building is a shower bath in each block. The furnaces are so placed as to provide for the construction of four or five more blocks without disturbing any other part of the plant, as the capacity of the ore bins, crusher room, power house and pottery are such as to supply an eight-block plant.

A remelting pot of 25 tons capacity is now being constructed. This is not being built exclusively for settling out lead or iron, but more with the view to making the shipment of a car more uniform throughout, thus avoiding the danger of the purchaser accidentally using in his sample any greater proportion of one draw of metal than another.

The plant is connected directly with the water [illegible] Van Buren, which maintains a pressure of [illegible] In addition to this there is a 30,000-gal. tank, w[illegible] full by a float valve connected with the [illegible]. Leading from this main is a complete cir[illegible] around the plant without any dead-ends. This line has, placed at the most important points, hydrant and hose connections—eleven hydrants in all. Should a fire occur at any time, the 500-gal. fire pump is started. A separate suction line connected with the pump and the 30,000-gal. tank make it possible to draw from both tank and city water mains if desired or, by closing a valve, to draw only from the city water mains and hold the 30,000-gal. tank in reserve. Each building is equipped with hydrants with linen hose attached, using a total of 1,000 ft. of hose.

The boarding house is a commodious, two-story frame building, 30x124 ft., consisting of a sleeping porch 10x124 ft., 27 rooms, 3 bathrooms and an extra washroom, a kitchen 20x30 ft., a dining room 30x30 ft., and a lobby 30x30 ft.



TILE REQUIRED TO ONE BLOCK		
NO OF PIECES	MARK ON TILE	REMARKS
40	4	Block
40	5	Block
400	6	Plate
120	7	Single Skewback
60	9	Double Skewback
550	10	Riser
450	11	Shelf Tile
40	55	Key Brick
40	72	Pillar Block
150	74	" "
75	76L	" "
75	76R	" "
40	77	" "
112	81	Shelf Tile

DETAILS OF THE BRICK SHAPES FOR DISTILLATION FURNACES, VAN BUREN, ARK.

It was the intention of the company to build here so that later there would be no difficulties encountered due to poor construction in any way, and accordingly extraordinary precautions were taken in constructing the foundations, using over 175 carloads of cement, gravel and sand in the foundations and concrete work alone.

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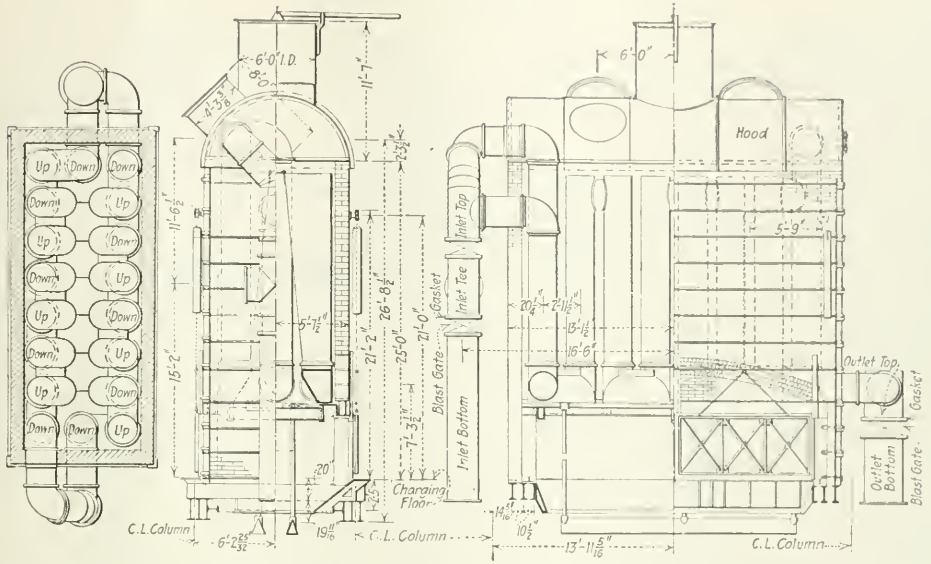
The Premelting of Ferroalloys is discussed in "Iron and Coal Trades Review," Aug. 25, 1916, in connection with a device for the purpose invented and patented by Wheeler and Blair, in England. A melting compartment is provided as an extension to the rear wall of the furnace, and in this compartment the alloys are designed to be melted, utilizing the heat of the furnace. The compartment is preferably placed near the top hole of the furnace, and the melting chamber is open to its interior. A melting hearth is provided for the chamber, and also a tap hole. Entrance to the chamber is through a back opening that can be closed by a sliding door. The alloys to be melted are charged through this door and are then subjected to the heat of the furnace.

Late Blast-Furnace Designs

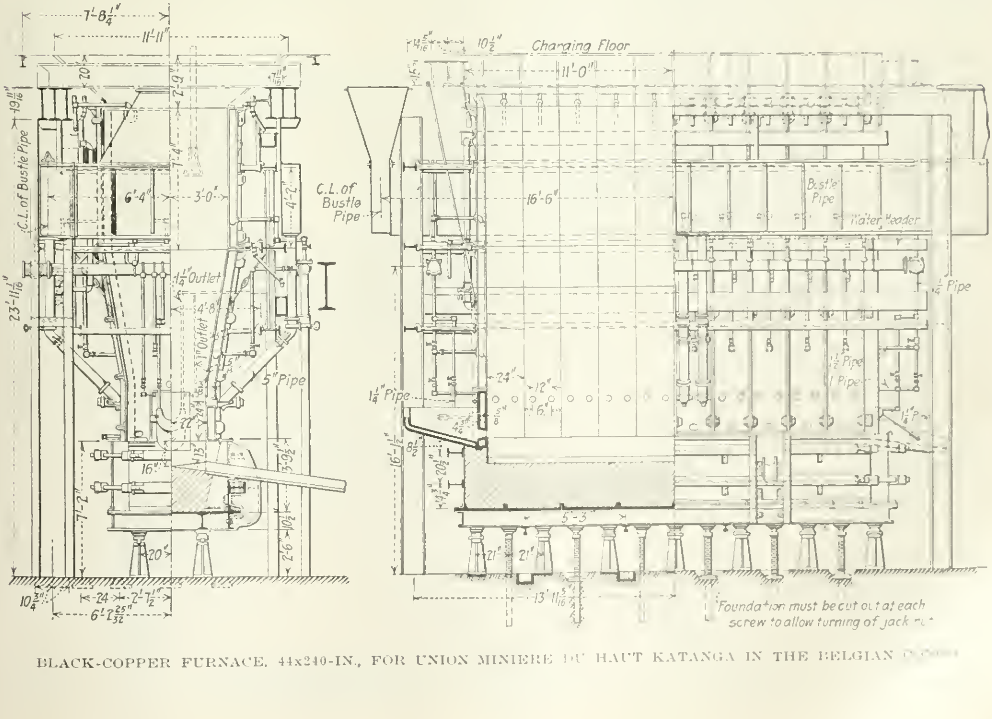
The general lines of several blast furnaces of recent design are shown in the accompanying illustrations. They represent three important examples of modern blast-furnace equipment: (1) A large black-copper furnace used at the Katanga copper field in the Belgian Congo; (2) a copper-matting furnace with plunger-feed arrangement, at the Anyox, B. C., plant of the Granby Consolidated Mining, Smelting and Power Co.; and (3) a lead furnace at the latest plant to be designed in the United States, the Bunker Hill & Sullivan works now under construction at Kellogg, Idaho. All these furnaces were fabricated by the Traylor Engineering and Manufacturing Co., of Allentown, Penn., which has kindly supplied the general drawings from which the illustrations have been made, and the information contained in following brief notes on the general features of the furnace construction:

The illustrations on the opposite page show a 44x240-in. black-copper furnace, four of which were sent to the Union Minière du Haut Katanga, at Lubumbashi, near Elisabethville, Belgian Congo. This equipment is of special interest as the operation in the Belgian Congo is one of the few places in the world today where an important output of black copper is being made. The Katanga company is probably turning out the largest production ever made by this method in a single plant, and the furnaces themselves are undoubtedly the largest ever used for smelting to black copper.

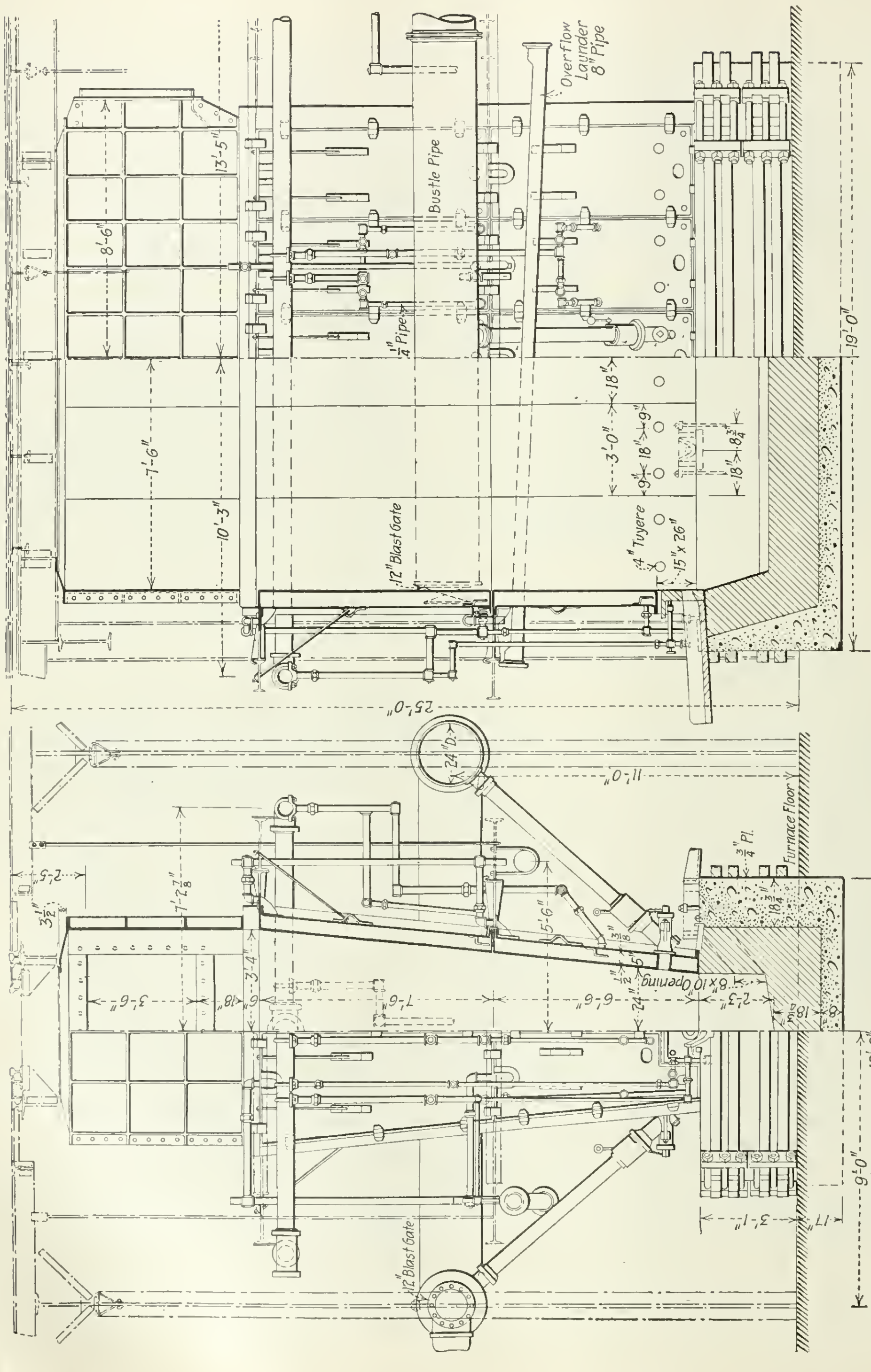
The Katanga furnace has two tiers of jackets, the lower ones being of the knee type 10 ft. high and 24 in. wide; the furnace is 44 in. wide at the tuyere line; the bosh begins about a foot above the center of the tuyeres



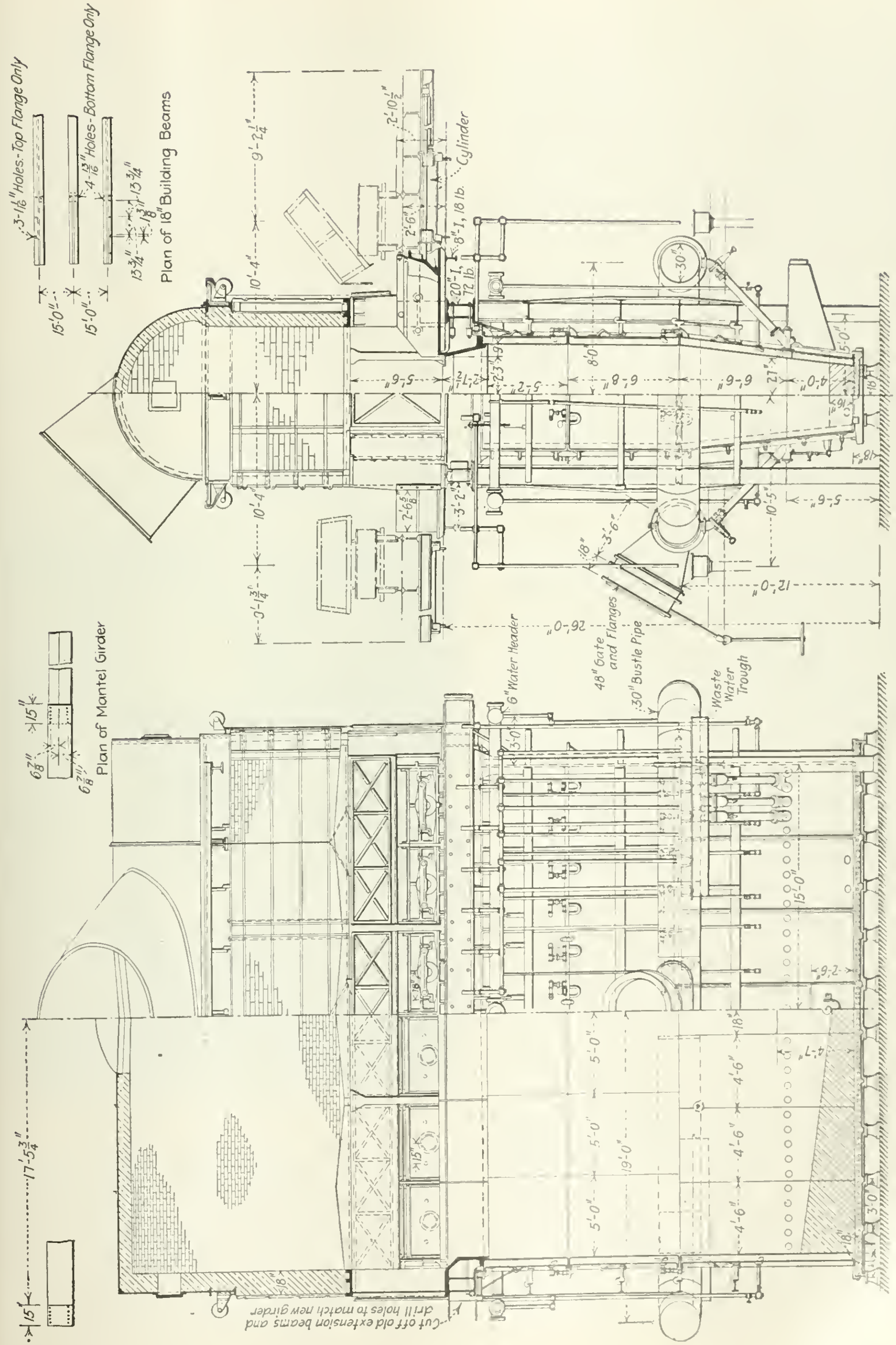
GIROUX HOT TOP, BUILT IN THE SUPERSTRUCTURE OF THE 44x240-IN. BLACK-COPPER FURNACE OF THE UNION MINIERE DU HAUT KATANGA, AT LUBUMBASHI, BELGIAN CONGO



BLACK-COPPER FURNACE, 44x240-IN., FOR UNION MINIERE DU HAUT KATANGA IN THE BELGIAN CONGO



BUNKER HILL & SULLIVAN'S 48x180-IN. LEAD BLAST FURNACE, THREE OF WHICH ARE TO BE INSTALLED AT THE NEW SMELTING WORKS NOW UNDER CONSTRUCTION, AFTER PLANS OF BRADLEY, BRUFF & LABARTHE, AT KELLOGG, IDAHO



THE 54x360-IN. COPPER-MATTING FURNACE, ARRANGED FOR PLUNGER FEEDING, AT THE ANYOX, B. C., PLANT OF THE GRANBY CONSOLIDATED and continues to the top of the lower jackets, where the furnace is 6 ft. wide. The upper jackets are 7 ft. 4 in. high. The tuyeres, 20 on each side, are 4 in. in diameter and are provided with the Traylor standard tuyere connections. The bustle pipe was made rectangular in section to economize in building space. The furnace columns and mantel beams are a part of the building structure, and the horizontal I-beams for taking the thrust of the jackets are framed into these building columns.

The furnace is provided with a water-jacket trap spout and breast for continuous slag flow, and a plain cast-iron spout and breast at the rear end to drain the furnace in case of emergency. The crucible has steel-plate sides and a cast-steel bottom, supported on a structural framework that rests on special adjustable supporting columns provided with removable key pieces. Between the supporting columns are jackscrews that may be used to take the load off the supporting columns, which can then be removed and the crucible lowered on the jackscrews for relining or other repairs.

Above the charging floor is provided a Giroux hot-blast top consisting of U-pipe around which the heated furnace gases pass and through which the blast air is drawn. Two water-cooled spreaders are installed just below the charging plates to assist in the proper distribution of the charge.

PLUNGER FEED ON GRANBY'S ANYOX FURNACE

The 54x360-in. copper-matting furnace of the Granby Consolidated plant at Anyox, B. C., is illustrated on p. 660. A particular feature of this furnace is the special plunger-feeding arrangement, but it also has an unusually deep furnace shaft, being now 24 ft. 6 in. from hearth plate to feed floor. The furnace has three tiers of jackets and is arranged for continuous flow at the center of the side, an emergency drain spout and breast being provided on the rear side. The lower side jackets are boshed from the hearth plate up and extend for a vertical distance of 10½ ft. They have Traylor patent welded tuyeres and standard tuyere connections. The tuyeres are 5 in. in diameter and are spaced at 11-in. centers.

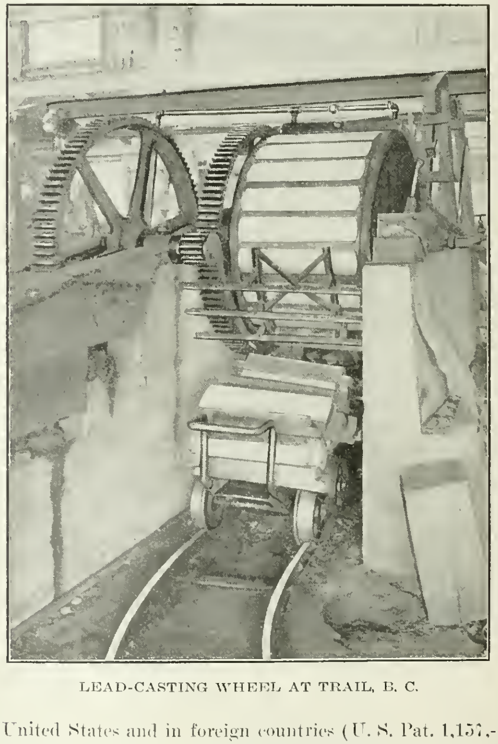
The most striking feature of the Granby furnace, however, is the plunger-feeding arrangement. On each side of the furnace are six of these charging devices into the hoppers of which are dumped the contents of the charge cars. When it is desired to feed the furnace, the valves controlling the hydraulic cylinders are opened and the plow moves forward pushing the charge into the furnace. By moving the plow ahead slowly or rapidly the charge may be placed in the center of the furnace or thrown against the walls. The manufacturers report that the working of this charging arrangement has been highly satisfactory.

The Bunker Hill & Sullivan furnace on p. 661 presents some new features in lead practice. The furnace is 18x-180 in. at the tuyeres and is water-jacketed for an unusual height. The double tier of water jackets extend for a vertical distance of 14 ft. and are boshed all the way up. Above the jackets are two courses of brick on which rest a superstructure of cast-steel plates instead of the usual brick shaft. The top plates are so connected with the structural-steel work of the feed floor as to allow the vertical expansion or contraction of the shaft.

The building columns form also the columns for the support of the furnace so far as is necessary. No mantel beams are used. The jackets are held in place by stays, and I-beams encircle the furnace at the top of the upper jackets and at the junction of the upper and lower tier. The bustle pipe is hung from the main girders of the feed floor and is 24 in. in diameter with a 30-in. butterfly-valve connection with the blast main. At the end of each leg of the bustle pipe a 12-in. gate valve has been placed to permit the expulsion of any furnace gases after a brief shutdown. To control the blast of each tuyere, a butterfly valve is placed in the saddle on the bustle pipe. The tuyeres are 4 in. in diameter spaced at 18-in. centers; they are of the Traylor standard type with automatic-cutoff safety valve. The general design of the Bunker Hill furnace is by Jules Labarthe, of Bradley, Bruff & Labarthe, of San Francisco.

Miller Lead-Casting Wheel

A vertical lead-casting wheel devised by John F. Miller, of Trail, B. C., is in use at the Trail plant of the Consolidated Mining and Smelting Co. of Canada, Ltd. The machine has been patented by Mr. Miller both in the United States and in foreign countries (U. S. Pat. 1,157,794) and embraces several constructions of which the following are the chief features: Water-jacketed molds on a vertical wheel; an outer water jacket snugly fitting the periphery of the mold wheel on the feed side and extending above the center of the wheel so as to close the molds as they pass upward; a pipe opening through the outer water jacket to deliver the molten lead to the molds as they pass; a shield on the delivery side of the casting wheel to assist in the gentle delivery of the pigs



LEAD-CASTING WHEEL AT TRAIL, B. C.

to the car or conveyor that may be in use for disposing of the product; a small recess in the mold lips, permitting the air to escape into the next mold and providing a receptacle for an automatic sample of the lead. This small sample ingot is ejected by the slight dropping of the main ingot as it passes a certain point of the protecting shield on the delivery side of the wheel. Lead is delivered to the casting wheel by a centrifugal pump set in the bowl of molten lead that is to be cast. The method of filling the molds ingeniously eliminates the usual trimming of the pigs after casting.

The accompanying illustration shows the Miller machine in actual use casting refined lead and delivering the pigs directly on tram-cars, thus expediting the loading into railroad cars for shipment to market. The machine here shown has a capacity of about 12 tons per hour and requires 3 hp. to operate. During casting, one man looks after the machine and weighs the lead; two other men tram and load the pigs into the railroad cars. Mr. Miller writes that a representative of a smelting company in the United States, after seeing the machine in operation, ordered two casting wheels, each to have a capacity of 15 tons per hour. The pigs as cast are stated to be free from rough edges, shrink holes and dross. The bars are remarkably uniform in weight; four railroad cars, each loaded with 509 pigs, gave net weights of 50,044, 50,031, 50,002 and 49,996 lb. respectively.

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Calumet & Arizona Smeltery*

The smelting plant of the Calumet & Arizona Mining Co. comprises a blast furnace, roaster, reverberatory and converter plants, with a sulphuric-acid plant addition under construction and nearing completion. The smeltery treats about 2,427 wet tons daily of ores from the company's own Bisbee mines and about 725 tons of customs ores. The production of blister copper shipped to New Jersey for refining is about 125 tons daily.

Dumped into receiving bins of 3,000 tons' capacity, the ore is crushed in two 24x36-in. Blake crushers and belt-conveyed by two belts to the two units of the sampling mill. A 10% sample here taken is successively recrushed and resampled down to a 160-lb. sample representing 100 tons.

Typical sulphide ores, constituting 50% of the total treated, have the following analyses: Copper, 3.82 to 4.77%; sulphur, 24.8 to 30.9%; iron, 25.4 to 30.9%; silica, 15.2 to 31.1%; Oxides carry: Copper, 1.75 to 5.38%; sulphur, 1.2 to 8.2%; iron, 21.3 to 25.6%; silica, 15.9 to 31%. About 280 tons daily of siliceous customs ores treated average: Copper, 2.15%; sulphur, 3.2%; iron, 5.8%; silica, 75.3%.

From the sampling mill the rejects are conveyed either to the fine or coarse beds—there are three of each, with a coke-storage pile between. The fine beds have a capacity of about 21,000 tons, and the coarse beds hold about 30,000 tons. Two Messiter reclaiming machines take the ore mixture from these beds, discharging it upon conveyor belts leading either to the blast furnace or roaster bins.

The roaster plant at present consists of twelve 21-ft. 6-in. diameter Herreshoff air-cooled roasters, and 12 similar ones are under construction. The fine beds' ore mixture discharges into storage bins of 90 tons' capacity per roaster. The calcines are conveyed in 20-ton electrically operated larries to the reverberatory furnaces. The gases have their dust content settled in a dust chamber 140 ft. long with a 3,300-ft. cross-section, before discharging up the stack.

The roasters treat 96.1 tons per day each, averaging 29.6% sulphur, which is roasted down to about 10%. Each requires about 66,000 cu.ft. of air per minute and produces dust averaging 2.61% of the charge. The calcine and dust product per furnace is 80.5 tons per day.

The blast-furnace department includes two furnaces 40 ft. long by 4 ft. at the tuyeres. Ore mixture from the coarse beds is discharged into bins paralleling the furnaces on both sides, from which traveling charge cars convey the ore to the blast furnaces. Coke is handled through a set of bins parallel to the ore bins.

Both matte and slag overflow continuously into settlers from which the matte is tapped as needed into ladles swung by the overhead cranes into the adjacent converter department. Slag overflows into 225-cu.ft. electrically tilted slag cars hauled by electrical locomotives to the dump. The gases are settled in a chamber 180 ft. long of 2,340 sq.ft. cross-section before discharging to the 305-ft. stack.

Each furnace has 64 tuyeres of 1½-in. diameter, and uses 68,645 cu.ft. of air per ton of dry charge under a pressure of 27 oz. The distance from feed floor to tuyeres is 16 ft. 1½ in. The average capacity per furnace day, exclusive of coke, is 996 tons. The coke percentage of total charge is 12.7, while that of the ores of dry charge is 89.7%; the amount of dust produced is 3.4%.

From ores charged having an average analysis of 5.29% Cu, 13.1% S, 25.9 Fe, 22.2% SiO_2, 5.3% Al_2O_3 and 5.9% CaO is produced a matte averaging 28.81% Cu, 10% Fe and 25.3% S.

The Reverberatory Department

The reverberatory department includes four furnaces whose inside dimensions are 19x100 ft. with a height at the charging end of 8 ft. 3 in., while that at the skimming end is 4 ft. 3 in. The charge and fettling material are introduced through center-drop and side-drop holes respectively. The furnace capacity per day exclusive of converter slag is 100.1 tons.

From an average ore charge analyzing 5.16% Cu, 29.3% Fe, 8.5% S, 28.3% SiO_2, 4.1% Al_2O_3 and 3% CaO is produced a matte averaging 25.03% Cu, 11.2% Fe and 26.1% S. The fuel requirement of each furnace per ton of charge is 0.752 bbl.

The converter department includes six stands, with two extra shells, of 12-ft. diameter Great Falls type of basic-lined, electrically tilted converters served by two 40-ton Morgan cranes. The matte, tapped from the blast-furnace settlers or reverberatories into 160-cu.ft. cast-steel ladles, is transferred by the cranes to the converters. The molten slag poured into the reverberatory or blast-furnace settlers has an average analysis of 2.79% Cu. A McGregor skull-breaker handles the skulls, which are resmelted in the blast furnaces.

The molten blister copper, which has a purity of 99.16%, is cast in two 40-mold electrically operated straight-line casting machines, the molds for which are made of blister copper in this department.

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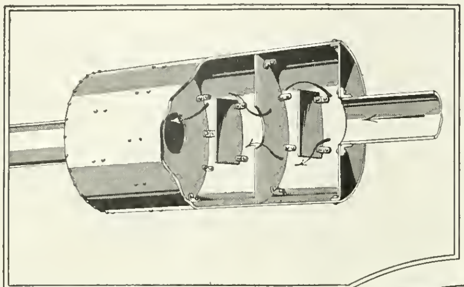
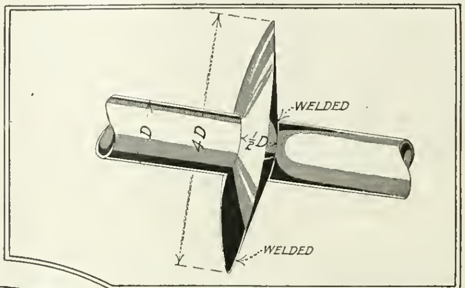
*Abstract from a booklet descriptive of its plant, printed by the Calumet & Arizona Mining Co. for distribution to visiting members of the A. I. M. E., Arizona meeting, September, 1916.

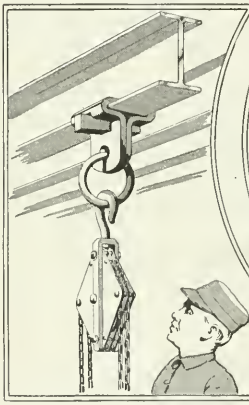
Kinks and Wrinkles



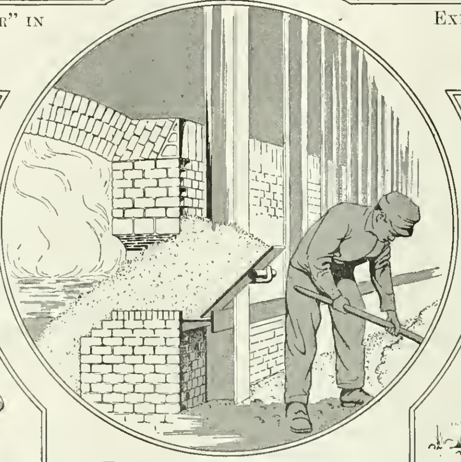
Muffler to Stop "Hammer" in An Air Line



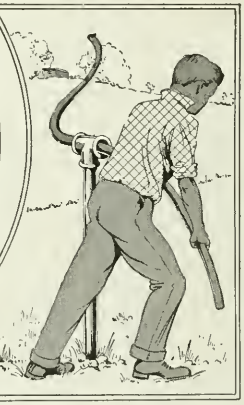
Expansion Joint for Converter Air Line



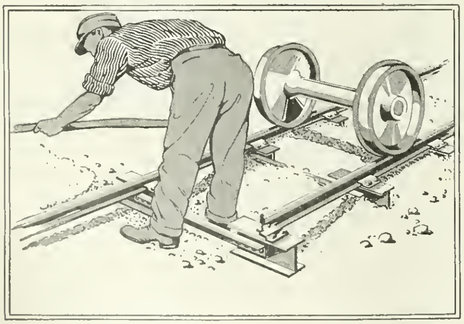
Quickly Detachable Clamp for Rails or I-Beams



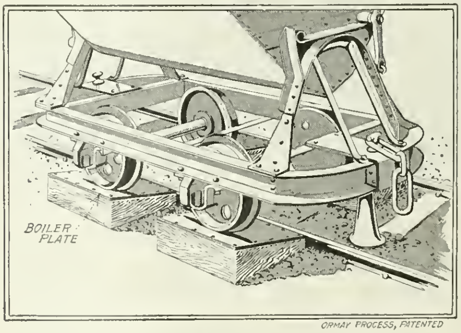
Fettling Used to Replace Side Doors



Bending Pipe in Improvised Field Stand

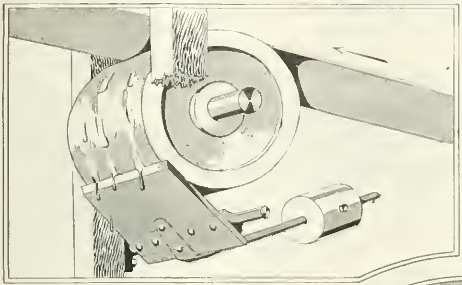


Industrial Track Tie Made from Scrap Structural Steel

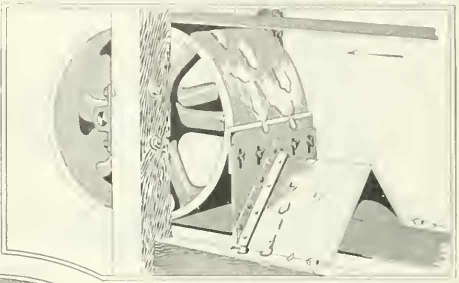


Replacing Derailed Cars with Jack and Blocks

For the Smelting Plant



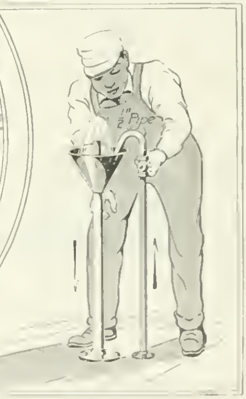
Scraper for Removing Material from Conveyor Idler



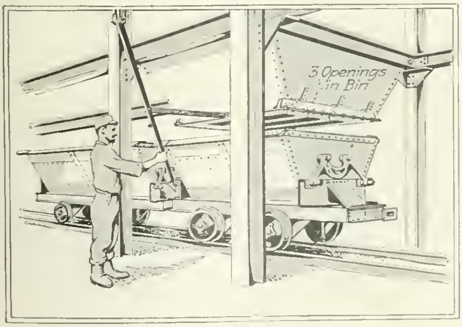
Scraper for Conveyor Pulley Is Mounted on V-Frame

Belt-Shod Scraper to "Sweep" Steel Floors

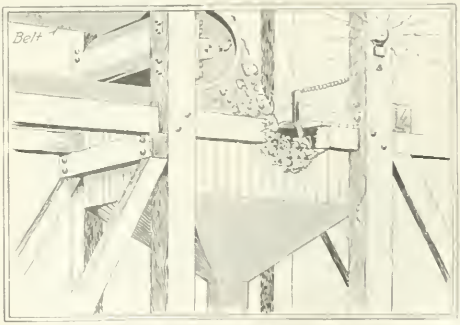
Hoist, Around the Corner, Used to Unload Heavy Packages



Home-Made Sanitary Drinking Fountain

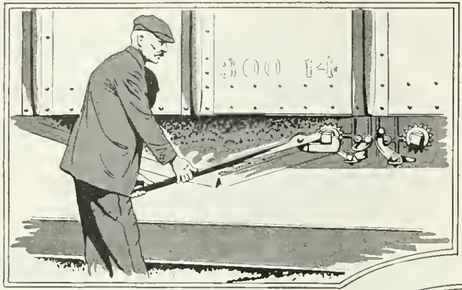


Shallow Hopper and Gate Necessitated by Low Head-Room

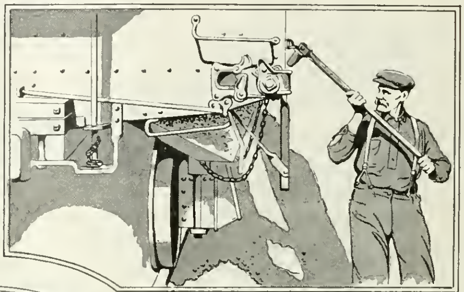


An Electric-Bell Alarm for Announcing a Full Bin

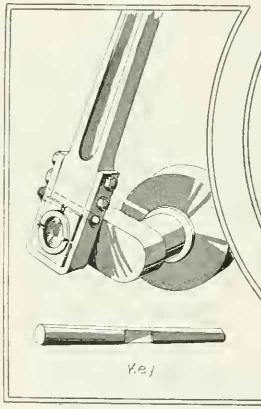
Kinks and Wrinkles



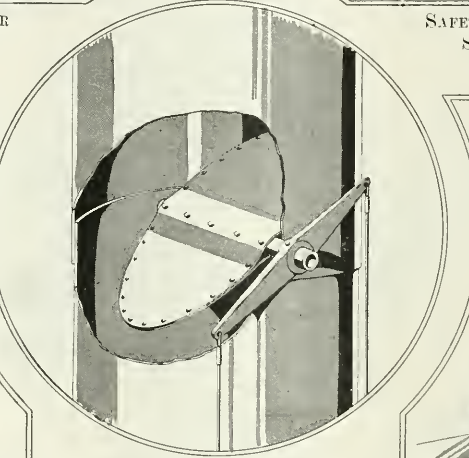
Safety Car Wrench for Bottom-Dump Car



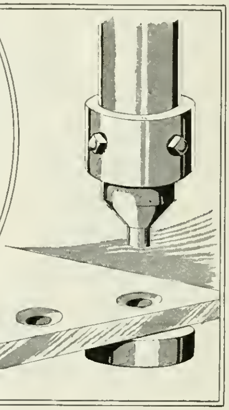
Safety Knuckle Bar for Side-Bottom Dump



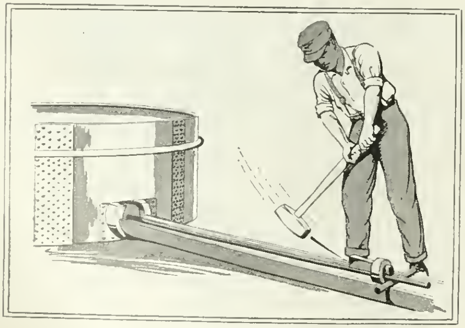
Round Key Saves Making Square Holes



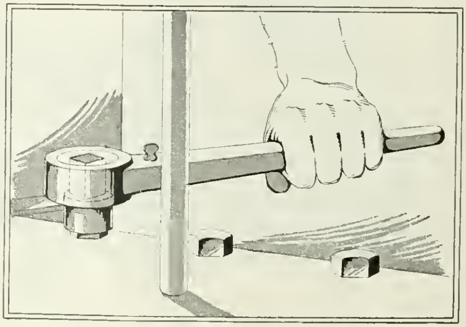
Stack Damper Made from Two Plates and a Pipe



Countersinking Holes with Punch and Die

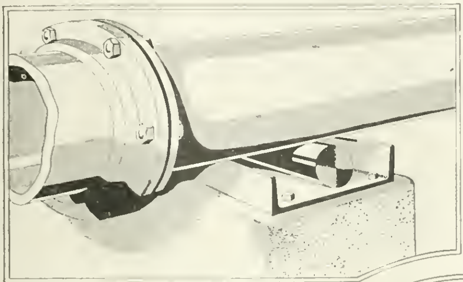


Ring and Wedge for Withdrawing Tapping Bar

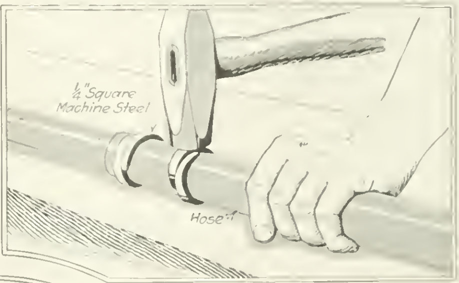


Ratchet Wrench for Places of Small Clearance

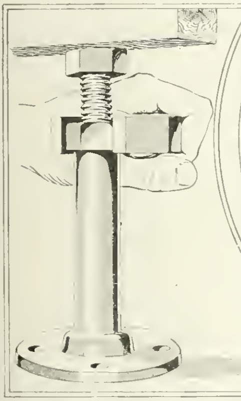
For the Smelting Plant



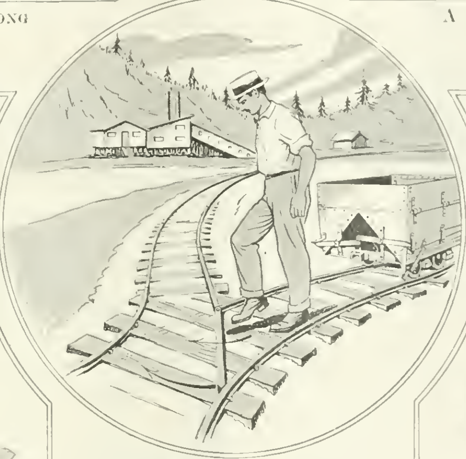
Roller Support for Long Pipe Line



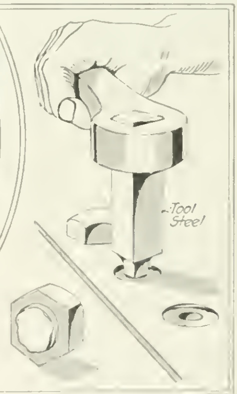
A Hose Clamp Made by the Smith



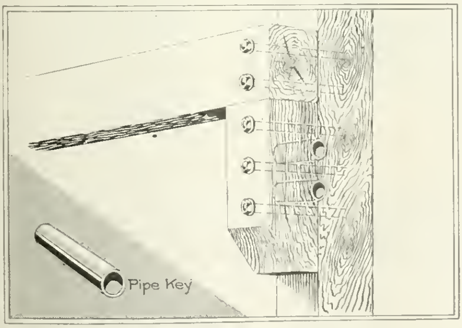
A Jack May Be Improvised from Bolt, Pipe and Nut



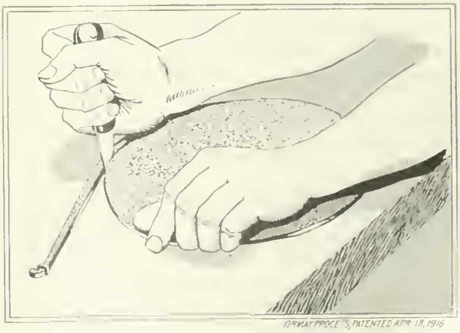
Inexpensive Switch Adapted to Light Tram Service



A Method of Removing Broken Stud Bolts



Method of Keying Bracket to Post with Round Hole and Pipe



ORDWAY PROCESS, PATENTED APR 18, 1916

Spiral Cut to Get Long Belt Lace in an Emergency

Blast vs. Reverberatory Furnace

By B. Magnus*

SYNOPSIS—A consideration of the advantages of the blast furnace as compared with the reverberatory for the treatment of the copper-gold ore of the Mount Morgan Gold Mining Co. in Australia. Only slight difference in profits indicated in estimates for either type of treatment, but operating considerations and known results turned the balance in favor of the blast-furnace plant.

Previous to 1912 the Mount Morgan Gold Mining Co. in Australia treated—in addition to the gold ore, which went to the chlorination works—a high-grade gold-copper ore in a small blast furnace. About this time it became apparent that there was no more ore available for treatment in the chlorination works and that a modern smeltery would be necessary to treat the large quantity of copper ore which was still available, though of lower value than the copper ore that had been treated previously.

There was in the mine a good deal of ore too high in silica to be smelted profitably, as the company had at all times to buy flux—either as iron ore or pyritic ore—at a high price.

It was not considered profitable at this time to treat any of the lower grade copper ore by concentration because of the large quantity of finely divided free gold in the copper ore; its recovery by ordinary methods would be exceedingly poor, and the recovery of the copper would also be unsatisfactory. Extensive experiments were carried on to devise means of concentrating the low-grade copper ore, and by the use of a flotation process it was proved that about 90% of the copper and 75% of the gold could be saved from an ore running about 2% copper and 7 dwt. of gold. The blocks of ore in the mine were so irregular that a face one day might give an ore which was consigned to the smelting plant and the next day the output from this face would have to be sent to the concentrator, either because it was too high in silica or too low in valuable metals.

BLAST-FURNACE VS. REVERBERATORY SMELTING OF MOUNT MORGAN ORE

(Calculated October, 1912)

Assumptions:

1. Handle monthly 20,000 long tons smelting ores and 15,000 tons concentrating ores.
2. Average grade of ores: Copper, 3%; gold, 8 dwt.
3. Concentration of 2½ tons of ore into 1 ton of concentrates.
4. Roaster-and-reverberatory recoveries: Concentrates—copper, 92%; gold, 96%; crushed ores—copper, 88%; gold 95%. Blast-furnace recoveries: Copper, 85%; gold, 95%. Concentrator recoveries: Copper, 92%, gold, 75%.
5. Costs: Blast-furnace smelting of ore not exceeding 52% SiO_2, $4.29 per ton; extra cost for sintering or melting fines, 24c. per ton.
    Crushing high-grade ores, 24c. per ton; roasting, 72c. per ton; concentrating, 10c. per ton; reverberatory smelting of roasted concentrates, $2.43 per ton; reverberatory smelting of roasted high-grade ore, $3.65 per ton.
    Converting 32% matte from blast furnace, $14.60 per ton of copper.
    Converting 46% matte from reverberatory $9.73, per ton of copper.

Reverberatory Proposal No. 1: Concentrate low-grade ores and crush high-grade ores; roast concentrates and crushed ores, and smelt in reverberatory.
Reverberatory Proposal No. 2: Concentrate all ores, roast concentrates and smelt in reverberatory.

Recoveries

Blast Furnace:

3%	copper	× 85%	= 2.55%	× 2.92	= $7.44	
8 dwt.	gold	× 95%	= 7.60 dwt.	× 1.01	= 7.69	$15.13

Concentrating:

3%	copper	× 92%	2.76%	× 2.92	= $8.06	
8 dwt.	gold	× 75%	= 6.00 dwt.	× 1.01	= 6.08	$14.14

Roasting and Reverberatory Smelting:

2.76%	copper	× 92%	= 2.53%	× 2.92	= $7.39	
6	dwt. gold	× 96%	= 5.76 dwt.	× 1.01	= 5.84	$13.23

Crushed Ore:

3%	copper	× 88%	= 2.64%	× 2.92	= $7.71	
8 dwt.	gold	× 95%	= 7.60 dwt.	× 1.01	= 7.70	$15.41

Combined Recovery by Proposal No. 1:

$\frac{15,000}{35,000} \times 13.23 + \frac{20,000}{35,000} \times 15.41 =$ $14.45

Costs

Blast Furnace:

$4.26 + $0.24 fines treatment + $0.12 Extra Converting Costs...... $4.62

Reverberatory Furnace:

Proposal No. 1:

$\frac{3}{7}[\$1.22 \text{ Concentrating} + \frac{1}{2.5}(\$0.72 \text{ Roasting} + \$2.43 \text{ Smelting})] =$ 1.06

$\frac{4}{7}(\$0.24 \text{ Crushing} + \$0.72 \text{ Roasting} + \$3.65 \text{ Smelting}) =$ 2.63

$3.69

Proposal No. 2:

$\$1.22 \text{ Concentrating} + \frac{1}{2.5}(\$0.72 \text{ Roasting} + \$2.43 \text{ Smelting}) =$. 2.49

Profits

Blast Furnace.. .... $15.13 — $4.62 = $10.51

Reverberatory Furnace:

Proposal No. 1.. .... $14.45 — $3.69 = $10.76
Proposal No. 2.. .... $13.23 — $2.49 = $10.74

In the above calculation of Proposal No. 1, the results are not absolutely correct, due to assuming the same grade of ore concentrated as smelted direct, whereas the first would be lower than the average and the other correspondingly higher; but for the purposes of this calculation, the method of computation is sufficiently correct, more detailed calculation having shown that the error in no instance exceeds 6½c. a ton.

Résumé of Blast-Furnace Smelting

Advantages

1. Maximum recovery on all ores of higher grade than assumed above and 1,250,000 tons are known to be of higher grade.
2. More flexible—hence better provision if mine develops high-grade ores.
3. Certainty of continuous operations when changing from old to new plant.
4. Erection completed more quickly.
5. Recoveries and costs attainable are known.

Disadvantages

1. Handling concentrates and flue dust.
2. In eight years, present high-grade ores will be exhausted; then there will be no need for blast furnaces.
3. Sintering or melting plant will have to be operated for handling concentrates and flue dust to overcome disadvantage No. 1.
4. Possible serious increases in cost of coke (already $2.75@3.00 per ton of Mount Morgan ore smelted).

Résumé of Reverberatory Smelting

Advantages

1. Saving in capital cost on power plant and smeltery about $97,000.
2. Water supply not a serious item.
3. No difficulty in handling concentrates and flue dust.
4. No Many Peaks ore would be used and in Proposal No. 2 neither Many Peaks ore nor ironstone would be used.

Disadvantages

1. No experiments ever having been made on concentrating these ores, it is not known what recoveries will be attained.
2. No trained reverberatory smeltermen, hence possible serious delay when starting new plant.
3. Extensive experiments will need to be made on settlement of roaster dust and may involve big outlay of capital (M. S. concentrates very fine).
4. Coal must all come from Newcastle.
5. Lay of ground not very suitable.
6. Excellent recoveries and costs assumed but not definitely known if they can be attained.

Memo. Added January, 1915: The recoveries indicated for the concentrator are not as yet attainable. The recoveries for the reverberatory smelting, particularly considering roaster losses on Minerals Separation concentrates, as indicated, are better than it is now considered possible to obtain. The cost for concentrating indicated is not yet attained. The costs indicated for roasting and reverberatory smelting are the best that might be hoped for after years of experience. It is therefore apparent that reverberatory smelting at Mount Morgan could not be considered desirable with the possible exception of roasting and smelting the concentrates, now produced, in reverberatories direct to high-grade matte. In view of the heavy dust losses which might be looked for on roasting M.S. concentrates, and the cost of a roasting plant, it would appear as if it is desirable either to melt or sinter concentrates and smelt the product in the blast furnaces.

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*Consulting engineer, 61 Broadway, New York.

At that time it was therefore impossible to determine definitely how much of the ore in the mine would be concentrated and how much smelted. The amount of high-grade ore was definitely known, but it was anticipated that this quantity would be augmented by the richer portions of ores which previously were calculated in the average of the leaner ores. It was therefore anticipated that a larger quantity would be available for blast-furnace treatment than the reserves showed. Before undertaking the design of the new plant, calculations as set forth in the accompanying table were made and show why a blast-furnace plant was finally determined upon.

TABLE 1. DETAILED EXAMINATION OF ORE RESERVES TO DETERMINE PROPER TREATMENT FOR THE VARIOUS BLOCKS

	Block No. 1 SiO_2	Block No. 2 SiO_2	Block No. 3 SiO_2	Block No. 4 SiO_2	Block No. 5 SiO_2	Block No. 6 SiO_2	Block No. 7 SiO_2	Block No. 8 SiO_2	Block No. 9 SiO_2	Block No. 10 SiO_2	Block No. 11 SiO_2	
Actual SiO_2..	58 5	56 9	52 5	51 0	48 4	46 9	43 8	41 3	41 2	38 5	34 0	
$SiO_2 + 2\%$[12]	60.5	58.9	54 5	52 1	50 4	48 9	45 8	43 3	43 2	40 5	36 0	
Gross Value per Long Ton	Tons Ore	Tons Ore	Tons Ore	Tons Ore	Tons Ore	Tons Ore	Tons Ore	Tons Ore	Tons Ore	Tons Ore	Tons Ore	
$23 98							312,000[7]					
22 89			36,500[3]									
22 55	86,000[1]											
20 67		166,000[2]										A
19 78						276,500[6]						
16 03					246,000[5]							
17 71				1,000[4]								
12 73									370,000[9]			
11.66										151,900[10]		B
11 42								78,800[8]				
8 62											190,000[11]	

Treatment Costs, Recoveries and Profits	S[15]	C[16]	S	C	S	C	S	C	S	C	S	C	S	C	S	C	S	C	S	C	S	C
Mining...	$3.41	$3 41	$3 41	$3 41	$3.41	$3 41	$3 41	$3 41	$3 41	$3 41	$3 41	$3 41	$3 41	$3 41	$3 41	$3 41	$3 41	$3 41	$3 41	$3 41	$3 41	$3 41
Conc'tr'g, etc.		1.58		1.58		1.58		1 58		1 58		1 58		1 58		1 58		1 58		1 58		1 58
Smelting.....	6 30	.85	6 08	.85	5 41	85	5 04	.85	4 78	.85	4 53	.85	4 07	85	3 68	85	3 68	85	3 26	85	2 59	85
Conv. and realiz...	1 64	1.44	1 60	1 42	1.84	1 62	.38	.32	1 44	1 28	1 74	1 54	2 19	1 92	1 07	93	1 58	1 40	1 60	1 41	1 17	1 03
General expenses..	.49	49	.49	49	49	49	.49	49	49	49	49	49	49	49	49	49	49	49	49	49	49	49
Total cost..	11 84	7 77	11.58	7 75	11 15	7.95	9 32	6 65	10 12	7 61	10 17	7.87	10.16	8 25	8 65	7 26	9 16	7 73	8 76	7 74	7 66	7 36
Yield...	21 17	16 98	19 32	15 59	22.22	18 02	17 15	13.14	14 88	12.12	18 39	14 94	22 26	18 12	10 58	8 63	11 57	9 74	10 48	8 96	7 76	6 58
Profit per ton	9.33	9.21	7 74	7.84	11.07	10 67	7 83	6 49	4.76	4.51	8 22	7.07	12.10	9 87	1 93	1 37	2 41	2 01	1 72	1 22	.10	.

Detailed Value of Ore in Individual Blocks of Mine[13]

	Metals	Content	Gross	Value per Ton Recovered By Smelting	Value per Ton Recovered By Concentrating
[1]Block 1..	Gold	12 78 dwt.	$12 94	$12 70	$9.10
	Copper	3 30%	9 65	8 47	7 46
[2] Block 2..	Gold	11 13 dwt.	11 28	11 04	8 28
	Copper	3 23%	9 40	8 27	7 29
[3] Block 3..	Gold	11 92 dwt.	12 07	11 82	8 86
	Copper	3 71%	9 87	8 68	9 16
[4] Block 4..	Gold	15 30 dwt.	15 30	15 18	11 37
	Copper	0 76%	2 23	1 94	1.73
[5] Block 5..	Gold	7 49 dwt.	7 58	7 44	5 57
	Copper	2 90%	8 47	7 44	6 54
[6] Block 6..	Gold	9 78 dwt.	9 97	9 71	7 27
	Copper	3 51%	10.24	9 03	7 93
[7] Block 7..	Gold	11 06 dwt.	11 22	10 97	8 21
	Copper	4 39%	12 84	11 29	9 93
[8] Block 8..	Gold	5 06 dwt.	5 73	5 04	3 77
	Copper	2 13%	6 30	5 55	4 87
[9] Block 9 .	Gold	3 43 dwt.	3 45	3 40	2 55
	Copper	3 18%	9 29	8 17	7 19
[10] Block 10	Gold	2 22 dwt.	2 24	2 19	1 65
	Copper	3 23%	9 44	8 30	7 30
[11] Block 11	Gold	1 77 dwt.	1 80	1 75	1 33
	Copper	2 34%	6 84	6 00	5 28

Regrouping of Ore Reserves

	Tons Ore	Profit	Obtained Metals Gold, Oz.	Obtained Metals Copper, Tons
A Group: High-grade ore..........	1,123,000	$9,707,670 $8.63 per ton	557,579	35,279
B Group: Medium-grade ore.......	791,700	1,333,284 $1.68 per ton	11,529	20,088

Blocks 8, 9, 10 and 11 will be concentrated because when crediting them with iron contents recovered in concentrating, they will show at least same profit by concentrating as by smelting.

Details of Treatment Costs

Smelting Ore

Mining	$3 04 + $0 37 = $3 41 per ton
Smelting.	$2 19 per ton, gross burden
Fluxing	$0 10 per unit, excess SiO_2
Converting	$0 14 per 1% copper recovered
Realization	$0 42 per 1% copper recovered
General expenses ...	$0 49 per ton

Concentrating Ore

Mining	$3 41 per ton
Concentrating, etc...	$1 09 per ton
Royalty	$0 12 per ton
Sintering..	$0 36 per ton
Smelting.	$0 85 per ton
Converting	$0 14 per 1% copper recovered
Realization	$0 42 per 1% copper recovered
General expenses	$0 49 per ton

Copper recovery: By concentration, 88%; by smelting, 88%

Gold recovery: By concentration, 75%, by smelting, 98%

$$\text{Fluxing} = 5\left(S - \frac{100 - S}{2}\right)$$

where S = silica content + 2

[12] Arbitrary addition of 2% for metallurgical calculations.

[13] In original chart, these data are shown with the tonnage figures for ore in each block. Space, however, did not permit of that arrangement on this page

[14] Copper taken at 13c per lb.; gold at $1 01 per dwt

[15] S = Figures relative to treatment by direct smelting

[16] C = Figures relative to treatment by concentration and smelting.

If it had been possible to operate a reverberatory plant at anything like the cost obtainable in American plants, then the proposal to concentrate the leaner ores and to crush and roast all the high-grade ores would have been the best proposal, but on account of the cost of labor and material, no low reverberatory-smelting costs could be achieved. Further, the cost of reverberatory smelting would probably constantly increase, whereas there was no similar reason for expecting the blast-furnace costs to rise.

Metallurgical Calculations as Affecting Mine Valuation

By B. Magnus*

Soon after starting smelting operations in the new Mount Morgan plant in Queensland, Australia, it became apparent that the monthly net earnings did not correspond with what might have been expected when deducting the cost of mining and treatment from the reported value of the recovered metals in the ores. Upon investigation, it was found that while the assays of the ores treated over a long period corresponded fairly well with the mine-assay plans, there was great variation day by day in ore coming from the same blocks. Mine-assay plans were therefore rearranged into blocks of more nearly uniform grades even though the ore could not be mined in accordance with the indication of this regrouping. The calculations then made are shown in Table 1. [illegible] in 1912 the mine reports showed 1,500,000 tons of high-grade and about 2,000,000 tons of medium-grade ore.

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*Consulting engineer, 61 Broadway, New York.

It was considered that all the high-grade ore would be smelted and, in addition, a certain amount of ore from the medium-grade bodies, but after a study of Table 1 it became apparent that the figures given were by no means the tonnages available for the specified treatment.

When the ore reserves were resurveyed, a different condition was found to exist. Blocks 8, 9, 10 and 11 are good examples of the result of a detailed study of the different ore blocks. These medium-grade blocks show a fair profit by smelting, and being low in silica as compared with the high-grade blocks, they were regarded as desirable smelting ores. Nevertheless, it was decided to concentrate these blocks. It will be noted by the table that the blocks show a slightly higher profit by direct smelting than by concentration. However, for metallurgical reasons, the latter treatment was decided upon, the increased iron tenor of the concentrates entitling the concentrating treatment to a metallurgical credit so that, properly, concentration showed at least as great a profit as direct smelting and the excess iron in the concentrates reduced the amount of ironstone to be imported for fluxing the siliceous ores.

To the engineer closely in touch with a property there would not be much surprising in these results, but the average man is accustomed to considering total reported tonnage of ore at average value as being the assets of a mining property. The error in this is shown by Table 2, which is an exaggerated example, but calls attention to the advisability of reporting mine reserves according to the grades of ore within strict limitations. Table 1 further shows the necessity of metallurgical consideration being given to the grades of ore in the mine before any figures dealing with reserves are reported.

TABLE 2. SHOWING PROFIT ON ORE RESERVES CONSIDERED AS A WHOLE AND IN SEGREGATED BLOCKS

Ore Reserves, Tons	Copper, %	Gold, Oz.	Recovered Metals Copper, Tons	Recovered Metals Gold, Oz.	Value Recovered, Metals Copper	Value Recovered, Metals Gold	Value Recovered, Metals Total	Value, Less Mining and Treatment at $10 per Ton
(A) 1,000,000.	4	0.1	36,000	100,000	$10,800,000	$2,000,000	$12,800,000	$2,800,000
(B) 600,000 (6%)....	4	0.1	32,400	60,000	9,720,000	1,200,000	10,920,000	4,920,000
400,000 (1%)								

The block of 400,000 tons of 1% ore in (B) would not be mined. On the basis of 4,000 tons copper produced per annum, the mine life would be nine years in case of (A) and amortization would be 12½% per annum, whereas in (B) life would be eight years and amortization 14½%. Daily smeltery capacity in (A) would be 300 tons, in (B) 200 tons, and amortization in (B) would probably be $50,000 yearly less than in (A). If it were decided to smelt 300 tons of ore daily in either case, then life in (B) would be only 5½ years, but production would be 5,800 tons copper annually from a smeltery which cost the same to build as in (A).

Furthermore, an investor often lumps the amount of metals that will be produced from the published ore reserves of the mine, whereas the most economical working of the property might mean a decidedly lesser quantity of metals produced. It is reasonable to wish to publish all ore reserves—including those that are not immediately profitable but may be in the future—but it would be advisable to publish these entirely separate from other figures, so that the figures as presented to the public would enable the discriminating investor in mining properties to estimate from time to time, the value of his investment with almost the same degree of accuracy as in estimating the earning capacity of an industrial enterprise.

⁂

The Direct Production of Iron-Nickel Alloys

In order to avoid the separate extraction of iron and nickel, or iron and any other metal, such as manganese, from an ore when it is possible to obtain a desirable alloy by direct reduction, Frederick A. Eustis, of Milton, Mass., and Charles P. Perin, of New York, have devised a process for the direct production of such alloys.

Taking Cuban ore as an example, containing about 1% nickel, a lot of ore is divided into two parts, one of which is to be treated for the extraction of a predetermined amount of its nickel, which is subsequently added to the second part, thereby enriching the mixture in nickel. Then the mixture is smelted to produce an iron-nickel alloy. The treatment of the first part of the ore for the extraction of nickel may be accomplished by roasting with sulphur-bearing material, yielding a sulphated product from which nickel sulphate can be leached. The nickel solution thus obtained may be precipitated and the precipitate added to the second part of the ore prior to smelting. The inventors have been granted U. S. Patent No. 1 185,187.

⁂

Safe Practice at Blast Furnace

In Technical Paper 136 of the United States Bureau of Mines, the subjects of accidents and their prevention has been dealt with in a painstaking manner. This paper is a manual for foremen and men, telling each class of workmen of the things which they should do and the things which they should not do—principally the latter.

The paper is amply illustrated, to the extent that a mere child would find the book an interesting one; thus exploding the popular fallacy that government publications are dull and uninteresting. One set of three pictures, showing the improper and proper way of transporting a dinner bucket from the bottom of a ladder to an elevated platform, should appeal to mine managers; though it is questionable whether the Bureau of Mines will insist upon the adoption of this system for underground use. Reel 1 shows "Taking Chances on a Ladder, Carying Bucket in One Hand"; Reel 2, "Man Falls from Ladder" (presumably Monday morning); Reel 3, "The Safe Way; Haul Up the Bucket with a Line."

If each and every workman about a blast furnace were to carry a copy of this manual in his hip pocket and obey implicitly all the instructions therein provided for his individual guidance, it is difficult to conceive how any accident, however trivial, could happen to any one but a rank intruder or an ignorant wop. But should anything transpire, turn to page 62 and consult the notes on first aid. A first-aid box in the charge of the chemist, storekeeper or watchman is recommended as an encouragement for the workmen to form the habit of seeking immediate first-aid treatment for slight injuries. Every wound should be primarily looked upon as infected and receive immediate attention. A fresh cut should not be washed, even by the first-aid man; leave that for the physician. For details of first aid, bandaging, use of splints, stretcher work and methods of resuscitation, see Miners' Circular 23[1].

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[1] "Elementary First Aid for the Miner," Miners' Circular 23. Bureau of Mines, 1916. (In press.)

Lead-Smelting Practice in the United States

By Arthur S. Dwight*

SYNOPSIS—Recent lead-smelting practice has not changed greatly, the advances being chiefly in refinements in the preparation of the charge and in the handling facilities to permit better metal recoveries. Economy in labor, improved furnace operation and higher recoveries have resulted. Double roasting has permitted sulphur content to be reduced to 2.5% by automatic apparatus, hand roasting having almost completely disappeared. Newnam hearth promises rejuvenation of Scotch-hearth type of furnace for smelting the highest grade lead concentrates.

A review of the field of lead smelting in the United States shows that most of the recent progress in the art has been made (*A*) in the methods of preliminary preparation of the furnace charge, including desulphurization and the agglomeration of fines, and (*B*) in the better handling facilities that have been devised for making up the furnace mixtures, whereby not only economy in labor, but improved furnace operation and better metal recoveries are attained.

It is not the purpose of this article to record in detail even a fraction of the many individual or minor improvements in apparatus and method that have been worked out and that in the aggregate have done much to improve conditions, but rather to treat the subject in a broad way, and with especial emphasis on the two phases of the question named.

The lead-smelting plant of today, excluding the refineries in which ore smelting is merely incidental, consists essentially of (a) blast furnaces with auxiliary equipment, (b) roasting plant, (c) power plant, (d) facilities for weighing, unloading, sampling, storing the ores and fluxes, handling them through the intermediate stages of the operation, and at last making up the proper smelting mixture and delivering it to the furnace; (e) means for handling, separating and disposing of the molten products from the furnace; and finally (f) means for the collecting and disposal of flue dust, fume and waste gases (chiefly SO_2) from the roasting and smelting furnaces in such manner that the health of the workmen is safeguarded and the least possible injury may be caused to persons and property in the environment. This article will discuss only the items (a), (b), and (d).

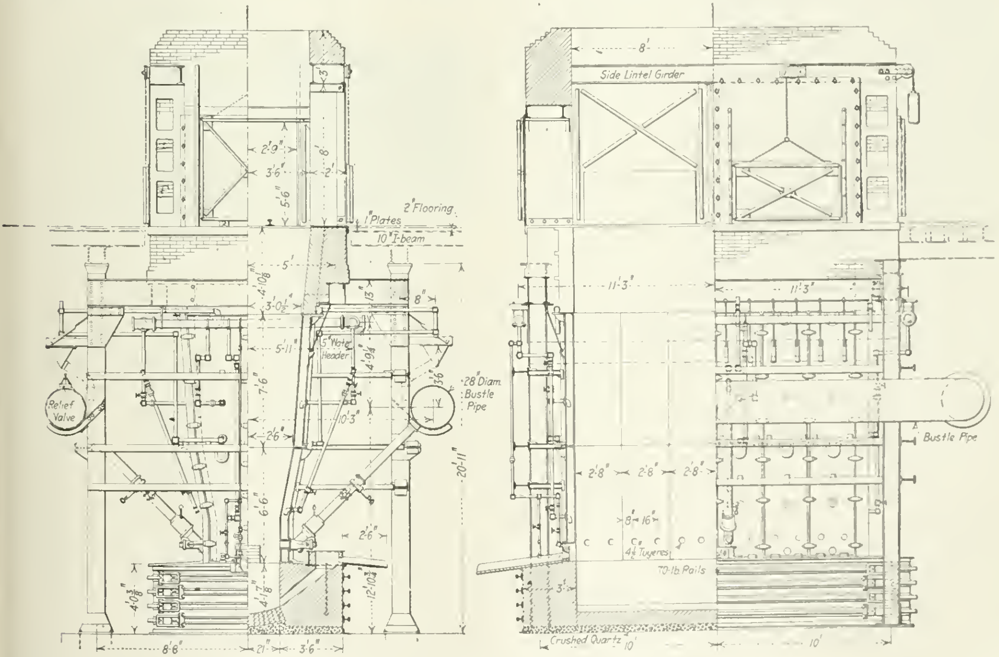

FIG. 1. END AND SIDE ELEVATIONS OF 42x192-IN. LEAD-BLAST FURNACE IN REMODELED PLANT OF NORTHPORT SMELTING AND REFINING CO., AT NORTHPORT, WASH.

No attempt will be made to discuss the power plant, the handling, separating and disposing of the molten product of the furnace, or of the smoke question. The last-named subject, especially, has in the last few years been under investigation by the brighest minds and the most skillful scientific methods that the large smelting companies could command. Much valuable matter has been published already in connection with smoke suits in Utah, Montana and California, but an enormous amount of data has been gathered which is as yet unpublished, but which it is hoped may some day be presented.

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*Consulting engineer, 29 Broadway, New York.

Modern American lead-smelting practice is, almost without exception, based on a preliminary treatment of all ore fines for purposes of desulphurization and agglomeration by either the Huntington & Heberlein, or the Dwight & Lloyd systems. Thus in the 25 most important lead smelteries in the United States, Mexico and Canada (excluding refineries, unless they also treat crude ores, all but two have D. & L. sintering equipment; 10 have H. & H., 23 have D. & L., while eight of crude ores), all but two have D. & L. sintering equipment; operating side by side. Therefore I cannot well avoid frequent references to a process in which I am naturally peculiarly interested, but will try to treat this phase of the subject as merely incidental to the general discussion and in as impartial a spirit as possible.

THE STANDARD LEAD BLAST FURNACE

I shall first deal with the central figure in the smelting plant, the blast furnace. The standard blast furnace has not changed much in the last 10 years, but its capacity has been greatly increased, its general behavior steadied, and its metal recoveries improved by the greater care that has been expended in the preliminary preparation of ore charge and in the general adoption of correct methods of feeding.

The blast furnaces in common use are of the well-known rectangular type, 42 to 44 in. wide and up to 18 ft. long, inside measurement at the level of the tuyeres, with an ore column from 14 to 18 ft. high; water jackets extending in some cases nearly up to the charge floor and with bosh on the sides, but seldom on the ends; lead crucible with Arents' siphon tap; water-jacketed slag tap; large removable forehearth settler from which the matte is tapped as required and from which the slag overflows nearly continuously into large-sized slag cars handled by electric or steam locomotives; a furnace top arranged for removing the furnace gases and a mechanical feeding apparatus which is usually an adaptation of the Williams charge car and the Dwight spreader,[1] both more or less modified. The old-style brick or sheet-iron furnace top with downtake pipe, seems to make less flue dust than the style that removed the gases below the floor level at one end. The latter also is supposed to cause irregularities in the smelting zones through the unequal influence of the chimney shaft. For reasons of mechanical simplicity when charging cars are used, the low top is generally used in spite of these objections, though some excellent examples of the high top are found in combination with the car.

Fig. 1 shows a furnace that may be taken as a fair example of good modern practice. It represents the furnace recently designed for the Northport smelting plant by the manager, Samuel James, and fabricated by the Traylor Engineering and Manufacturing Co., of Allentown, Penn. Three of these furnaces were successfully started up this year and are making an excellent record. It is particularly interesting because, although served by a charge car, the high top is adhered to.

The following comments on the structural features of this furnace may be pertinent: The area of the smelting zone is 42x192 in. at the tuyere level, with an ore column approximately 18 ft. high. The side water jackets are 32 in. wide, arranged in an upper and a lower tier. The lower jackets are 6 ft. 6 in. high with bosh and two tuyere openings 4½ in. diameter on 16-in. centers, making 16 tuyeres on each side of the furnace. The upper jackets are 7 ft. 6 in. high and set so as to continue the bosh upward though at a lesser angle than on the lower jackets. Special attention is directed to the arrangement of the columns and mantle beams supporting both the superstructure of the furnace and the charge floor, which, by the wide spacing of the columns, gives free working space when it becomes necessary to change jackets. The water-pipe system can be swung out of the way, likewise the tuyere pipes and fittings. Besides back-pressure relief valves on the bustle pipe, each tuyere pipe is provided with an Eilers automatic tuyere valve to guard against back-fire.

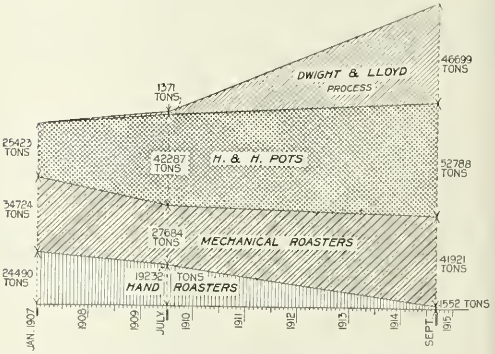

FIG. 2. GRADUAL CHANGE IN ROASTING METHODS AT 10 IMPORTANT U. S. LEAD SMELTERIES

The superstructure of the furnace consists of a steel and cast-iron framework inclosed in red brick. On each long side there are doors which can be used for hand feeding when the furnace is being blown in and for barring down the walls of the furnace. The end doors of the superstructure are arranged to admit a charging car of the same length as the furnace, which is switched into position by a steam locomotive and discharges its burden of 8,000 lb. through drop doors in the flat bottom held shut by chains from a windlass shaft, much like the Hixon charge car.[2]

As the problem of distributing the charge in the furnace is a comparatively simple one, 70% of it being D. & L. sinter, a small longitudinal spreader placed a short distance below the car is sufficient. Such a furnace as here shown will smelt about 250 short tons of charge per 24 hr., or about 4½ tons of charge per square foot of area at the tuyeres, with a blast pressure of 30 to 40 oz., using a fuel charge equivalent in fixed carbon to 10 to 11% of the weight of the charge, besides 3% sulphur. The matte is about 7%, assaying 10 to 12% Pb, and the slags about 0.5% Pb. The amount of lead in the charge is about 25%.

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[1] "The Mechanical Feeding of Silver-Lead Blast Furnaces," by A. S. Dwight. "Trans. A. I. M. E.," Vol. XXXII, 1902. See also L. D. Anderson, "Eng. and Min. Journ.," May 20, 1916.

[2] "The Mechanical Feeding of Silver-Lead Blast Furnaces," by A. S. Dwight, "Trans. A. I. M. E.," Vol. XXXII, 1902.

A satisfactory roasting process for lead smelting must effect a maximum elimination of sulphur and leave the product in coarse form. The latter point has now come to be regarded as almost of equal importance with the former. The higher percentages of sulphur can be disposed of satisfactorily by the old-style mechanically rabbled roasting hearth and economically too, if one is satisfied with 10% or more residual sulphur. The finishing roast can be performed either in H. & H. pots or D. & L. machines, both of which yield a coarse product in excellent condition for the subsequent blast-furnace smelting, and with residual sulphurs running from about 2½ to 5%. If this preroasting were omitted with heavy sulphides and they were subjected at once to a blast-roasting operation adjusted to produce the maximum percentage of agglomerated product, the mass of sulphide particles would tend to fuse or matte prematurely in the intensity of the oxidation induced by the forced draft and this layer of matte would tend to shut off the further passage of the air blast. Blast roasting is most successful on a charge in which the sulphide particles are mixed with other particles of more or less refractory material, so chosen that during the first, or roasting, period they shall remain inert, acting as isolaters to prevent mass action among the burning sulphide particles, but which subsequently, during the second or sintering period, shall be capable of chemical reaction with the metallic oxide produced by the roasting to form silicate or other similar compound, which at the moment of nascency will become sufficiently fluid at the intense temperatures developed by the reaction, to be performed by the air blast into the peculiar cellular or cokelike mass now called sinter.

SULPHUR LIMIT 16 TO 18% FOR GOOD SINTERING

A sintering charge for the H. & H. pot or D. & L. machine will usually be limited to 16 or 18% sulphur—usually less. This tenor may be obtained with heavy sulphides either by partly desulphurizing them beforehand, as previously suggested, or by mixing the crude sulphide with other fine materials lower in sulphur, such as flue dust, siliceous and oxidized ore screenings or other material that it may be desirable to sinter, until the sulphur is sufficiently diluted for effective treatment by the sintering process. Thorough mixing of the ingredients is highly essential in order to bring about the complete isolation of the separate sulphide particles from one another to meet the ideal conditions outlined. Both these methods are sometimes followed in the same plant.

The type of furnace originally adopted for this purpose in the H. & H. plants in this country was the Godfrey, in which the ore is carried on a revolving circular hearth fired by coal and stirred by stationary rabbles extending down through the dome roof. The simplicity of this furnace recommends it, but it has the objection common to all the old-style mechanically rabbled roasting hearths; namely, that it is difficult to prevent wide variations in temperature on the roasting hearth, and this lack of heat control followed by premature fusion of the unroasted sulphides is what killed the mechanical roasters for treating lead ores—so extensively introduced in the Rocky Mountain region back in the 90's.

The precise temperature control possible with the modern Wedge furnace led me to believe that with it the difficulties that had formerly been considered insuperable objections to using mechanically rabbled roasting hearths for roasting easily fusible sulphides could be obviated. On my recommendation, a Wedge furnace was installed by the St. Joseph Lead Co. at Herculaneum, Mo., early in 1911 to preroast leady matte. This was the first Wedge furnace installed for lead ores and behaved so satisfactorily that many other smelters have installed the same type and the Wedge may now be considered as standard practice for preroasting, especially in connection with sintering operations.

EXTINCTION OF THE HAND ROASTER

The old hand roaster, which has been for so many years the unfailing friend of the lead smelter, has been rendered practically obsolete in the United States by the development of the modern roasting methods and the successful revival of the mechanically rabbled furnaces for preroasting. A few survivors may be found still standing, here and there, but with little work to do.

In this connection the diagram shown in Fig. 2 may be of interest. It represents the tonnages being treated by the various roasting processes in 10 representative lead-smelting plants in the United States for a period of about seven years, from the time the first D. & L. plant was built in the United States until September, 1914, by which time the D. & L. tonnage had grown to about equal that of the H. & H. tonnage in these plants, while the hand roasters had dropped to almost nothing.

The D. & L. system is so flexible that it can be made to perform either the preroasting of charges high in sulphur without sintering, or the finishing roast of a charge with a lower initial sulphur to yield a superior quality of sintered product, but it cannot do both satisfactorily in a single operation. The use of the D. & L. machine as a preroaster is a recent development in this country, but has been practiced in Australia since the D. & L. process was first introduced at the Port Pirie works of the Broken Hill Proprietary Co. in 1908. This company uses one battery of D. & L. machines for preroasting and another for sintering. Several American plants have within the last year found that they could preroast on their D. & L. machines more cheaply than by their Godfrey or Wedge furnaces and then finish either in their H. & H. pots or by another pass over the D. & L. machine. This procedure has been called "double roasting," and will be discussed later.

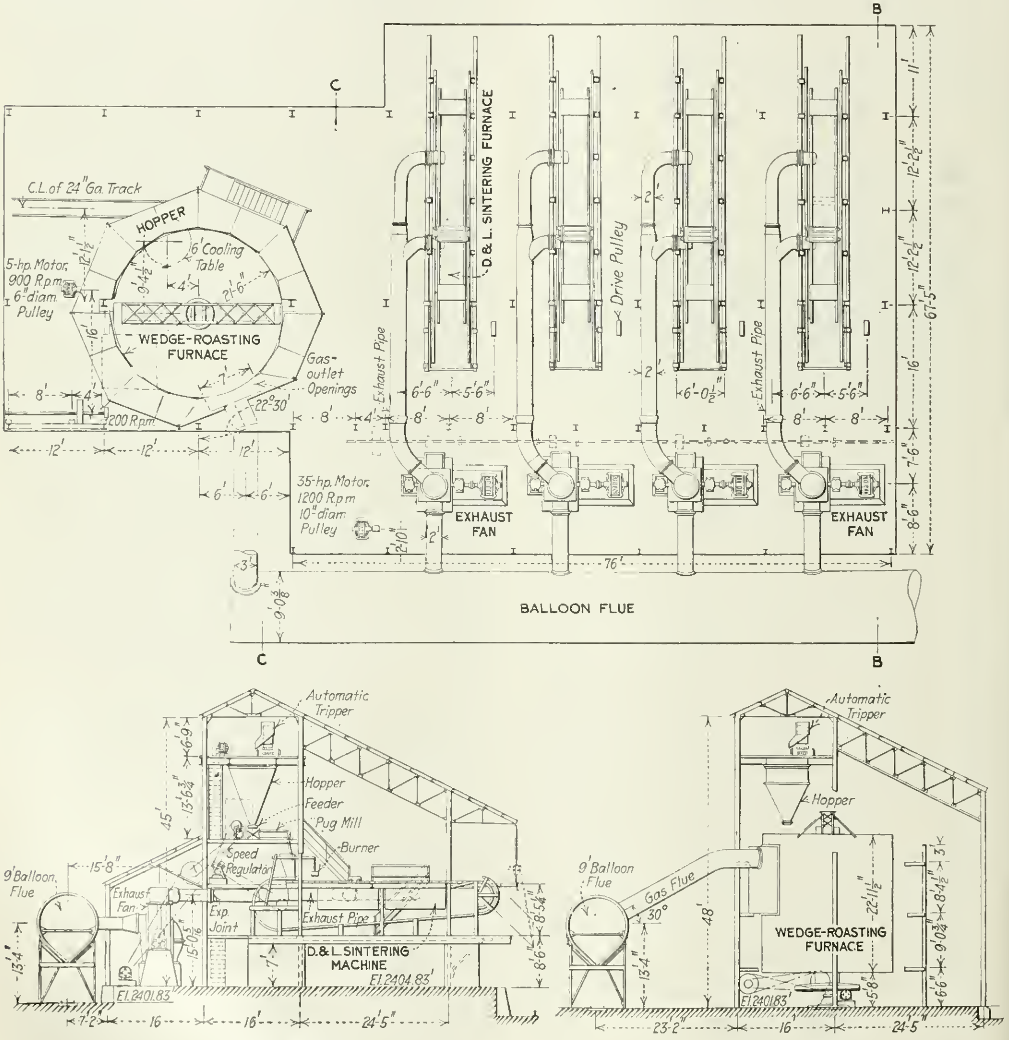
Numerous references to the H. & H. pot plants now in operation in the United States may be found in current technical literature. Therefore no attempt will be made in this article to describe them. As the American Smelting and Refining Co. owns the American rights to the H. & H. patents, they are the sole users in the United States. No important changes have been made in their design, nor in fact, have any new installations or increases in old ones been made, as far as I am aware, in the last seven or eight years. The single plant of the Savelsberg process in the United States, at the Herculaneum, Mo., plant of the St. Joseph Lead Co. was shut down about four years ago after the D. & L. system had demonstrated its greater economy. The Salvesberg plant consisted of 29 pots and a[illegible]

Neither will any elaborate description be [illegible] of the D. & L. process. Numerous descriptions [illegible] have been published which give full in[illegible] the general subject is now well understood. The plants recently constructed are substantially built, with steel buildings and complete equipment for economically handling the ores, automatically proportioning the ingredients, mixing and moistening. The feeding system generally employed is one that was developed by Dwight & Lloyd, and will be more fully described in the paragraphs on "The Handling of the Materials."

New Bunker Hill Roasting Plant

A typical arrangement of a roaster plant containing a Wedge roaster and four D. & L. machines is shown in Fig. 3. It is the roaster building for the new Bunker Hill smelting works at Kellogg, Idaho, which is being built by Bradley, Bruff & Labarthe, of San Francisco, Calif., by whose courtesy these drawings are published. Automatic proportioning of ingredients will be used, the same system of belts supplying both the Wedge furnace and the D. & L. machines. The preroasted product of the Wedge furnace will be returned by tram-cars to the main ingredient bins, from which it can be again fed into the charge to the sintering machines.

The sintering machine itself has not been modified to any serious extent since the present standard type was adopted six years ago. While it has been frequently claimed by critics that the construction is entirely too light for the work it is called upon to do and beginners have almost invariably been ready to recommend many changes, the machines have shown such endurance under the most difficult service and such flexibility under all



Section B-B

Section C-C

FIG. 3. PLAN AND TYPICAL CROSS-SECTIONS OF THE ROASTING-SINTERING PLANT OF THE BUNKER HILL SMELTERY NOW BEING ERECTED AT KELLOGG, IDAHO

kinds of conditions that the builders have been slow to depart materially from a design that has proved itself so satisfactory. Changes of small details have been made wherever a real improvement could be demonstrated, but in general the effect has been to standardize the parts and not to change for the mere sake of changing. The straight-line type (Type E) with pallets 12 in. wide and an effective hearth area 12x261 in. (77 sq.ft.) has been adhered to. This is rated at 100 tons per day, but is actually treating over 200 tons per day in some cases. The expense for repairs has probably not averaged much over 5c. per ton, and yet no machines of the present type can be said to have been worn out, though they have been in constant operation for over six years. A number of them have been through fires which they survived with little damage.

One important mechanical improvement has been the adoption of a heavily built double-inlet fan in place of the single-inlet fan previously used. The present standard type of fan has the same-sized impeller wheel as before (66 in.) with a center plate, or septum, extending from the hub to the periphery, each half being supplied by a separate gas inlet through the fan casing. The impeller is carried on a heavy shaft with outboard bearings and is preferably driven by direct-connected electric motor. The fan casing is made sectional, so that a portion of the casing is removable to facilitate the proper adjustment of the impeller in erection. This improved fan has contributed much to the increased capacity of the sintering unit and has shown itself distinctly economical in power. A separate fan should be provided for each machine.

The most striking feature in present practice is the great increase in tonnage that the machines have shown recently as the result of the growing understanding by metallurgists of the far-reaching effect of a proper regulation of the minutiae of the process, and a better knowledge of how to control the governing factors, as for instance, by regulating the composition of the mixtures, the percentage of moisture, the volume and degree of suction, the permeability as affected by the unformity of pressure in the ore mass as deposited on the grates of the machine, the segregation of the coarse and fine particles and finally the proper degree of ignition.

In several plants the machines are showing capacities as high as 150 and 200 tons per day, producing a satisfactory quality of sinter in one operation. As the tonnage is pushed above this figure, the quality of the product is apt to deteriorate and a certain amount of fines result, which strictly speaking, ought to be screened out and sent back to the machines.

OVERBURDENING THE SINTERING MACHINES INTENTIONALLY

This procedure is deliberately followed in several large plants, where the machines are run at a capacity of about 250 tons per day, of which about 25 to 50 tons will be fines to be screened out and sent back to the charging bins, leaving a clean product of about 200 tons per machine per day of sinter for the blast furnaces. The fines consist of partly roasted ore and small pieces of friable sinter that desintegrates when the product is discharged. The favorable effect of a certain proportion of crushed sinter returned to a sintering charge has long been noted, and it has been frequently observed that instead of displacing other material, it will not only carry itself, but actually increase the capacity of the machine for new material.

Referring again to the so-called "double roasting" in which D. & L. machines are used for preroasting a charge relatively high in sulphur, a small amount of sinter will probably be produced in the first operation, which must be removed or crushed to small size before the preroasted product is charged back to the final sintering operation on another set of D. & L. machines, as this apparatus is peculiarly sensitive to the physical character of the material fed to it, and good results cannot be obtained if large lumps are mixed in with the otherwise fine charge. H. & H. pots are not so easily affected by coarse material in the mixture, and therefore it has been found convenient in those plants that are already equipped with H. & H. pots to use them for the finishing roast after having performed the first roast on the D. & L. machine. In the end nothing is saved by avoiding the intermediate crushing; because the huge cakes of H. & H. product require crushing before the material can be sent to the smelting furnaces, while the D. & L. sinter does not require crushing. As a mere matter of handling, the H. & H. plant equipped with overhead crane can meet this service most satisfactorily, as the D. & L. machine can discharge the preroasted ore directly into a pot bowl, which can then be moved by the crane to the blowing stand. Several plants are now using their H. & H. pots to good advantage in this way. Another large lead plant, which has used the D. & L. process for six years, is making extensive alterations to permit of carrying on both preroasting and finishing on the D. & L. machines, using a battery of 12 units.

It will be observed that there is a similarity in the two plans just described, the essential difference being based on the proportion of finished sinter that it is aimed to make in the first operation. The double roast will yield a product with residual sulphur as low as 2.5%, with most of it as sulphate, so that but little matte is made. In the single operation, 4% sulphur is about as low as can be reasonably expected in the sinter.

THE HANDLING OF THE MATERIALS

The lead smelter has never been able to take full advantage of the opportunities for economical handling made possible by the general introduction of hopper-bottomed railroad cars and locomotive cranes and grab buckets for handling materials in large bulk. The reason is that he is always confronted by the necessity of sampling his material with great care, as the entire commercial side of the business depends upon extremely accurate sampling of ores purchased and of metals sold. In spite of this handicap it has been found possible in many plants to effect considerable economy in the handling and sampling of ores on arrival at the plant by the adoption of such of these conveniences as could be made to fit the special conditions. For ores that are to be smelted direct, it is generally considered desirable to limit crushing to what is necessary for taking an accurate sample. Special unloading tracks, where the cars can be discharged by shoveling or dumping into hoppers underneath the track, have been found satisfactory and economical, whence the ore can be transported by belt to the sampling mill or other department of the plant. The Vezin sampler still holds its place as the most popular automatic sampler for sampling work.

For storing the ore previous to treatment, bins are generally used, supplemented sometimes by stockpiles from which the ore can be reclaimed by steam shovel or grab bucket with locomotive crane, loaded into cars and delivered to the bin nearer the smelting furnace. The making of huge ore beds with carefully stratified layers of different materials, as was once standard practice in the lead-smelting business, is not so frequent now, though small lots have to be bedded. The very ingenious ore-bedding system devised by Messiter was originally planned to meet the peculiarly exacting requirements of the lead smelter, but it has never been adopted in all its details at any plant smelting lead ores, though it has been extensively used in copper-smelting practice since the first one was built by me at Cananea in 1906. There has been a distinct tendency in the last few years to carry smaller ore stocks than was formerly the case, and moreover, a large proportion of the blast-furnace tonnage is now furnished by the roasting department, and some excellent devices have been developed for economically making up the roaster charge from separate ingredient bins. Hence there has not been so much need for a bedding system. One of these methods is to have a weighing hopper under each bin from which a larry car operated by an electric motor can take its charge when desired. Another way is to have a scale on the larry car itself and take from each bin the exact amount of each ingredient required. This is the basis of the admirable plan devised by L. D. Anderson, superintendent of the United States Smelting Co., Midvale, Utah, and which not only seems to meet most of the theoretical requirements of correct feeding, but combines a number of clever mechanical economies.[3]

Still another method, adapted especially for fine material, is that developed by Dwight & Lloyd in connection with their sintering plants. This improvement, which was worked out by Henry J. Stehli, of the Dwight & Lloyd staff, consists in having each ingredient bin provided with a slowly moving self-feeder, the belt forming the bottom of the bin and dragging out through an adjustable opening in the front of the bin a predetermined volume of material, which is discharged upon a collecting belt that carries it to the proper place for the subsequent operation. The discharge from these belt feeders can be accurately calibrated for each material; by weighing the actual amount delivered in a given time and by carefully adjusting the front gate, it is possible to get exactly the right amount required per minute of each ingredient, which is then delivered in stratified form on the collecting belt. Thus a minimum mixing is needed to deliver a thoroughly average and intimately mixed stream of ore to the next succeeding operation. Fig. 4 shows a view of a battery of storage bins equipped with this style of belt feeder, as installed in connection with the Dwight & Lloyd plant recently built at the Northport smelting works. The bins thus equipped represent a total storage capacity of 3,000 tons and can turn out easily 600 tons per day of accurately proportioned mixture for the sintering plant. One man per shift is all the labor required. As practically three-quarters of the blast-furnace charge at this plant consists of D. & L. sinter, it will be evident that the labor of weighing, mixing and handling the ingredients of the charge as ordinarily practiced has been largely eliminated by this plan. There are several successful installations of this kind that have been in steady operation for a number of years, so that the plan may be considered as having been thoroughly proved out.

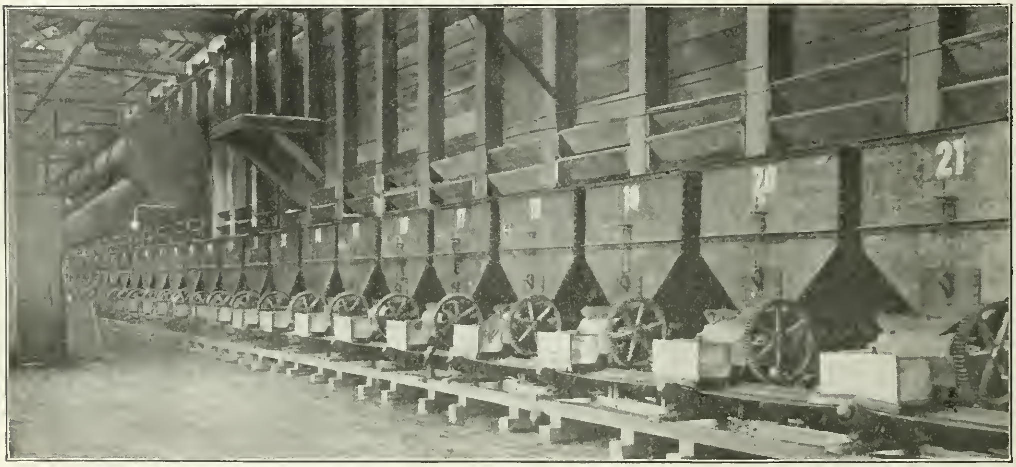


FIG. 4. AUTOMATIC SYSTEM OF PROPORTIONING THE CHARGE FOR D. & L. SINTERING PLANT AT NORTHPORT, WASH.

There seems to be no good reason why the same plan of continuous feeding cannot be used for making up charges for the blast furnace and delivering by conveyor directly to the furnace, substituting, of course, for the belt feeders, which are primarily adapted to fine material, a device capable of delivering a regular measured supply of lumpy material. The operations of the blast furnace would doubtless be favorably affected by the absolute uniformity of conditions that could thus be maintained.

As many plants are now making up almost the entire blast-furnace charge on the sintering machines, it would seem to be logical to go a little further and sinter all the charge except perhaps the limestone, and let the sintering machines deliver directly to a properly designed continuous-charging device on the furnaces. Some precautions would have to be observed, of course, to maintain the fundamental requirements of each apparatus, but there appears to be no reason why this cannot be worked out satisfactorily.

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[3] L. D. Anderson, "Eng. and Min. Journ.," May 20, 1916.

General Tendencies in Lead-Smelting Practice

Lead ores may be smelted with two distinct objects in view: (1) To use the lead as a collector of gold and silver in the ore charge, the metals to be afterward separated by the refining process; and (2) to extract the lead, primarily for its own sake. Most of the Western lead-smelting plants follow the first plan and smelt charges carrying 12 to 15% lead, making a relatively large proportion of slag. The Missouri plants start with a rich galena concentrate and aim to smelt this with a minimum amount of fluxes—just enough in fact, to take care of the residual gangue in the concentrates. They carry a percentage of lead on the charge as high as 45% and make the smallest possible quantity of slag—sometimes as low as 900 lb. per ton of original concentrates. No ores other than lead are available, and therefore the fluxes are barren of values, silica sand, oxide of iron and limestone being usually most available.

In the Northwest, where Idaho lead ore is comparatively plentiful, there has been a tendency recently to approach the Missouri practice and smelt principally for the sake of producing lead. This is the case at East Helena, Northport and, presumably, will be at the new Bunker Hill smelting works.

When one comes to regard the situation critically, one is forced to admit that it is a somewhat irrational procedure to spend money on expensive concentrating plants to remove the natural gangue of a lead ore and then mix the rich lead concentrates so obtained with other earthy substances for the sake of reducing them to metal. It seems as though the rich PbS concentrate should be regarded as a chemical substance rather than an ore, and logically there ought to be some better way to treat it than to use the same method that is especially adapted to the treatment of large tonnages of low-grade ore. I believe that such a method will be found in due time, but that it is not yet in sight.

Scotch Hearth Revived by Newnam's Development

The Scotch hearth has been largely used to treat the rich lead concentrates of Missouri, and at one time the Flintshire furnaces were also used. The unsanitary features of these processes, the large production of lead fumes difficult to recover and re-treat, and the fact that the "gray slags" from the hearths have to be put through the blast furnace with sufficient amount of flux to make the same amount of slag that would have been made in a direct smelting of the original concentrates have militated against the hearths. The dangerous nature of the occupation, the severity of the labor while exposed to heat and poisonous lead fumes, and the impossibility of getting men to stand it at all during the hottest months of summer did much to throw the decision in favor of the blast furnace. The Scotch hearth drove out the Flintshire furnace, and when the combination of sintering and blast furnace had almost driven out the Scotch hearth, a new element entered the problem in the recent development, at the Collinsville, Ill., plant of the St. Louis Smelting and Refining Co., of a modified Scotch hearth devised by W. E. Newnam[4] in which hand labor is largely dispensed with and much of the danger of lead poisoning eliminated. It is twice as long as the ordinary Scotch hearth and has nearly three times the capacity, using two men per shift. The device has already given a good account of itself and promises to save the Scotch hearth from extinction. Whether it can compete in the long run with blast-furnace smelting remains to be proved. It can probably do cheaper work than the blast furnace on concentrates carrying 70% Pb or over. A certain proportion of the output of the Missouri mills will come under this category and be amenable to treatment by the Newnam hearth, but the bulk of the tonnage is below 65% Pb and must go to the blast furnaces.

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The Empire Zinc Mill at Hanover, N. M.

The Hanover mine is in Grant County, New Mexico, just over the ridge from the Chino steam-shovel pits at Santa Rita. Hanover lies at an altitude of 6,200 ft. The mines were first opened up by the Mineral Point Zinc Co. under the supervision of W. N. Swancoat in the early 90's. A large tonnage of high-grade zinc carbonate and some sulphide was mined and shipped. The property was then idle for several years. In 1908 work was again started, and production has been fairly continuous to the present time.

HANOVER MILL OF EMPIRE ZINC CO.

The mineralized area consists of sedimentary series, largely limestones, of Carboniferous age, intruded by a large mass of granodiorite porphyry. This intrusion was followed by intense metamorphism resulting in the formation of such characteristic contact minerals as garnet, epidote, magnetite, hedenbergite, etc. At the same time the zinc sulphide was formed with pyrite and other sulphide minerals. In all cases the ore occurs near the contact. Part of the zinc ore was later oxidized to carbonate, which has been the principal commercial ore to the present time.

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[4] "The Newnam Hearth," by W. E. Newnam, Bull. A. I. M. E., October, 1915.

Oxidized zinc ores, mainly carbonates, have been mined from numerous openings along the contact, but the main workings are in the vicinity of the Nason Tunnel, approximately one-quarter of a mile northwest of the mill on the Buck Horn Gulch. Sulphide ores are being mined here also. In the Thunderbolt shaft, about one mile east of the mill, a considerable tonnage of sulphide ore has also been developed.

The mill, designed by L. G. Rowand, was started in June, 1916. It has a crushing capacity of 300 tons and a separating capacity of 100 tons per 24-hr. day. The ore is a hard, dense sulphide with contact rock and limestone carrying sphalerite, pyrite, galena and other sulphides in small amounts. Practically all the minerals are more or less magnetic, with the exception of the limestone and galena. The feed is closely sized, giving 8 sizes between 10-mesh and 150-mesh. Practically all material through 150-mesh is removed by the dust separator.

AVERAGE MILL RESULTS ON ROWAND WETHERILL MAGNETIC SEPARATORS

	% of Feed	Approximate Assays			
		Zn	Pb	Fe	Ins.
Feed	100	18	0.2	6	39
Pole 1, 2 c.o., 3 c.o.	44	5	tr.	8	51
Pole 2 and 3 (part)	9	10	0.1	5	46
Pole 3 (part) and 4, concentrate	24	40	0.1	..	..
Pole 5 and 6, concentrate	6	51	0.1	..	..
Tails	4	10	12	16	23
Dust	11	20	0.1	4	34
Loss	2	..	...	..	..

Certain of the products are being stored for retreatment. Average recovery of zinc in concentrate, 67%.

Separator details: Speed of belt, 50 ft. per min.; speed of take-off belts varies from 940 ft. per min. on the highly magnetic material to 310 ft. on the lowly magnetic; power required for mill, about 110 hp.; power (d.c.) required for magnets, about 40 h.p.

Power is generated by a 250 h.p. Snow internal-combustion oil engine, using crude oil of 28° to 30° gravity. Consumption of fuel oil averages about ½ lb. per hp.-hr. A.-c. and d.-c. generators, each rated at 75 kw., are driven by the oil engine and furnish the operative power. The power plant is a delight—cool, clean and quiet; no pulsations or explosions, no dirty coal or smoky boilers.

The property is in charge of C. T. Brown, district manager and C. A. Schmidt, his assistant. K. A. Strand is superintendent.

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Reclaiming Junk Metal

In a paper presented at the annual meeting of the American Institute of Metals[1], the handling of waste at the Hawthorne Works of the Western Electric Co. is described. The monthly averages of scrap metal are: Brass, 100 tons; copper, 180 tons (125 from cable, rubber and insulating shops); german silver, 17.5 tons; iron and steel, 89 tons; solder skimmings, 4 tons; lead, 833 tons.

Sheet metal from which special forms have been punched is compressed into bales with other large scrap pieces. Small chips and metal shavings are freed from dust and dirt by a mechanical sifter, and the iron and steel separated from brass and the like by a magnetic separator similar to the Ball-Norton type.

Junked cable is heated in gas ovens until the lead is melted and the insulation burned off. The lead is run into a furnace, which separates the ash and dross from it by gravity, and then cast into pigs for sale to refiners. The copper wire remaining in the ovens is compressed into brick form by means of a hydraulic press.

Inspiration Operations in August, 1916

The ore at Inspiration occurs as disseminated chalcocite in silicified schist and granite porphyry, approximately 90% being in schist. The orebody of which the Inspiration holdings are a part extends from its eastern limits in Miami Co.'s ground to its western limits in the Inspiration-Live Oak ground, a distance of 9,700 ft. The ore is continuous for this distance, except where the Keystone ore is parted from the Inspiration ore for a horizontal distance of 1,100 ft., owing to the movement along the incline of the Bulldog Fault. The ore varies in width in the Inspiration ground from 200 to 1,600 ft. and has an average vertical dimension of approximately 150 ft.

Previous to the beginning of stoping in July, 1915, the ore had been developed by 29⅓ mi. of churn-drill holes and opened up by underground work as follows: 1.2 mi. shafts; 7.7 mi. haulageways; 21.1 mi. ordinary-sized drifts; 21.2 mi. main raises; 2.5 mi. finger raises; making a total of 53.7 mi.

The mining system consists of undercutting and thus caving the ore, which is then drawn off through a system of inclined raises to the haulageways below. It is estimated that for each 1,000 tons of ore mined there will have to be driven 13 ft. of ordinary-sized drift, 20 ft. of main raises and 1.4 ft. of haulageways, making a charge for this account of approximately $0.20 per ton of ore mined.

MILL STATISTICS, AUGUST, 1916

Dry tons milled		498,270
Tons per day		16,073
Per cent. copper in feed, total		1.564
Per cent. copper in feed, oxidized		0.392
Per cent. copper in feed, sulphide		1.172
Per cent. copper in concentrates		30.22
Per cent. solubles in concentrates		31.30
Per cent. moisture in filtered concentrates		17.67
Per cent. copper in tailings, total		0.417
Per cent. copper in tailings, oxidized		0.325
Per cent. copper in tailings, sulphide		0.092
Per cent. copper recovered		74.36
Per cent. copper recovered, oxides		20.00
Per cent. copper recovered, sulphides		92.44
Kw.-hr. per ton milled (includes coarse crushing, but does not include pumping new water		16.07
Water used per ton ore, total gal.		1,145
Water used per ton ore:		
Reclaimed in tanks at foot of mill	249	
Reclaimed from ponds	514	
New water from Kiser pump station	382	
	1,145	
Average tonnage ore ground per Marcy mill in 24 hr.		475
Flotation agents, lb. per ton ore (coal tar 1.12 lb., oils 0.19 lb.)		1.31

For the five-months' period ending with August, there was mined 18.1 tons for each shift's work above and

DETAILS OF SCREEN ANALYSIS

	Feed to Ball Mills	Producer
On 1.5-in.	17.7	....
On 1-in.	16.5	....
On ⅜-in.	24.7	....
On 3-mesh	7.3	....
On 6-mesh	7.7	....
On 8-mesh	2.2	....
On 14-mesh	4.8	....
On 28-mesh	3.6	....
On 48-mesh	2.9	2.9
On 65-mesh	....	7.9
On 100-mesh	2.3	12.6
On 150-mesh	....	12.6
On 200-mesh	1.5	5.8
Through 200-mesh	8.8	58.2
	100.0	100.0

The kw.-hr. required per ton ore in coarse grinding, conveying and sampling	0.409
The number of kw.-hr. required per ton ore in fine grinding in Marcy ball mills, divided into the following: Power for conveyor, Dorr classifier and cranes, 0.18; power for Marcy ball mills, 9.68	9.86
Total power for crushing and fine grinding, kw.-hr.	10,269
Steel ball (chrome) consumption per ton ore ground, lb.	1.79
Average tonnage per ball mill for 24 hr. in August	425
The per cent. of product stopping on 48-mesh screen	3.1

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[1] "How a Large Manufacturing Company Disposes of Its Old Metal," by J. H. Bateman, Sept. 11-15, 1916.

below surface properly chargeable to the mining department. The statistics for milling operation in August are given in the accompanying table.

The mine ore is crushed first in gyratory crushers having a maximum opening for discharge of 3¼ in. This product passes through Symons disk grinders having a discharge opening of 1½ in. This product is finished in Marcy ball mills at the concentrator as per accompanying table.

In the flotation department there are four sections equipped with Callow machines, 13 with Inspiration machines and one with Minerals Separation machine—Hebbard type (injects air under stirring paddles).

FLOTATION POWER REQUIREMENTS

Power Used:	Pneumatic Flotation Machines	Minerals Separation Machines	Total
Returning cleaner machine tails to primary flotation machine	118,240	7,000	......
For crane over flotation floor	450	70	......
For driving turbo-blowers and Root blowers	1,311,800	10,980	......
For pump returning slime overflow drag-belt tanks for re-flotation	13,440	.....	......
For motors driving Minerals Separation Machines	......	114,690	......
	1,443,930	132,740	1,576,670
Tons ore treated	472,242	26,028	498,270
Kw.-hr. used per ton ore in flotation	3.06	5.1	3.16

The flotation oil consumption per ton of ore treated is shown by the following table:

OIL CONSUMPTION

Coal tar	1.1216
Coal tar creosote	0.1333
Wood creosote (Cleveland Cliffs)	0.0023
No. 80 oil (Pensacola)	0.0058
No. 6-11 oil (Oregon)	0.0204
No. 880 oil (Yaryan)	0.0072
No. 9 oil (General Naval)	0.0205
	1.3111

Power used in August was as follows:

AUGUST POWER REQUIREMENTS

	Kw.-Hr.
For air compressors	32,800
For vacuum pumps	48,400
For Dorr thickeners	4,270
For elevators	13,220
For filters	3,510
For concentrate conveyor	6,910
Total	109,110

A total of 19,106 tons concentrates were filtered at a power cost of 5.71 kw.-hr. per ton.

POWER CONSUMPTION IN AUGUST, 1916

		Kw.-Hr.	Kw.-Hr. per Ton
Mining—Tons mined, 493,900:			
Power for machine drills and vent. 100 lb. air		651,300	1.310
Power for air haulage, 1,000 lb. air		185,790*	0.376
Power for ore hoisting		358,320	0.725
Power for lights		9,300	0.019
Power for miscellaneous mine department uses		59,760	0.121
		1,264,470	2.56
Coarse crushing, conveying and sampling, tons treated 493,900		201,000	0.409
Concentrator—fine crushing, tons treated, 498,270		4,914,980	9.86
Flotation		1,576,670	3.16
Tables:			
Power for tables—Kw.-hr., 182,760; tons treated, 245,790; kw.-hr. per ton, 0.74; power for drag belt classifiers separating sands for concentration—Kw.-hr., 20,430; tons treated, 469,274; kw.-hr. per ton, 0.04		203,190	0.41
Filters—Concentrates, kw.-hr. per ton, 5.71		109,110	0.22
Tailings disposal—Motors for Dorr dewatering tanks		4,980	0.01
Water reclamation — Repumping water from tailings ponds		941,365	1.89
Sundry power—Machine and carpenter shops, incline hoists, etc.		30,950	0.06
Lights		25,170	0.05
Pumping new water	655,485		
Lights	1,320		
		656,805	1.32
Crushing rock for concrete		1,000	...
Lights for offices, dormitory, dwellings, etc.		1,410	...
Total kw.-hr.		9,931,100	19.95

*Average mine haul, 0.475 mile; kw.-hr. per ton-mile, 0.796.

The flotation concentrates average 38.11%. The air consumption is approximately 75,000 cu.ft. In filtering the concentrates the stream of water carrying concentrates from the mill goes first to Dorr thickening tanks and then to six Oliver filters, 11 ft. 6 in. diam., 12 ft. long. The stream to the Dorr tanks contains 90% water; the feed from tanks to filters contains 12% water; while the filtered concentrates contain 17.67% water. The settling of concentrates is done in five 60-ft. and three 80-ft. diam. tanks having a total area of 29,217 sq.ft.

The power required for mining was 2.56 kw.-hr. per ton; for milling, 16.07 kw.-hr. per ton, and for pumping new water, 1.32 kw.-hr. per ton, making a total of 19.95 kw.-hr. per ton. The average power requirement in August was 0.83 kw. per ton of daily capacity.

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Efficiency of Rope Drives

By William Hirst

To one who has not had experience with rope drives it may be difficult to understand why a single strand of rope will show a higher efficiency than two or more, says *Power*. The natural inference is that if one rope has an efficiency of 97 per cent., a drive of ten should have the same.

To have each individual rope pull exactly its share of the load each groove must be exactly the same pitch-diameter and shape. Furthermore, the ropes themselves must be of the same diameter and tension when running, so that each will rest at the same depth in the groove. If this condition could be realized, then the same efficiency could be attained with a number of ropes side by side as with one, but this degree of perfection is never realized; hence the actual efficiency depends largely if not altogether on the degree of accuracy in the sheaves and uniformity in the size and tension of the ropes. No matter how small the difference in the pitch diameter may be, the rope or the groove having the greatest diameter in the driving sheave, or the one having the smallest in the driven sheave, will pull the hardest. Assuming this difference to be 0.01 in., it will be 0.0314 in the circumference and in 100 revolutions the rope in one of these grooves would have drawn ahead of the others more than 3 in. and taken more than its share of the load; therefore, this rope or some other must slip. In most rope drives some of the ropes are slack on the pulling side and they can be heard creeping in the grooves. This accounts for the relatively low efficiency of the rope drive.

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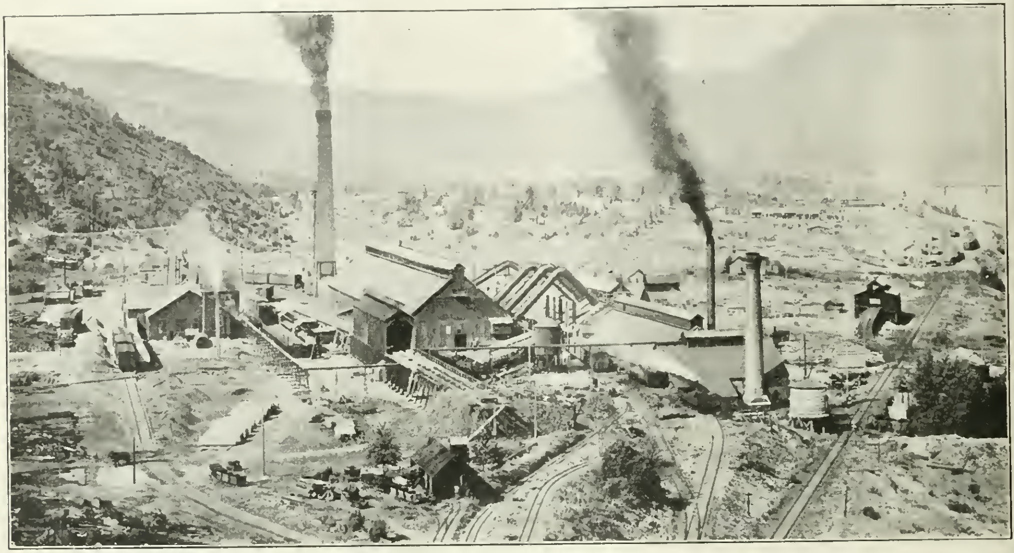
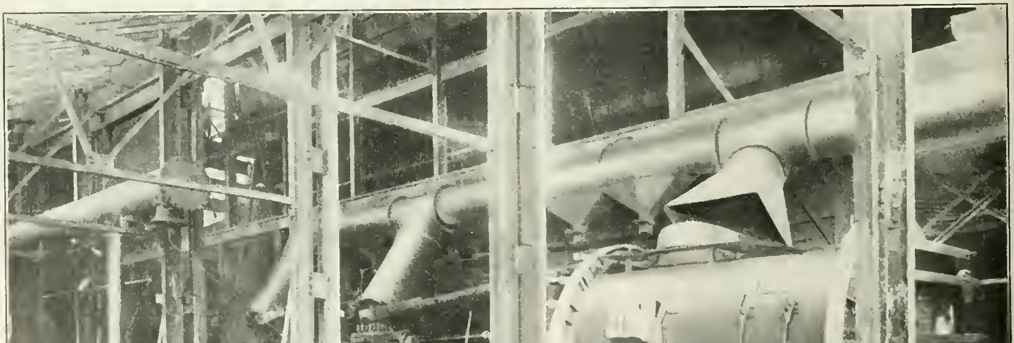
Refractory Vessels from Rare Earths

A recent German patent (287,554, Nov. 29, 1913), according to "Chemical Abstracts," deals with the manufacture of refractory shapes from zirconium dioxide, thorium dioxide, or both, or with various of the rare earths. The mixture is subjected to high mechanical pressure. After relieving the pressure the product is finely ground and then stirred up with water or an alkaline solution, after which the liquid mass is poured in the usual manner into the desired forms, dried and burned. The molded article is readily removable from the form and does not show cracks either on drying or burning. The vessels are claimed to be tight and sufficiently strong to resist fracture when thrown upon a hard floor.

Photographs from the Field

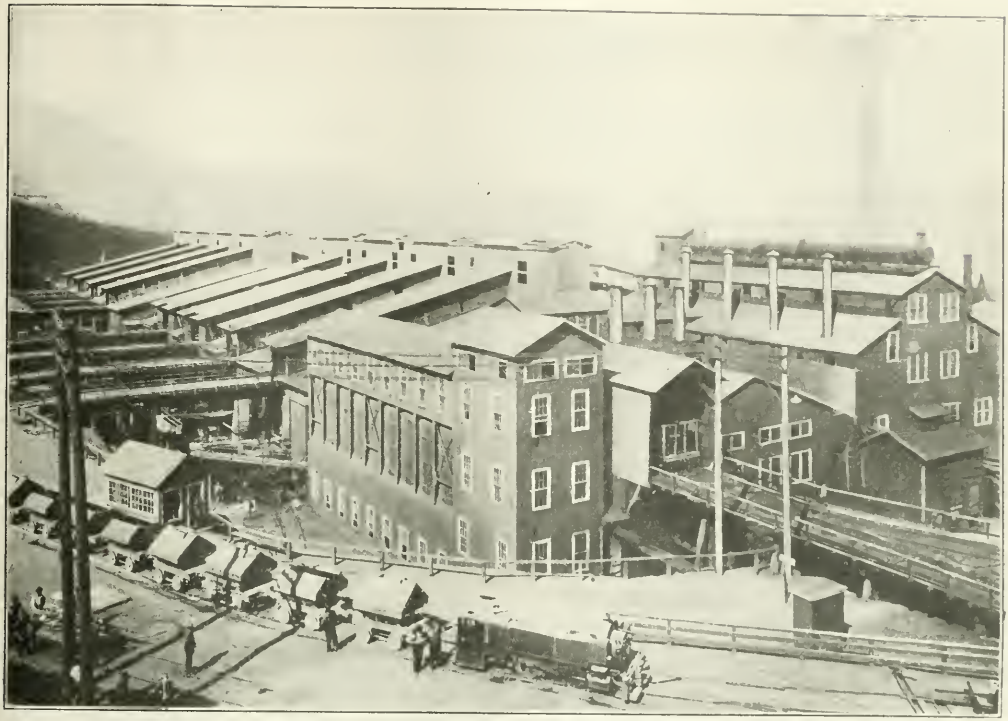


NORTHPORT SMELTING AND REFINING CO.'S PLANT AT NORTHPORT, WASH.

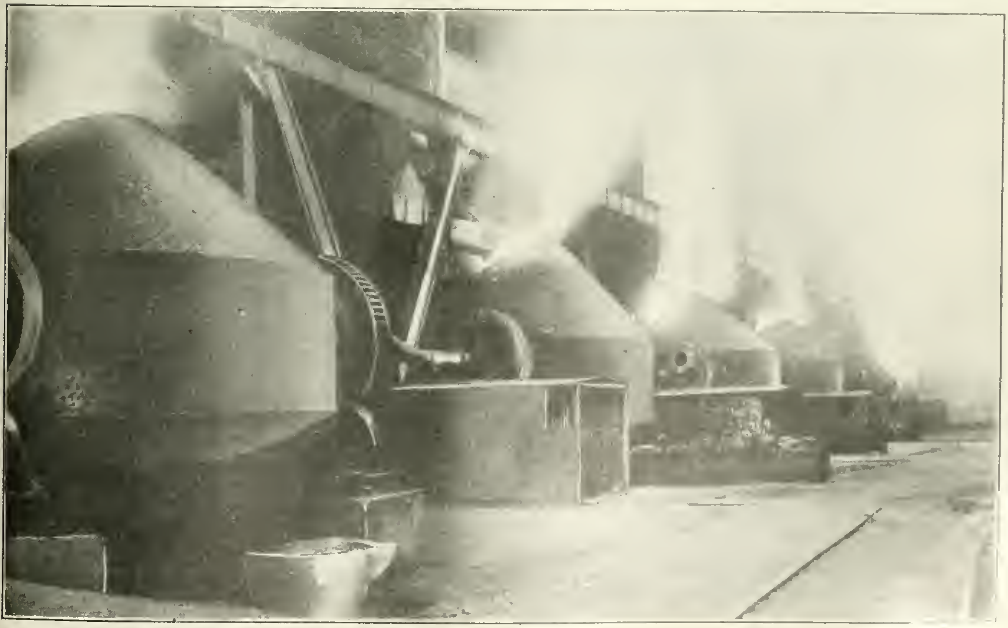


A SHORT PIERCE-SMITH BASIC-LINED COPPER-CONVERTER IN A CHILEAN SMELTERY

The above shell, 10 ft. diam. by 14 ft. 7 in. long, is in the Naltagua plant in central Chile. A number of these small units have been installed in foreign countries but none is in use in North America where the standard size is 10x25 ft., though shells 37 ft. 2 in. in length have been used.



REVERBERATORY-SMELTING AND COAL-PULVERIZING DEPARTMENTS AT ANACONDA, MONT.



THE 20-FT. GREAT FALLS TYPE CONVERTERS AT THE WASHOE REDUCTION WORKS, ANACONDA, MONT.

Editorials

This Smelting Number

This number is especially for smelters, not mill-men or metallurgists in general. Therefore the contributions do not include anything pertaining to hydrometallurgy except for some incidental references. The scope has been limited so closely to the special field that not even is the important work of the refiners included.

With regard to the work of the smelters, however, the view has been broad, taking in copper smelting, lead smelting, zinc smelting and quicksilver smelting. All these subjects are treated by authoritative hands. Indeed, the collection of contributions in this number is noteworthy. The names of Dwight, Laist, Landers, Capron, Kuzell and Magnus speak for themselves. The articles by Mr. Laist reviewing improvements at Anaconda, which name is becoming a synonym for leadership in the art of copper smelting, and by Mr. Dwight on lead smelting are especially remarkable and valuable.

In the subject of zinc smelting are described two new plants that are the last words in American practice—Donora, exemplifying a remarkable plant in which coal is the fuel, and the works at Van Buren, Ark., of the Arkansas Zinc and Smelting Co., which is the latest of constructions for natural-gas firing. The former was designed by Nicholas L. Heinz, the latter by George E. Nicholson, both of them experienced and successful zinc-smelting builders. In both cases extraordinary records in speed of construction were made.

Both Mr. Dwight and Mr. Ingalls in their contributions have been uncommonly free in their expressions of opinion. This was the result of a conspiracy incited by Dr. Ricketts, which however, fell down through his own delinquency. Ricketts said, not long ago:

"Let's have some articles in which we do not dwell too much on realities, but speculate on some of the things that we think ought to be and may be. Never mind if we are wrong in a lot of our ideas, we can afford to be, and if we can get some of the younger men working on new lines, that will be worth while."

"That's a good idea, Ricketts," we said. "Start it, yourself."

"All right, I will," said he. But he had to go to Arizona to run the very successful meeting of the American Institute of Mining Engineers and did not come to time, leaving his fellow conspirators a solitary pair. So all we could do was to publish his picture, but we feel sure that our readers will hear from Dr. Ricketts later.

⁂

Tuyeres for Copper and Lead Blast Furnaces

Attention is directed to the two pages, 640 and 641, in this issue of the *Journal*, presenting drawings of the leading types of tuyere connections used in important North American smelting works. Occasionally there have been tuyere drawings published, but we do not recall any adequate and convenient collection presenting this detail of the blast-furnace equipment. Hence we hope that metallurgists and designers will find the present collection—made possible through the coöperation of the operating officials of the leading smelting works—a convenient source of reference when the question of tuyere design is to be decided.

While smelting practice is in general respects well standardized in this country, both as to equipment and practice, there is probably no single feature of smelting equipment in which more variety of design exists than in the tuyere connections for copper and lead blast furnaces. This is the more remarkable because the requirements of the service are practically identical. In other features of the blast furnace there exist divergencies in different districts in such matters as bosh, feeding arrangement, etc., but these are usually inherent upon different physical conditions of the ore, or of plant arrangement, whereas the tuyeres and tuyere boxes perform practically the same service at each furnace and conditions of maintenance are nearly identical.

It is proper, however, to regard the copper and lead furnaces in two different classes; certain differences in practice make it necessary to take greater precaution in lead operations against explosion of furnace gases, after back-drafting; also in lead practice the tuyeres are punched only as specially needed. In copper practice it has been customary at most plants to punch tuyeres regularly on each shift, though of late years there has been a tendency to punch only when needed. In the main the conditions at the copper works have varied only in the frequency of slagging or of punching. These are differences in degree only, but have been responsible at certain plants for the redesigning of tuyere boxes, particularly where frequent slagging involved the digging out of tuyeres and increased labor cost, or reduced attention on the part of the crew to other details of the furnace operation. Air leakage was an important matter that only lately received efficient attention.

Different plants have to a certain extent different problems, but the variety that has developed in tuyere design was largely the result of individual action at the different works when furnaces were being rebuilt or when leaking or slagging tuyeres accelerated the redesigning of this feature alone. Generally speaking, little attempt was made to take advantage of the improvements made at other works, though one enterprising manufacturer of mining machinery has appreciated the possibilities of an eclectic equipment that would incorporate such of the local improvements as were adapted to general smelting conditions. This is of considerable advantage to the industry, as new smelting works may now start with an improved tuyere instead of beginning with the old-style slightly-cheaper-in-first-cost tuyere that soon leaked air and probably filled with slag on the first day of service—and continued its inefficient career until the metallurgist awakened to the expense of compressed air and misdirected labor.

Many plants have simply pursued a policy of *laissez faire* in regard to the use of their old-style "expensive" tuyere connections; the metallurgist has been busy with larger problems, and perhaps if he had asked for more efficient tuyere boxes, he would have been refused so long as the original ones were not all broken. Another cause for the survival of the stereotyped tuyere box was that at some of the larger works, all construction was in the hands of the engineering department, the headquarters of which were often away from the plant; or it might have been that the engineering and operating departments were not in complete harmony. At any rate there was no coöperation between the two departments; when an addition was made, the engineers, not being familiar with the operating difficulties, often designed "good castings," but did not improve the operation of the new section of the plant. This condition happily has to a great extent disappeared, though it is still to be guarded against in some large organizations.

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Minerals Separation vs. Miami

A decision in the case of Minerals Separation, Ltd., vs. Miami Copper Co. was rendered by Judge Bradford of the United States District Court for Delaware, at Wilmington, Sept. 29, 1916. Before considering this decision it will be helpful to explain the position of the court that makes it.

The first case involving the flotation patents in the United States was brought by Minerals Separation vs. Hyde in the United States District Court for Montana, and a decision in favor of the plaintiff was rendered by Judge Bourquin at Butte. Hyde appealed, and from the United States Circuit Court of Appeals, sitting in San Francisco, obtained the famous reversal of Judge Bourquin's opinion and the new judgment that the Minerals Separation patents were quite invalid.

Minerals Separation being determined to get the case before the United States Supreme Court, which ordinarily does not hear patent cases at all, had two courses open to it; namely, to take the chance of reaching the Supreme Court through a writ of *a certiorari* or to institute a new suit in another district with the hope of reaching the Supreme Court through conflicting decisions. It took both of them. The Supreme Court granted the writ of *a certiorari,* thus insuring a hearing, but nevertheless Minerals Separation stuck to its suit against Miami in the Delaware district. The decision of Judge Bradford is analogous to that of Judge Bourquin. If the case be now appealed and if another Circuit Court of Appeals upholds Judge Bradford and conflicts with the decision rendered in San Francisco, the case would be bound to go to the Supreme Court.

Judge Bradford, in a lengthy, argumentative decision, upholds the main Minerals Separation patents on points that may be stated simply. In U. S. Patent 835,120, granted Nov. 6, 1906, to Sulman, Kirkpatrick and Ballot, claims 1 and 12 specify the use of "a fraction of one per cent. of oil" and are held to be valid. Claim 9 specifies "a small quantity of oil," which is regarded as so indefinite as to render the claim void. According to this decision anybody using 0.99% of oil would infringe claims 1 and 12; the use of 1.01% would not. Everson, Froment and all the other previous experimenters in this field used more than 1% of oil, and their processes are pronounced uncommercial and nonanticipatory.

This is about as contradictory of the San Francisco decision as anything could be. That decision is not mentioned by Judge Bradford, but everything held by the court there to anticipate the Minerals Separation patents has been distinctly held by him to do no such thing, and practically all the conclusions of the San Francisco court are inferentially to be regarded as erroneous in the opinion of Judge Bradford. His avoidance of any specific reference is to be ascribed to his knowledge that the decision of the San Francisco Court is before the Supreme Court for review. Indeed, that case is probably to be argued during the week commencing Oct. 30.

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The rapid growth of the zinc-smelting industry in Japan has been one of the interesting features of the recent era of high prices. A large tonnage of Australian ore is being taken by Japanese smelters, and there are reports of more smelteries to be erected in Japan. It was not to be expected that the Japanese would be inactive in such a situation as has existed of late.

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We suggest special attention to the article by Mr. Pigott, which appears in this number, for it describes what is really a remarkable change in lead blast-furnace smelting practice during the last two years; namely, the elimination of slag-shell resmelting. This may sound like heresy to many old lead metallurgists who ever since they were born—into metallurgy—have seen slag shells saved, broken and resmelted. The innovation has saved thousands of dollars to the several lead smelters who are practicing it.

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As we forecasted last week, the general sympathy strike in New York proved to be a fiasco. A considerable number of Jewish citizens ceased work, it being a holiday season, and so did a few brewers, whose defection caused no noticeable suffering among the population, but on Monday, Oct. 2, the police reported only 400 of all trades on strike. Monday brought a real trouble, however, in the cutting off of a large part of New York's milk supply by a conspiracy of farmers (!) who carried out their threat to do that thing if they could not get the price they wanted for their product. Verily, we are becoming a lawless people. If things do not suit any organized group, hold up everybody! Is this a result of exempting labor unions and farmers from the Sherman law?

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The American Institute of Mining Engineers has just completed in Arizona the most successful meeting of its history. The scenario was the best there could be. Montana and Utah have great and interesting mining and metallurgical centers, but Arizona has more of them and more diversification. There was, moreover, an old-time Institute flavor in the experiences of traveling from place to place and enjoying repetitions of the kindly hospitality of good men and women who tried to outdo one another. The *Journal* sent two members of its staff—Lieutenant Barbour, who obtained leave of absence from his regiment and Mr. Hall—to represent it at the meeting and report. They have turned in a wealth of material which ought to have gone in this number, but unfortunately this issue had been scheduled three months ago and there could be no deviation from the plan. A full acount of the Institute meeting will be given next week.

PERSONALS

Otis D. Welsch has changed his address to Berlin, Nev., from Tonopah, Nev.

C. Mason Farnham, chief geologist for the Cerro de Pasco Mining Co. is in New York.

J. B. Tyrrell, of Toronto, is making an examination of the Rice Lake gold field, Manitoba.

A. F. Peterson has moved to 435 N. Park, Madison, Wis., from 217 Aurora Loc., Ironwood, Mich.

G. D. Van Arsdale is in Douglas and Bisbee in connection with the Copper Queen leaching and flotation experiments.

August Heckscher, a director of the Eastern Steel Co., is on the board of directors of the Alaska Mines Corporation.

John Seward is examining mining properties in Ontario and Quebec and will return to New York the middle of October.

Albert H. Morrell, formerly assistant engineer of the Central Chile Copper Co., has been recently made mine superintendent.

Montrose L. Lee, formerly with the Uruguayan Geological Survey, has returned to the United States and has gone west on an examination trip.

James Gayley, formerly vice-president of the United States Steel Corporation, is the president of the newly-organized Alaska Mines Corporation.

M. C. H. Little has resigned his position as manager of the St. Anthony mine, Sturgeon Lake, Ont., Canada, having volunteered for Overseas Service.

Homer Neal, formerly with the Braden Copper Co., has recently been appointed engineer in charge of the Central Chile Copper Co. mines in Tambillos.

E. H. Gary, chairman of the United States Steel Corporation, who for several months past has been touring Japan and the Far East, arrived at Seattle, Sept. 23.

Philip Gleason, formerly with the Braden Copper Co., is metallurgical chemist and assistant superintendent of the smelter of the Central Chile Copper Co.

Prof. Charles S. Parsons of the Bureau of Mines sailed for Europe Oct. 5, to make an extensive study abroad preliminary to the establishment of the proposed government nitrate plant.

Norman M. Shand wishes to deny the report, published in the technical press, that he has been appointed assistant general manager of The Sons of Gwalia Mine. in Western Australia.

Prof. Francis Church Lincoln, director of the Mackay School of Mines, University of Nevada, Reno, Nev., has recently returned after spending the summer in mining work in Bolivia and Peru.

H. M. Wolflin, of the Bureau of Mines, is enjoying a vacation at his home in Redlands, Calif. He is expecting to return to Pittsburgh by way of San Francisco, Seattle, Butte, Chicago and Detroit.

J. Volney Lewis has just returned to the East from an extended professional trip through the western mining states, British Columbia, and Alaska, in the interest of a development company.

P. A. Mosman, making one of his semi-occasional tours of inspection of the various A. S. & R. smelting plants, accompanied the A. I. M. E. excursion from El Paso to Douglas, Bisbee, Globe and Miami and then returned to El Paso.

D. W. Brunton, G. H. Clevenger, Walter Douglas, Karl Eilers, Sidney J. Jennings, Seeley W. Mudd, E. P. Mathewson, J. J. Ormsbee, O. C. Ralston, Bradley Stoughton, and **H. H. Thayer** were among those who took the recent trip of the A. I. M. E. to the Southwest for the Arizona meeting.

W. H. Bischoff, superintendent of open-hearth department No. 2 of the Saucon plant of the Bethlehem Steel Co., has resigned to become superintendent of coke ovens, blast furnaces and open hearths for the Dominion Iron and Steel Co., Sydney, Nova Scotia. Mr. Bischoff had been with the Bethlehem company for 24 years.

Charles Camsell, of the Canadian Geological Survey, has returned from an extended tour of investigation in the West and reports discoveries of crude oil on the North Shore of Great Slave Lake. He found drilling for oil in progress at the Thomas well at Peace River chutes and at the McArthur well near the town of Peace River.

OBITUARY

Samuel Powell Stackhouse Ellis, aged 66, died, Sept. 19. in his home, 5716 Rippey St., Philadelphia. He was born in Philadelphia. Aug. 6, 1850, and was educated in Philadelphia High School. In 1870 he went to Johnstown as private secretary to the late D. J. Morrell, of the Cambria Iron Co., and was connected with that company for 19 years as assistant to the general manager, when he resigned to accept the position of sales manager for the Pittsburgh district of the Lorain Steel Co. He was with the Lorain company 23 years. His widow, Mrs. Acsa Frazer Ellis, and four children, Dr. Charles J., Misses Sara F. and Catherine Ellis, and Mrs James H Kennon, survive.

SOCIETIES

National Safety Council will hold its fifth annual meeting at the Hotel Statler, Detroit, Mich., from Oct. 17 to 20 inclusive. Iron and steel foundry sectional meetings will be a feature of this congress.

The American Society of Mechanical Engineers, New York section, will hold a technical session on October 10th at 8.15 p.m., in its rooms at 29 West 39th St. Dr. Charles L. Reese, of the du Pont company will give an illustrated lecture on explosives with special attention to their use for industrial purposes.

NEW PATENTS

United States patent specifications listed below may be obtained from the "Engineering and Mining Journal" at 25c. each. British patents are supplied at 40c. each.

AMALGAMATOR. Erastus B. Bennett, Denver, Colo. (U. S. No. 1,198,408; Sept. 19, 1916.)

ALKALI-METAL COMPOUNDS, Process for the Manufacture of. Edgar Arthur Ashcroft, London, England. (U. S. No. 1,197,329; Sept. 5, 1916.)

ALLOYS—Process of Making Brass and Copper Alloys. Guilliam H. Clamer, Philadelphia, Penn. (U. S. No. 1,198,618; Sept 19, 1916.)

COKE—Process of Making Coke. Henry W. Buhler and Charles J. Emerson, Boston, Mass., assignors of seven-eighths to George D. Haskell, Boston, Mass. (U. S. No. 1,191,943; July 25, 1916.)

CONCENTRATION of Ores. Raymond F. Bacon, Pittsburgh, Penn., assignor to Metals Recovery Co., New York, N. Y. (U. S. No. 1,197,590; Sept. 12, 1916.)

CONVEYOR MECHANISM. Hugh B. Lowden, Denver, Colo., assignor to Colorado Iron Works Co., Denver, Colo. (U. S. No. 1,199,580; Sept. 26, 1916.)

CRUSHER—Vertical Crushing Mill. Thomas Joseph Sturtevant, Wellesley, Mass., assignor to Sturtevant Mill Co. (U. S. No. 1,198,597); Sept. 19, 1916.)

CYANIDING—Process of Extracting Precious Metals from Their Ores. Albert E. Vandercook, Alameda, Calif., assignor of one-half to Leslie B. McMurtry, San Francisco, Calif. (U. S. No. 1,198,086; Sept. 12, 1916.)

DRILL—Pulsator for Pulsatory Tools. Lewis Condict Bayles, Eaton, Penn., assignor to Ingersoll-Rand Co., Jersey City, N. J. (U. S. No. 1,191,757; July 18, 1916.)

ELECTRIC FURNACE. Joseph Lawton Dixon, Detroit, Mich. (U. S. Nos. 1,197,458 and 1,197,459, Sept. 5, 1916; 1,198,625 —Sept. 19, 1916.)

ELECTRICAL FURNACE. August Eimer, New York, N. Y. (U. S. No. 1,197,275; Sept. 5, 1916.)

EXCAVATOR. Walter Ferris, Milwaukee, Wis., assignor to Bucyrus Co., South Milwaukee, Wis. (U. S. No. 1,197,195; Sept. 5, 1916.)

FLOTATION—Apparatus for Separating Oiled Concentrates from the Gangue of Ores. Ralph T. Mishler, Pomona, Calif. (U. S. No. 1,197,843; Sept. 12, 1916.)

FLOTATION—Method of Treating Liquids with Gases. Charles S. Bradley, New York, N. Y. (U. S. No. 1,198,519; Sept. 19, 1916.)

FUEL—PULVERIZED-FUEL BURNER. Wirt S. Quigley, New York, N. Y., assignor to Quigley Furnace and Foundry Co. (U. S. No. 1,191,225; July 18, 1916.)

HOISTING MECHANISM. Harry E. Jenkins, Joplin, Mo., assignor of one-half to George H. Glade, Joplin, Mo. (U. S. No. 1,192,322; July 25, 1916.)

MELTING—Process for the Electric Melting of Metals. Charles Albert Keller, Paris, France. (U. S. No. 1,191,435; July 18, 1916.)

MOLD for Casting Steel Articles. Charles G. Robinson, Pittsburgh, Penn., assignor to Harry E. Sheldon, Pittsburgh, Penn. (U. S. No. 1,191,474; July 18, 1916.)

Editorial Correspondence

SAN FRANCISCO—Sept. 25

A Dividend from Cerro Gordo, California's premier silver-zinc mine, is just announced. The Cerro Gordo Mines Co., operating this old zinc-silver property in Inyo County, has declared a dividend of \$25,000—2½c. per share. The mines were reopened three years ago under lease by L. D. Gordon, who a year ago became one of the principal owners and general manager. In the last year the mine has paid off an indebtedness of \$40,000, expended \$15,000 for improvements, paid \$25,000 on outstanding shares and created a \$50,000 treasury reserve, a total of \$130,000. The company produces silver, copper, lead and gold, in addition to the zinc.

The Labor Strike in Amador County was precipitated without a demand being made upon the employers. The closing down of the mines without any effort to fill the places of the strikers was also an unusual proceeding. After denying that there was any intention of making a demand for increased wages, the union made a formal request for a meeting with the mine owners to discuss a uniform wage scale. This notice was delivered two weeks after the posting of the mine-owners' announcement that the mines would be closed if the demand for increased pay were made. The mine owners failing to reply to the note by Sept. 18, the union then ordered its members to remain away from work on the morning of Sept. 19 assigning as the reason that the mine owners had refused an increase in wages of 25c. per day per man. No demand had been made for the increased pay, but it is supposed that the union considered the announcement of Sept. 2 as being equivalent to a refusal. There are 1,500 mine employees in Amador County. About 1,200 were out on account of this strike. As evidence of the strength of the union and of the controlling element which brought about the strike, there was a mass meeting on Sept. 20 attended by about 500 men. This large attendance really surprised the strike leaders and encouraged them to have a parade next day. The parade formed at Jackson, marched to Sutter Creek, gathering up strikers at that point and then to Amador where others joined in the procession, making a total of about 255. The members of the local union number about 400 and it is believed that about 250 voted for the strike. A noticeable feature of the parade was the absence of Americans, Englishmen and Italians, and the preponderance of Austrians. Of the 11 mines, which signed the announcement of Sept. 2, three were exempted from the strike because they were paying a satisfactory wage scale. These were the Keystone, Original Amador and Consolidated Amador. The wage paid in these three mines was not a permanent and established scale, but a premium for rapid advancement of development and repair work. The strike leaders were anxious also to exempt the Plymouth Consolidated, because of the fear that if that mine, which is controlled by English investors, should close down, it might not be reopened again until the end of the European War. But the Plymouth closed on the day following the closing of other mines and on the next day the miners requested by petition that they be returned to work at the old scale and without recognition of the union, and the Plymouth resumed operation. The Original Amador, despite the fact that no strike was called in that mine, closed two days after the others had closed. The Keystone continued operation and the Consolidated Amador went ahead with its unwatering of the mine and repairing of the shaft. The mines which closed on the morning of Sept. 19 and remained closed are in the order of their situation, traveling north: The Argonaut, Kennedy, South Eureka, Central Eureka, Treasure, Bunker Hill, Fremont, a total of seven and with the Original Amador, of eight that remained closed during the week. It is evident that the strike was brought about by agitation from outside sources and that the majority of the union was in the early period of agitation, opposed to calling a strike, but the agitators worked chiefly among the Austrians and they are reported to have demanded that a strike be called. A peculiar feature of the whole affair is that at least 1,200 miners in the county were not in favor of the strike yet they allowed the remainder to close eight of 11 producing gold mines in the county, which has an annual production of about \$2,000,000.

Later (by telegraph)—Many single miners leaving county. Companies giving men with families work on surface. No stamps dropping. Rumored that engineers will be asked by strikers to stop work.

BUTTE—Sept. 28

Anaconda in the Movies is the next step in its safety-first campaign. According to statement of H. J. Rahelly, of the U. S. Bureau of Mines, who is in Butte on an inspection trip, Anaconda is leading in the "safety-first" propaganda, having probably the largest mine-rescue crew in the world. From now on about 200 men will be prepared for safety work. Mr. Rahelly expects to pronounce 100 men qualified for this work this week. To bring the nature of the work to the knowledge of all employees and of the general public in Butte and to other districts of the country, moving pictures of operations at the Anaconda and Great Falls smelteries, and of demonstrations of first-aid and rescue work are now being made by the company and will be shown at theaters in Butte and in other towns where there are employees of the Anaconda company.

The Rich Strike in the Emma Mine of the Butte Copper and Zinc Co., which is being operated by the Anaconda company, attracted much attention in the district. On the 800 level, 15 ft. of high-grade zinc was cut and is said to be as rich as any zinc ore yet mined in the Butte district. Regular shipments are being made from the Emma to the concentrator at Anaconda but production is being held back by the delay in getting the refinery at Great Falls working to capacity. The Emma is capable of supplying from 800 to 1,000 tons of ore per day. The long crosscut that is being run from the Gagnon mine of the Anaconda company to develop the Emma at a depth of 1,600 ft., has reached a point about 200 ft. distant from the Emma shaft, where a raise will be made to connect with the shaft, now 800 ft. deep. Sinking will be started at the same time that work on the raise is begun.

A 2,000-ft. Developmeat Tunnel is to be driven along the foothills on the east side by the North Butte Mining Co. to prospect its east-side properties. The preliminary work, upon which the engineers have been engaged for some months, was completed a few days ago and a small force of men at once put to work on the tunnel. Machinery is being installed to drive the tunnel about 400 ft. per month and it is expected that the entire work can be completed in five or six months. The portal of the tunnel will be on the south side of the Park Cañon entrance, just east of the Tropic mine of the Anaconda company, and will be driven south, back of the Bullwhacker property and the Montgomery claim of the Butte-Duluth company, the North Butte owning practically all of the mountain back of those properties. The tunnel will open the ground at an average depth of about 600 ft. and is expected to prove or disprove the many theories advanced by engineers and geologists regarding the possibilities of territory lying east of the continental fault, as an ore producer. The finding of orebodies in that district, which could be profitably mined and treated, would mean a great deal to Butte, as it would stimulate the exploitation of numerous other properties in that region which show surface indications as promising as those found on the North Butte holdings. Simultaneously with this new enterprise, the company is carrying on extensive development work in its older claims on Anaconda hill. Sinking at the Granite Mountain shaft has been carried to a depth of 3,710 ft., making the shaft the deepest in the camp. In view of the satisfactory showing on the 3,400 level of the Anaconda's High Ore mine, North Butte is planning to crosscut from the 3,710 station as soon as the latter is completed. On the 2,800 level the crosscut has encountered the Snowball vein now being developed by drifting.

DENVER—Sept. 28

Deep Mining in Cripple Creek District has proved a decided success. The latest big strike at depth being in the Portland mine, where on the 19th level (1,950 ft.) a stope of rich ore has been opened for more than 500 ft. The company's remodeled Independence mill is expected to be ready to begin operation about the first of January with a daily capacity of about 1,250 tons.

New Mining Companies Incorporated in Colorado, since the first of this year, number 350, according to Fred Carroll, commissioner of mines, who estimates that the 1916 output from the state's metal mines will exceed last year's total by 25%. The newly awakened interest in metal mining has been responsible for the revival of numerous old camps that have been practically dormant for a decade or more.

Portland's New Assay Office at Colorado City has been completed, replacing the one destroyed by fire some time ago. This office is said to be one of the most complete plants of its sort in the west. The company is progressing with the construction of its large sampling works at the Independence mine at Victor, although considerable delay has been experienced by labor difficulties in eastern factories that are furnishing equipment.

Vindicator's Flotation Mill which is being erected at Goldfield (Cripple Creek district) is nearly completed and operations will probably begin about the latter part of October with an initial daily capacity of from 350 to 500 tons. The mill occupies the site of the defunct LaBella Power Co.'s plant. Plans are made for gradually enlarging this plant to an ultimate capacity of 1,500 tons daily. The mine dumps of this company are estimated to contain 3,000,000 tons of rock carrying from $2 to $3 per ton in gold which it is proposed to put through this mill, mixing it with fresh low-grade ore from the mine.

MIDAS, NEV.—Sept. 27

Reduced Milling Charges by the Elko Prince mill has brought a more optimistic feeling in the Gold Circle district. Milling rates have been reduced $1 per ton for all grades, and a return of 92% instead of 85% is now made. Paul Ehlers is sending about 80 tons of ore to the mill from the June Bell lease and Noble & Stone have about 30 tons ready for a mill run. A matter of interest is the consolidation of the Missing Link and Rico groups into the Midas Merger Mines Co. Numerous shipments have been made both to the local mills and to the smeltery at Murray, Utah. Leasers have been operating in these properties for some time but it is expected that company work will soon be begun under the direction of Supt. M. J. Paisley.

MORENCI, ARIZ.—Sept. 28

Arizona Copper Co.'s Clay Mine Is Idle at present on account of a fire which started in a working stope Saturday night, Sept. 24, and which has not yet been extinguished. The origin of the fire is unknown, but it is thought it was caused by a burning candle left in contact with timber. The existence of the fire was not known until the shift went on Monday morning at 7:30 o'clock, as the mine was down Sunday and nobody passed through it. The stope is worked by a slicing system, therefore a great lot of old timbers is left in it, and by the time the fire was discovered, it had gained such headway that it was impossible to check it without bulkheading off all the rest of the mine. This is being done as fast as the helmet men both of the Arizona and the Detroit companies are able to do it, and it is thought that within 24 hr. more they will have the stope cut off entirely from the rest of the mine. Normal operations may then be resumed. D. A. Langley, a young mining engineer who was secretary to Peter B. Scotland, general superintendent for the Arizona company, lost his life on Monday in gas on the second level, which is two levels below the fire, it being on and above the adit. Mr. Langley was coming from Metcalf or Coronado on the second-level haulage road, which was not known to be gaseous at that time. The gas from the fire also penetrated the Copper Mountain and the Ryerson mines of the Detroit company in dangerous quantities in some places, but was soon bulkheaded off. The only production interrupted was that of the Clay mine itself and that of the Coronado mine, the latter's ore being ordinarily brought to Morenci via the second-level haulage road mentioned above.

HOUGHTON, MICH.—Sept. 29

Developments in the Osceola Lode in the most southerly extensions of the drifts from the Osceola mine have recently engaged local attention. These extensions run into the La Salle property and the grade of the rock opened is the best ever found in this branch of the Osceola lode. The operations on the La Salle property have been continued, in a limited way, all this year, as they were last year. They were profitable, notwithstanding the comparatively small amount of copper taken out and the low percentage obtained per ton of rock. The rock was stamped at the Franklin mill. But the openings on the La Salle property, have never been looked upon as promising for the future of the mine. The showing of nine pounds per ton is too small to operate profitably excepting under abnormal conditions. However, all of the work done on the La Salle, since the Calumet & Hecla took over the Tecumseh and other property which became part of the La Salle, has been confined to the Kearsarge amygdaloid, which apparently dwindled considerably in content at this point. Last year the old Osceola extended southerly drifts from No. 6 shafts to the La Salle boundary and mined its best rock there. Last week another extension to the boundary was made and the showing was even better. Of course, for the La Salle to operate in this territory means either a working contract with Osceola and a long lateral haulage and nearly a mile hoist afterward or development by new shafts from the La Salle surface, so that no immediate advantage to La Salle is in sight. But the Osceola developments, in this old Osceola lode, are of particular advantage as showing a possible future for La Salle on a lode hitherto considered of questionable merit.

Versatility of the Copper Miner in the Lake Superior district was illustrated when the strike of the railway employees seemed probable. Most of the mines here are served by local railways, and the men are not as a rule members of the Brotherhood. Calumet & Hecla, Isle Royale and Quincy have their own railways, operated by their own nonunionized men —or if they are organized their runs are so short that they would not be called in a strike. But the mines served by the Mineral Range Ry., a subsidiary of the Duluth, South Shore & Atlantic Ry., were ready to go on strike. The injustice of a force of 130 men, constituting the train crews on these ore-hauling lines, forcing 8,000 or more mine employees into idleness for their demand for an increase in pay, when they already receive higher pay than the average mine employee, did not appeal to the miners. To be fair with railway men so involved, none of them wanted to strike, few of them attempted to justify the strike and did not intend to strike except as a matter of sticking to the fellow railway unionists. But unless the "rock" from the mines is hauled away with facility it is quite impossible to operate any copper mine to capacity. Some of the men might be utilized to help in advancing underground openings and some might be placed in other mines not damaged by the strike. When it looked as if the strike would come and orders to strike actually were received the officials of the Mineral Range were astonished to find applications for railway jobs from 100 former railway men who wanted jobs back again and these applications came without solicitation. A hurried canvass of one mine showed 200 men with railway experience and every man was willing to go to work to help keep the 8,000 other mine employees on their jobs.

JOPLIN—Sept. 30

Inefficient Use of Powder in this district was charged by a representative of the du Pont company in an address before a meeting of mine operators during the last week. Operators were informed if they would use lower grade powders with higher grade detonators, they would get as good results as they were obtaining with high-grade powders with low-grade detonators, and powder bills would be considerably decreased. He also advised that all holes be tamped.

Settling of Slimes in Joplin mills has been the subject of considerable study by the Dorr representative in this district, Charles W. Burgess, and further improvements in this department are expected. Mr. Burgess recently sent to the company's laboratories at Denver a representative assortment of slimes from local mills. He left Sept. 29 to conduct experiments to determine settling rates of the different slimes. During the last year about 40 thickeners have been installed in this district.

TORONTO—Sept. 30

Gold Discovery is reported near Bourke's station at mileage No. 184 on the Temiskaming & Northern Ontario Ry. A settler named Anderson in clearing his farm uncovered a wide vein, with visible gold, extending across his property. A rush of prospectors to the district has begun.

Metal Production in Ontario for the first half of 1916 was much larger than in the corresponding period of last year, according to returns to the Ontario Bureau of Mines by the metalliferous mining companies of the province. The output reported was gold, 235,060 oz ; silver, 10,267,743 oz.; copper, metallic, 77,795 lb.; copper in matte, 11,426.5 tons; nickel in matte, 20,651.5 tons; nickel, metallic, 13,933 lb.; cobalt, metallic, 121,817 lb.; cobalt and nickel oxides, 401,408 lb.; molybdenite, concentrates, 12,631 lb.; iron ore, 80,698 tons; pig iron, 295,349 tons. If the present rate of production is maintained the gold output for the year will reach approximately $10,000,000 as compared with $8,500,000 for the previous year. The Hollinger and the Dome are the two big producers, although the McIntyre is rapidly increasing its production. The number of ounces of silver is less than for the corresponding period of 1915 but on account of the higher price the value of the output shows an increase of $1,000,000. Practically all the silver comes from Cobalt and the life of the camp will be prolonged by the introduction of the flotation system for the treatment of low-grade ores and old tailings. The most important increase was in nickel with a value of $10,325,766 as compared with $7,591,000 for the corresponding period of 1915, and $2,872,843 in 1914. The value of the cobalt and nickel oxides has increased about 400 per cent. due to the opening up of new markets on account of war conditions. The total value of the production for the six months is $28,631,292 as compared with $21,255,583 for 1915, or a gain of 34.7%. It is expected that this increase will be maintained if not exceeded for the rest of the year.

The Mining News

ARIZONA

Cochise County

BUNKER HILL MINES (Tombstone)—Has added eight stamps to mill.

COPPER QUEEN (Bisbee)—At the testing plant at Lowell experiments have been started on the sulphidizing and subsequent flotation of carbonate tailings from Morenci.

BISBEE COPPER MINING AND DEVELOPMENT (Bisbee) —New copper flotation to develop 237 acres north of the Copper Queen holdings. Two churn drill holes have been sunk to 185 and 267 ft. respectively, and hoisting equipment capable of sinking 1,000 ft. is to be used on proposed 3-compartment shaft on Pauline claim. A. H. Livingston, secretary.

KEYSTONE COPPER (Johnson)—Two-compartment shaft has reached 500-ft. mark; in low-grade ore for over 200 ft.; last 15 ft. ran 3% copper. Company owns 310 acres about 2 mi. from Johnson. Its O. K. shaft is down about 70 ft. and in high-grade sulphide ore. Equipment consists of 30-hp. gasoline hoist, 28-hp. crude-oil engine running four-drill Ingersoll-Rand compressor and jackhamers, used in shaft—sinking about 2½ ft. per shift. U. R. Miller in charge.

Gila County

NEW DOMINION COPPER (Globe)—New organization of Pennsylvania oil men has taken over Mallory property.

Mohave County

NELLIE (Oatman)—Has cut station at 350-ft. level.

OATMAN CRESCENT (Oatman)—Again driving adit to tap vein at 300-ft. level; in about 450 ft.

BIG JIM (Oatman)—Raising from 400-ft. level to ascertain upward extension of big oreshoot.

Pima County

NEW CORNELIA COPPER (Cornelia)—Preliminary leaching operations begun though entire plant not yet ready.

CORNELIA EXTENSION (Ajo)—Hoisting high-grade material from new shaft at 65-ft. depth; 3 drill holes down to depth.

Yavapai County

SILVER BELL (Humboldt)—Plan to sink new 1,000-ft. shaft; electrical machinery to be added.

ARIZONA & ARKANSAS (Jerome)—Unwatered and will resume operations as soon as machinery arrives.

COMMERCIAL COPPER (Copper Basin)—Will resume shipments to United Verde smeltery at Clarkdale.

VENTURE HILL (Jerome)—A 3-ft. vein malachite, containing also native copper, struck in tunnel 275 ft.

JEROME VICTOR (Jerome)—The 1,200-ft. shaft and all workings unwatered. Will extend west crosscut on bottom level.

OCTAVE (Wickenburg)—Will now resume operations after expert examination; 27-in. vein said to average $10 a ton for 270 ft.

UNITED VERDE EXTENSION (Jerome)—Winze being sunk from 1,400 to 1,600-ft. levels opened big flow water at 115-ft. point.

BIG LEDGE DEVELOPMENT (Huron)—No. 2 shaft sunk 147 ft. farther to level of lower tunnel; sinking new Le Duc shaft, 800 ft. south.

ARIZONA SAMPLING AND REDUCTION (Wickenburg)—New company will build custom sampling mill, and a concentrator of 50 tons daily capacity.

CONSOLIDATED ARIZONA SMELTING (Humboldt)—Considering addition new furnaces; concentrating and sampling plant destroyed by fire now rebuilt.

JEROME VERDE (Jerome)—Sandstone formation reached in enlarging 700-ft. shaft from one to three compartments; new electric pumps easily handling all water.

GREAT WESTERN SMELTERS CORPORATION (Mayer)—Issuing $250,000 in bonds to remodel old Treadwell smeltery and may add another furnace. Will smelt ores from Big Ledge Development Co., with which smelting company is allied.

GLADSTONE-McCABE (McCabe)—These mines to be reopened at once by C. M. Garrison and associates, of New York. Ore can be shipped within six weeks, as all mining machinery is in place.

DUNDEE-ARIZONA (Jerome)—Work suspended pending arrival adequate pumps to handle water struck 150-ft. point; during shutdown 60-hp. engine will replace present one of 25 hp. and larger compressor will be installed.

GREEN MONSTER (Jerome)—Plans to sink two 150-ft. shafts on Amazon & Missouri claims; the George tunnel on the Cliff claim has been cleaned out and track laid to the elbow about 800 ft.; two crosscuts being made from Revenue tunnel; 6,000-ft. pipe line laid to Cliff Creek.

VERDE COMBINATION COPPER (Jerome)—At recent meeting of stockholders, John L. Dyer, of El Paso, was elected president; Alfred F. Kerr, of El Paso, vice-president; above officials and R. M. Dudley, W. N. Richards, John S. Eberman, J. C. Callaghan and James M. Layman comprise the directorate.

Yuma County

UNITED MINES (Plomosa)—Bought 13 claims from J. C Denton for $18,000.

CALIFORNIA

Amador County

EIGHT PRODUCING GOLD MINES of Amador County were closed during the week of Sept. 22 on account of alleged refusal of mine owners to discuss wage scale with United Federation of Labor. The union numbers about 400 men, about half of whom were opposed to the strike. The mines remaining closed down during the week are the Argonaut Kennedy, South Eureka, Central Eureka, Original Amador Treasure, Bunker Hill and Fremont. The Plymouth Consolidated was closed for a few shifts, but resumed operation on petition of the miners. The Keystone did not close because a premium of 25c. per day was being paid for rapid development. Consolidated Amador continued unwatering and repairing shaft and for that work was paying an extra 25c per day.

PLYMOUTH CONSOLIDATED (Plymouth)—Newly installed Nordberg electric hoist has capacity 5,000 ft. depth; double-drum gear, drums 9 ft. diameter, 88-in. face, each grooved for 5,000 ft. of 1⅜-in. rope; hoist provided with Welch safety stops; shipping weight, exclusive of electrical apparatus, 220,000 lb. First 1,520 ft. of shaft is vertical, then inclined at 60

BUNKER HILL (Amador City)—Shaft lined with concrete to depth of 225 ft. This improvement practically completed when general strike was called; one man, retained on finishing work on the second day of the strike, was badly beaten by strikers as he came off shift at 11 p.m. This shaft collar caved about four years ago locking some of miners in lower workings for about a day.

Calaveras County

PIONEER (Angels Camp)—Crosscutting and drifting discontinued and sinking now in progress; shaft will be deepened to 500 ft.

MOUNTAIN KING (Hodson)—T. Silva killed at 600-ft. level by explosion of a missed hole on Sept. 19; another man severely injured.

Colusa County

BOGGES QUICKSILVER (Williams)—New oil-burning furnace being installed; stated that saving of $100 per month will result from substitution of oil for wood. Monthly output reported at 80 flasks.

Eldorado County

CHROME DEPOSITS on the Pilliken place on Negro Hill, owned by Hill & Hobler, reported sold to Noble Electric Steel Co., operating smeltery at Heroult, Shasta County. Ore will be hauled on motor truck to Folsom for shipment by rail.

Glenn County

CHROME DEPOSITS near Fruto said to have been worked out, so far as high-grade ore is concerned, and property closed pending prospecting for new deposit or continuance of old one.

Inyo County

SANTA ROSA (Keeler)—Hauling ore from mine to railroad with caterpillar tractor and five trailers, capacity 25 tons per trip; 1,500 sacks ahead of teams necessitated adoption of caterpillar. Company employing 10 men; 23 working on 15 leases; most leasers working from surface by underhand stoping; ore high-grade.

Kern County

SERIES OF FIRES at Randsburg Sept. 17; incendiarism suspected. Reward of about $300 offered for conviction of incendiaries. Buildings destroyed or damaged were owned by Judge E. D. Maginnis, Dr. O. L. Cochrane, O. F. Ranaldi, David Thompson and Mr. Hartley.

Nevada County

DELHI (Nevada City)—Unwatering shaft; water lowered to 300-ft. point, making 50 ft. per week; shaft 500 ft. deep. Property in Columbia Hill district, formerly owned by St. Gothard Mining Co., now being financed by Nevada City men.

Placer County

DREDGE PROSPECTING by the Guggenheims reported on north fork of American River near Codfish Cañon; ground said to be the Bond claim and ⅝ mi. of river bed owned by Boswell Dunlap; lower parts of river gave rich gold returns in early days.

San Bernardino County

ATOLIA (Atolia)—Has 30 men at work in Churchill shaft; operation of mill not resumed.

Siskiyou County

McKEEN (Callahan)—New mill and other machinery will be installed at this old producer, now operated by San Francisco men; W. L. Fraser in charge.

Tuolumne County

SPRINGFIELD TUNNEL (Columbia)—Rich gravel reported in ground purchased from Ranch Mining Co.

SWADLY (Soulshyville)—Bonded to San Francisco men who have installed hoist and compressor and begun development.

NEW YORK (Sonora)—The 90-ft. tunnel has been extended into the river side of the hill to a point 250 ft. below earlier exploration. Property in East belt of the Mother Lode

COLORADO

Boulder County

BOULDER TUNGSTEN PRODUCERS' special committee met in Boulder Sept. 13 to draw up brief stating reasons why tungsten industry should have protective tariff. Further steps will be taken later.

UP TO DATE (Boulder)—Recent development opened rich silver-gold-copper ore.

FAIRFAX (Salina)—Fortune vein cut and streak of sylvanite ore opened. Work in progress on all four levels.

HERALD (Boulder)—Leased from John Yales by Heane & Withrow. Larger hoist will be installed and shaft sunk additional 100 ft.

BISMARCK (Caribou) — Bonded by Fred Carlson and August Wilimzik. Opened 8-in. streak of 40-oz. silver ore. Main tunnel advanced 300 ft.

AMERICAN (Boulder)—Mine will be reopened and flotation plant installed. Property once producer of high-grade gold-telluride ore. Ore of milling grade left in mine.

UNITED STATES GOLD CORPORATION (Boulder)—New pumping plant being installed. Winze below fourth level will be unwatered and sinking resumed. High-grade ore opened in this winze but was followed by cutting of water course which forced temporary suspension. Same oreshoot opened on 500-ft. level by recent development.

Clear Creek County

PITTSBURGH (Breckenridge)—Shaft unwatered and retimbered. Crosscutting under way.

BULWER-STANDARD (Breckenridge)—Good-grade gold-silver-lead ore being mined. Shaft 50 ft. deep.

COHOMACK (Breckenridge)—Mill running on ore from the Puzzle dump. Two cars concentrates shipped recently. Puzzle mine also shipped car smelting ore.

CAPITAL (Georgetown)—Recent strike of gold-bearing quartz richer than first anticipated. Two feet of quartz on hanging-wall of vein stoped shows free gold in wires and flakes. Strike made in Hanson and Walthers lease at raise No. 15 west.

LAMARTINE (Freeland)—Taken over by Broderick Mining Co. Extensive development planned under management of I. W. Clokey. A 150-ton mill may be built near portal of old Lamartine tunnel. Flotation will be used. Old dump estimated at 50,000 tons will be treated.

Lake County

GOLD STRIKE ON RED MOUNTAIN in Twin Lakes region made recently by Mock and Hartman. Buildings being constructed and work will be continued all winter. Reported a second strike made on Bowerman group in same district.

HIBSCHLE (Leadville)—Surface plant formerly at Walcott shaft moved to this property. Walcott, Coronado and Hibschle under lease to Otto Thum and others. Heavy flow of water in Walcott workings prevented working through that shaft.

San Juan County

MEARS-WILFLEY MILL (Silverton)—Plant completely overhauled; is now operating on three shifts.

HIGHLAND MARY (Silverton)—Developing on two shifts. Ore shipped to North Star mill. J. H. Slattery, manager.

REWVILLE (Ironton)—This Red Mountain property is being developed by Hoffman and Flinn. New mine boarding house completed.

SILVER LEDGE (Chattanooga)—Being developed under management of Philip Sartore. Mill running on day shift making lead and zinc concentrates, shipped to Durango smeltery.

KITTIMAC (Silverton) — Crushing plant at mine being overhauled and cribbing constructed to protect tramway against snowslides during coming winter. Mill will be in operation soon with new flotation equipment.

ELK MINING AND MILLING (Silverton)—Contract to advance tunnel 500 ft. nearly completed. Company contemplating installation of compressor and machine drills to expedite development; property in Cement district; J. J. Cusick in charge.

San Miguel County

MATTERHORN MINING AND MILLING (Butterfly)—The 4,000-ft. crosscut being retimbered preparatory to advancing 600 ft.

CLIFF DWELLER (Norwood)—Leased by G. G. Galloway to Gibbs and associates who are developing a 12-in. vein of shipping ore.

SILVER BELL (Ophir Loop)—Two-compartment raise from tunnel level has broken through into sixth level, having been extended 828 ft. on the vein. Underground exploration will continue under F. E. Trumble.

IDAHO

Blaine County

MASCOT (Hailey)—Ore opened beyond faulted zone formerly worked and flotation plant may be erected.

Elmore County

RICH GOLD ORE reported opened at depth in one of the old mines at Atlanta, 80 mi. from Boise.

Shoshone County

COPPER KING (Mullan)—Diamond drill in 480 ft. from west drift of lower tunnel cut lead-copper vein. Crosscut will be run to orebody about 400 ft. from drill hole and will then drift toward latter. D. K. McDonald and other Spokane men interested; H. W. Ingalls, secretary.

SUNSHINE (Missoula, Mont.)—Ingersoll-Rand compressor and drills being installed to continue crosscut adit to get 450 ft. additional depth on the Toughnut orebody. Consolidation with other Beaver Creek properties under consideration but will not include Ray-Jefferson, as reported. Dr. E. G. Ellis, treasurer.

MICHIGAN

Iron

SUNDAY LAKE (Wakefield)—A Greene economizer and automatic stokers are being installed. A 30-ft. addition has been made to the boiler house. About 40,000 tons of ore averaging from 37 to 40% shipped from stock piles. Ores of higher grades also moved.

WAKEFIELD (Wakefield)—New pit "C" to be opened short distance from main pit. Overburden will be moved by hydraulic method. Is 65 ft. deep; about 600,000 cu.yd. will be moved. Some ore will be taken up inclines on side of pit; remainder will be milled. Owned by M. A. Hanna Co.

EUREKA (Ramsey)—Sixteen new company houses are to be built this winter. Concrete foundations now being put in. A new first-motion steam hoist to be purchased for No. 2 shaft, not in use now. New orebody found in the western portion of mine—not a continuation of Anvil orebody. Drill hole will be put down 1,100 ft. from surface to prospect for Anvil extension.

MINNESOTA

Cuyuna Range

TOD-STAMBAUGH CO. (Riverton)—Optioned lands adjacent to Rowe mine, with intention of stripping the property. Company also has option on lands in the manganiferous belt, held by Gopher Iron Co.

THOMPSON (Crosby)—First Cuyuna Range ore from a state-owned property shipped Sept. 26, when 50 tons were loaded from a state forty, leased to Inland Steel Co. The forty will be stripped and become a part of the Thompson pit.

Mesabi Range

HARTLEY (Chisholm)—Stripping started. One shovel and two locomotives working. No shipments will be made until spring.

HOLLAND (Biwabik)—The 30,000-ton stockpile purchased by John A. Savage, of Duluth, and is being shipped. Mine idle for several years.

BESSEMER (Franklin)—Three shafts are to be opened. J. S. Lutes, of Duluth, has control. Was operated from 1902 until recently by Republic.

DONNER MINING CO. (Hibbing)—Mining department of Donner Steel Co. has lease from Alexandria Iron Co. on four 40-acre tracts west of Hibbing, known as the St. Anthony No. 1 and No. 2 mines.

CHISHOLM (Chisholm)—Production will be started shortly. Ore will be trammed to "B" shaft of the Monroe property. Hoist now being installed at Monroe. Concreting being carried on in Chisholm shaft. Will not be in commission until first of year.

MISSOURI

Joplin District

WHITE OAK (Cave Springs)—Planning custom mill.

ST. REGIS (Joplin)—Opened rich disseminated formation at new property at Chitwood. New mill started.

MONTREAL (Century, Okla.)—Framework of new mill up; machinery to be installed soon. Sinking shaft.

A. R. G. (Duenweg)—New 400-ton concentrating plant started. All machinery on concrete foundations. Separate steam engine operates slime department and electric-light plant. Mining at 200 ft.; only one shaft now complete, but second to be ready soon. Concentrates run about 63% zinc.

Northern Arkansas

EUREKA HOLLOW (Tomahawk)—New mill contract let to Joplin contractor.

WHITE EAGLE (Rush)—Compressor installed; track from tunnel to mill completed and mill in operation.

BONANZA (Buffalo)—Sold 100 tons of its reserve concentrates to Fort Smith Spelter Co. which so far has not been able to get the 500 tons per month desired from this district.

MONTANA

Lewis and Clark County

THOMAS CRUSE MINING AND DEVELOPMENT CO. (Helena)—Executors of Thomas Cruse estate have transferred Franklin mine in Scratch Gravel district, near Helena, to this new company. Richard Cruse, president.

Silver Bow County

DAVIS-DALY (Butte)—Colorado orebody opened for 450 ft. on 2,500 level where Hesperus vein has been identified. Average width 12 ft., carrying 5 to 7% copper.

BULLWHACKER (Butte)—At depth of 110 ft. a crosscut, run 60 ft. from glory hole, opened body of rich copper ore. Leasing company. Management planning to sink shaft to 200 level and crosscut for orebody just opened.

LA FRANCE (Butte)—Atlantic Mines Co. which took over this silver-zinc property three years ago did not succeed in its exploitation and will sell the property at public auction Nov. 1. Anaconda is stated to have offered $10 per share and interest, plus the $250,000 which Atlantic spent in the exploitation.

NEVADA

Esmeralda County

CHAMPS D'OR GOLD (Hornsilver)—Dunfee lease resumed. Some ore will be shipped but plan is to block out sufficient ore to warrant mill.

JUMBO EXTENSION (Goldfield)—Optioned Kanrohat mine in Jefferson Cañon, about 6 mi. from Round Mountain, Nye Co. Contracts let for preliminary development.

GOLDFIELD CONSOLIDATED (Goldfield)—Final August figures were: Net realization, $18,211 from 17,300 tons; net costs, $7.43 per ton, including 64c. for construction.

PALMETTO CONSOLIDATED (Goldfield)—For six months 10 men have been developing claims of old Palmetto Mining Co. on south slope Palmetto Mountain about 35 mi. southwest. Some ore being stoped.

Lincoln County

GROOM (Pioche)—Regular shipments continue via Indian Springs station, 60 mi. from mine. Road being improved and expect to haul 30 tons per trip with "Cat" and six trailers. Ore carries about 60% lead and 20 oz. silver.

Lyon County

MASON VALLEY MINES (Mason)—New offering of 200,000 shares to stockholders at $5. Has acquired Gray Eagle group of 14 claims at Happy Camp in Siskiyou County, Calif., developed by John B. Farish and F. H. Dakin.

Nye County

TONOPAH ORE PRODUCTION for week ended Sept. 23 was 9,568 tons valued at $198,104 compared with 9,247 tons for week previous. Producers were: Tonopah Belmont, 3,094 tons; Tonopah Extension, 2,200; Tonopah Mining, 1,950; Jim Butler, 1,000; West End, 831; Rescue-Eula, 213; Halifax, 162; North Star, 51; miscellaneous 64 tons.

Storey County

ANDES (Virginia)—Saved 40 cars from development on 350 level.

MEXICAN (Virginia)—Old west crosscut 2,500 level reopened and repaired 60 ft. to 170-ft. point. Mill crushed 446 tons custom ore, average $15.26.

SIERRA NEVADA (Virginia)—Raise in northwest drift, 2,400 level, advanced 12 ft.; saved 32 tons, average $21. Saved 11 tons from south boundary stope, average, $8.98. North drift 2,500 level repaired 20 ft. to the 280-ft. point.

UNION CON. (Virginia)—Shipped 446 tons to Mexican mill, gross value about $6,700. Extracted 373 tons from 2,400 and 2,500 stopes and development work; 30 tons averaging $14.40; 41 tons, $14.58; 65 tons, $10.72; 27 tons, $9.78; 84 tons, $13.60; 126 tons, $17.76. West crosscut from 2,600 station, joint Union-Sierra Nevada winze, advanced 16 ft. Continued repairs in the 2,700 winze.

TENNESSEE

TENNESSEE ZINC CO. (New Tazewell)—Has repaired mill and is again operating its mine on Straight Creek, Claiborne County. L. L. Bristow, manager.

TENNESSEE COPPER (Copperhill)—Readjustment of company's affairs proposed on basis of doubling capital stock, new shares to be offered to shareholders at $16. Adolph Lewisohn may become president.

TEXAS

CHISOS MINING (Big Bend)—Recently shipped carload quicksilver valued at $25,000.

UTAH

Box Elder County

LAKEVIEW MINING (Saline)—Shipped six cars of zinc and lead ores in August. Leasing system adopted, 10 sets of lessees, employing 20 men. Zinc ore shipments run about 32%; lead ore ranges from 18 to 28%. Dividends to date $124,000. S. S. Arentz, manager.

Juab County

TINTIC SHIPMENTS for week ended Sept. 22 amounted to 183 cars.

TINTIC STANDARD (Eureka)—Shipping ore opened on lower level. Company owns 1,800 acres, 200 of which are patented.

COLORADO CONSOLIDATED (Silver City)—Drifting for 400 or 500 ft.—under contract to Walter Fitch, Jr.—will be done on 1,500 level.

SIOUX (Eureka)—Contract for sinking shaft to 1,000 level let to Duncan & Allen. Work through winze being done at depth of 675 ft.; formation similar to Iron Blossom at same depth; searching for continuation of Iron Blossom copper deposit opened at 800 ft.

Salt Lake County

BAKER MINING (Salt Lake)—Four inches of silver-lead ore showing in bedding, on tunnel level.

SOUTH HECLA EXTENSION (Alta)—Two cars of good ore shipped. Main workings reported to have flow of 3,000 gal. water per minute.

OHIO COPPER (Bingham)—Stay to confirmation of foreclosure sale gives stockholders until Oct. 13 to demonstrate ability to redeem property.

EMMA COPPER (Alta)—Diamond drilling in old Emma ground is affording interesting results; the second hole reported to have cut ore, having been driven through 15 ft. of shipping grade.

Summit County

PARK CITY SHIPMENTS for week ended Sept. 22 amounted to 2,962,379 lb.; shippers were Silver King Coalition, Daly West, Ontario, Silver King Consolidated, Judge Mining, Daly and Naildriver.

DALY (Park City)—Prospecting for continuation of ore-bearing veins of district. Some comparatively small bodies of ore of good grade opened, and knowledge gained in regard to faults and displacements affecting Ontario vein. Ore of good grade also found in limestone bordering on Daly vein. Considering 150-ton mill to treat by concentration and cyanidation ore left in stopes, and low-grade lead- and zinc-sulphide ore on lower levels. Shipments week ended Sept. 22, 65,260 lb.

Utah County

EUDORA BELL (American Fork)—Compressor repaired, and miners put on by Red Cloud Mining Co. operating this property.

MAJOR EVANS (American Fork)—Bunk houses and other improvements completed, and development will continue through winter. Will sink shaft. Eight men employed.

PACIFIC (American Fork)—Another car high-grade silver-copper ore shipped. One is at the smeltery, and two more are on the road. New mill expected to be ready in about a month.

WYOMING

PENN-WYOMING BONDS were sold at auction in Cheyenne to Raymond W. Starr, of Grand Rapids, Mich., for $83,000 to satisfy judgment obtained by Vivian E. Collins and the Continental & Commercial Trust and Savings Bank, of Chicago. Purchasers it is said may reorganize properties.

CANADA

British Columbia

PARADISE (Windermere)—Resumed ore shipments after idleness of 10 years. Eight teams hauling silver-lead ore to railway and 21 men are employed at mine. Short aërial tram being constructed to storage bins on line of the Kootenay Central Ry.

GALENA MINING AND MILLING CO. (Spokane, Wash.)—Organized to acquire the Galena Farm with its mill, near Silverton. Was bonded to late Patrick Clark a few months prior to his death. Since then about $150,000 has been expended in development, and equipment of mill and power plant. Net returns of $20,000 to $25,000 monthly.

COAST COPPER CO., LTD. (Trail, B. C.)—This new company formed to develop 31 copper claims on north end of Vancouver Island, acquired from W. E. Cullen and Maurice F. Bacon, of Spokane. Properties near Elk Lake which drains into southeast arm of Quatsino Sound. Low-grade deposit, some diamond drilling done. Consolidated Mining and Smelting Co. reported interested.

ONTARIO

AUGUST SHIPMENTS of silver ore from Cobalt over Temiskaming & Northern Ontario Ry. are reported by Arthur A. Cole as follows: Alladin, 25.20 tons; Beaver, 52.61; Cobalt Comet, 52.47; Coniagas, 71.23; Crown Reserve, 77.66; Kerr Lake, 110; La Rose, 130.88; McKinley-Darragh, 214.68; Mining Corporation of Canada, 183.20; Nipissing, 539.66; Penn Canadian, 43.74; Right-of-Way, 43.71; Trethewey, 38.28; total Cobalt proper, 1,583.32 tons; Casey Cobalt (New Liskeard), 30.46 tons; Miller Lake O'Brien (Elk Lake), 28.80; total silver ore shipments, 1,612.58 tons. Nickel ore, Alexo mine (Porquois Junction), 672.15 tons.

DAVIDSON (Porcupine)—Main vein 35 ft. wide on 100-ft. level. Station cut at 300-ft. level and cross-cutting started.

INSPIRATION GOLD (Porcupine)—New company to operate Shillington Richardson property near the Hollinger.

TASH-ORN (Tashota)—Compressor and other machinery being installed on Wells' claim; vein, 20 ft. wide, found adjacent to King Dodds claim, Kowkash.

MAIDENS MACDONALD (Porcupine)—New compressor will be installed; under option to the La Rose. Two shafts 600 ft. apart will be connected on 100-ft. level.

NIPISSING (Cobalt)—Paying 5% bonus in addition to regular quarterly dividend of 5%. Cash on hand Sept. 26 $1,218,838, and ore and bullion $957,314; total $2,176,163.

KERR LAKE (Cobalt)—Report for year ended Aug. 31 expected to show production of 2,300,000 oz.; cash and ore on hand about $1,000,000. Ore reserves practically the same as for previous year.

SENECA-SUPERIOR (Cobalt)—Declared dividend of 20c. a share; government tax was $15,000. Payment of this dividend will leave only small amount in treasury. Mine has been closed and plant sold.

INTERNATIONAL NICKEL (43 Exchange Place, New York)—Has taken option on group of seven nickel claims owned by Reamsbottom and Edwards in Langmuir township, near Frederickhouse Lake. Diamond drill will be sent in.

DOME (South Porcupine)—New working shaft is expected to be completed in October. During winter months less ore will be drawn from open cuts and, as the deficit will be made up from ore from lower levels, a higher grade is expected.

DOME EXTENSION (South Porcupine)—The deep diamond-drill hole was stopped at 2,000 ft. without cutting the Dome orebodies; hole changed its course and capacity of drill was reached before passing through the porphyry. Some good ore was cut in the center of the porphyry, where it was not expected. It is improbable that another deep hole will be drilled as developments in other sections have been favorable and there seems no doubt of the option being exercised by Dome Mines, Ltd.

NEWFOUNDLAND

NOVA SCOTIA IRON AND STEEL (West Wabana)—At iron mines on Bell Island, underground operations in the submarine areas are more active than for some time. The sinking of new slopes and crosscuts has been hastened. Recently a bad blasting accident occurred, several men being killed. Some interesting grouting of water seams in the back has been done by a machine on wheels that forces cement into the crevices (cement gun ?). While the summer's shipments were not up to other seasons, account stoppage of shipments to the Krupps in Germany and high ocean freights to England and America, preparations are being made for heavy shipments when more vessels are available. Ore is about 50% iron and high in phosphorus, being blocky and hard. Bethlehem Steel Co. has been a user but main consumption has been in company's own furnaces at Sydney and in the Dominion Iron and Steel Co.'s furnaces at same place. Shipping season will soon be closed by ice packs in Conception Bay.

CUBA

REPORTED POTASH DISCOVERY not yet authenticated. American consul general at Habana cabled Sept. 26: "Best information obtainable here indicates report as to potash deposit discovered not well founded. Will investigate further."

MEXICO

CIA. DE REAL DEL MONTE Y PACHUCA ([illegible] Hidalgo)—American staff withdrawn in June now returning. Loreto mill on the Pachuca side is operating and the Guerrero mill is expected to start early in October. Officially stated that arrangements have been made that should solve difficulties due to cyanide shortage. Rumored that new [illegible] tion ?) will be adopted.

The Market Report

Metal Markets

NEW YORK—Oct. 4

Copper was strong at unchanged prices, except that an advance had to be paid for prompt delivery A moderate volume of business was done. Lead was quiet and strong. October delivery, not previously contracted for, is scarce. Spelter showed a rising tendency on relatively light transactions.

Copper, Tin, Lead and Zinc

Copper—A fair volume of business was done at about the same prices as in the previous week. Small sales of prompt copper were made at 29c., r.t. A considerable amount of December copper was sold at 27¾@28c., net cash, New York, but it was only from one or two quarters that December delivery was available, producers in the main being fully sold out for the remainder of this year. The major market during the last week was for delivery during the first quarter of 1917, all of which business was done at 27c., r.t., equivalent to 26¾c., net cash, New York, while some business for January alone was booked at the same price. Several producers sold for delivery in the second quarter of 1917, acepting 26c., r.t., equivalent to 25¾c., cash, New York, a fairly large tonnage being booked for that delivery at that price. There were a few sales for export, but the major part of the business of the week was for delivery to domestic manufacturers. The aggregate of sales whereof we had reports was about 20,000,000 lb., compared with about 18,000,000 lb. in the previous week, the average realized on all business being about the same.

Many important domestic manufacturers have not yet booked the copper that they are normally expected to require in the first quarter of 1917, and it is the general belief among producers that the copper market has not yet responded to the change in statistical position produced by the recent large sale to the foreign governments. A noteworthy feature of last week was some important buying by wire manufacturers. A correspondent communicates the following interesting news respecting the situation among the brass makers of the Naugatuck Valley:

Copper Sheets continue unchanged at 37.5 for hot rolled and 38.5 for cold rolled. Wire has advanced slightly, quotations now being 32@33c.

Brass manufacturers are extremely busy and well booked ahead. The dearth of crucibles and the labor shortage during the summer reduced output about 33⅓%, and the pressure of these accumulated demands is forcing consumption to the very limit of capacity. What with the lack of reserves of electrolytic, this may cause an acute shortage for early delivery, and belated buyers will pay through the nose. Of course, the important ones are well covered; it will be the stray dog that will be hit. For next year's delivery, buyers are covering only as they sell manufactured material, and there is considerable if not most of the copper required still to be bought for first quarter.

Tin—A better business was done, chiefly for foreign delivery. On Oct. 3 a large business was done.

Lead—A good business was done, but the aggregate, as reported by producers, was a trifle less than in the previous week. Prices were unchanged, and on the whole were maintained stiffly, but there was some competition among producers for orders at interior points which resulted in trifling concessions in order to get the business. A little export business was done. Lead for October delivery, not previously contracted for, continues extremely scarce.

Spelter—This market improved from day to day on relatively light transactions. There was a good demand for October spelter, and producers appeared unwilling to sell it except on better terms. On the other hand, everybody was eager to place business for delivery in the first quarter of 1917, and some considerable sales were made for that delivery. Sales were also made for October-December, 1916. The business for delivery in the first quarter of 1917 was booked at slightly less price than for the current quarter of this year, but differences are now relatively small.

Zinc Sheets continue at the same price. The quotation is $15 per 100, less 8%, f.o.b. Peru, Ill.

Exports from Baltimore during the week included 168,094 lb. of spelter.

Other Metals

NEW YORK—Oct. 4

Aluminum—Demand is strong and in general is in about the same condition as last week, nominal quotations being 61@63c.

Antimony—Market very dull, with many sellers and but few buyers. Sales reported at 11c. We quote the market unchanged at 10½@11½c.

Quicksilver—Market strong on good demand. We quote $77 and sales at that price. San Francisco reports, by telegraph, $74, market firm. The superiority of the New York price is explained by shortage of local stocks and transportation difficulties.

Gold, Silver and Platinum

NEW YORK—Oct. 4

Gold Holdings by the Bank of England against notes has decreased by £611,060, according to report of Samuel Montagu & Co. The Transvaal output for August, 1916, amounted to £3,318,116, as compared with £3,307,975 in August, 1915, and £3,232,891 in July, 1916. During the week of September ending Sept. 9, over £3,600,000 of gold had been received by the United States from Canada.

Platinum—Early in the week sales were made at $85; since then the market became strong again and at the close is quoted at $87½@90.

Our Petrograd correspondent reports that for the period between July 16 and 29 the market was quiet, due to the lessening of the demand by domestic consumers and jobbers. An increase in prices was not expected at once since production was in full swing. Dredging especially was proceeding to full extent. The demand was fully covered by the offering. Prices remained generally unchanged.

In the period between July 30 and Aug. 12 the market improved considerably and toward the end of the period there was some fairly large sales to domestic consumers. The demand was strong and prices improved considerably. The price in Petrograd was $77.42 per oz. and at Ekaterinburg, $71.44 per oz.

Silver—The market has received a slight setback, having declined in the last few days ⅜c. Advices are to the effect that very large quantities of silver have gone from Shanghai to India during the last few months, but sales on that account in quantity are not likely to be continued.

The Silver Undertone continues good in London, according to Samuel Montagu & Co., Sept. 14, although the course of prices has been somewhat uncertain. The recent activity of the Indian Bazaars has simmered down, probably owing to a reduction of their interests in this market. The bear position seems to be practically eliminated, while bulls have realized a portion of their profits. Meanwhile prices in India show some recovery.

The China exchanges have moved up substantially, suggesting the probability of less pressure to sell from that quarter. It will be noticed from details below that silver is being shipped on a considerable scale from San Francisco to China. This partly accounts for the comparatively small offerings of American silver in this market.

Transactions during the week have not been upon a large scale. Buyers have been holding back, and sellers loth to meet them.

The following figures show a fall of 33 lacs in the holding of silver rupees by the Indian treasuries. The last three Indian currency returns received by cable give details in lacs of rupees as follows:

	Aug. 22	Aug. 31	Sept. 7
Notes in circulation...	7,434	7,401	7,356
Reserve in silver coin and bullion.........	2,748	2,737	2,704
Gold coin and bullion..	1,188	1,166	1,154
Gold in England......	1,192	1,192	1,192

Zinc and Lead Ore Markets

Joplin, Mo., Sept. 9—Price quotations per 2,000 lb.: Blende, high, $66.40 per ton of 60% zinc; premium ore, $65; medium grades, $65@60; low, $55. Calamine, per ton of 40% zinc, $45@35. The average selling price of all grades of zinc ore was $54.07 per ton.

The lead base price was $75@76 per ton of 80% metal content. High price was $76.50, and the average selling price of all grades of lead ore was $74.40 per ton.

Shipments for the week included 7,931 tons of blende, 789 tons of calamine and 1,058 tons of lead ore. The value of all ore shipped for the week was $550,250 and for the year, to date, was $28,203,070.

Another week of large shipping and heavy buying for advance shipment further improved the situation by lowering the stock on hand and disposing of a menacing surplus of ore. With this wiped out, metal prices will have a stronger support in advancing, thus lessening the possibility of a fluctuating ore and metal market, according to the belief of producers.

SILVER AND STERLING EXCHANGE

Sept.	Sterling Exchange	Silver New York, Cents	Silver London, Pence	Oct.	Sterling, Exchange	Silver New York, Cents	Silver London, Pence
28	4.7575	69⅛	32⅞	2	4.7569	69⅛	32⅞
29	4.7569	69¼	$32\frac{15}{16}$	3	4.7569	68⅞	32¾
30	4.7569	69⅛	32⅞	4	4.7569	68⅜	$32\frac{9}{16}$

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine.

DAILY PRICES OF METALS IN NEW YORK

Sept. Oct.	Copper Electrolytic	Tin Spot.	Lead N. Y.	Lead St. L.	Zinc St. L.
28	26½@27	39¼	7.00	6.82½@6.92½	8.87½@9.12½
29	26½@27	39⅜	7.00	6.82½@6.92½	8.87½@9.25
30	26½@27	39⅜	7.00	6.82½@6.92½	9.00@9.37½
2	26½@27	39⅜	7.00	6.82½@6.92½	9.12½@9.37½
3	26½@27	39⅜	7.00	6.82½@6.92½	9.12½@9.37½
4	26½@27	39¾	7.00	6.82½@6.92½	9.25@9.50

The quotations herein are our appraisal of the average markets for copper, lead, spelter and tin based on wholesale contracts for the ordinary deliveries of the trade as made by producers and agencies; and represent, to the best of our judgment, the prevailing values of the metals, reduced to basis of New York, cash, except where St. Louis is basing point.

The quotations for electrolytic copper are for cakes, ingots and wirebars. Electrolytic copper is commonly sold at prices including delivery to the consumers and is subject to discounts, etc. The price quoted for copper on "regular terms" (r.t.) is the gross price including freight to the buyer's works and is subject to a discount for cash. The difference between the price delivered and the New York cash equivalent is at present about 0.25c. on domestic business. The price of electrolytic cathodes is 0.05 to 0.10c. below that of electrolytic. Quotations for lead represent wholesale transactions in the open market for good ordinary brands. Quotations for spelter are for ordinary Prime Western brands. Only St. Louis price is given, St. Louis being basing market. We quote New York price at 17c. per 100 lb. above St. Louis.

Some current freight rates on metals per 100 lb. are: St. Louis-New York 17c.; St. Louis-Chicago, 6.3c.; St. Louis-Pittsburgh, 13.1 cents.

LONDON

Sept. Oct.	Copper Standard Spot	Copper Standard 3 Mos.	Copper Electrolytic	Tin Spot	Tin 3 Mos.	Lead Spot	Zinc Spot
28	117½	114	139	174½	174¾	31½	52
29	118½	115	140	175½	175½	32	52
30							
2	119	115½	140	175¼	175¼	31½	52
3	119½	116	140	175½	175½	31¾	52
4	120	116½	141	176¾	177	31¼	54

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2,240 lb. Copper quotations for electrolytic are subject to 3% discount. For convenience in comparison of London prices, in pounds sterling per 2,240 lb., with American prices in cents per pound the following approximate ratios are given, reckoning exchange at 4.80. £15 = 3.21c.; £20 = 4.29c.; £30 = 6.43c.; £40 = 8.57c.; £60 = 12.85c. Variations, £1 = 0.21⅜ cents.

The excessive summer drought, yet unbroken, is partly responsible for a number of mines being still out of commission, while preparations are making for drilling 1,200 to 1,500 ft. for water for wet concentration.

Until noon yesterday the zinc-ore market was a weak factor, but after that no ore sold under $63@65 base. Lead continues advancing.

Platteville, Wis., Oct. 1—Quotations of the district are according to the following figures: Base price, per 2,000-lb. ton for material assaying 60% zinc, is $58 for premium ore, down to $50 for medium grade. For material assaying 80% lead, the base price per 2,000-lb. ton is $74. Shipments for the week were 3,178 tons of zinc ore, 12 tons of lead ore, and 929 tons of sulphur ore. For the year to date the figures are 93,936 tons of zinc ore, 3,275 tons of lead ore, and 23,002 tons of sulphur ore. Shipped during the week to separating plants, 3,099 tons of zinc ore. The shipment to date of zinc ore to smelteries shows an increase of 22,180 tons over the corresponding period of last year.

The Peruvian government, through the Ministry of Finance, has authorized the Banco Mercantil Americano to have coined 50,000 Peruvian pounds ($243,325) in gold disks imported by the bank. The "West Coast Leader" of Aug. 24 states that this bank will import a first consignment of gold amounting to $500,000. The gold disks are to be exempt from import duty, and they are to be coined free of charge. The Banco Mercantil is to turn over half of the coined gold to the government in exchange for Peruvian bank notes of the same value

Other Ores

Tungsten Ore—Business was done in several quarters at $16@17, and we quote the market at that figure, unchanged from the previous week.

Charles Hardy in his latest weekly report (Oct. 3) gives the following interesting information: "Several hundred tons have changed hands and though the prices have not improved beyond $17, very considerable business has been done at that figure for home consumption and for export. An additional factor of interest is the placing here of considerable orders for ferro-tungsten and tungsten powder which amounted to close upon 200 tons during the past week, and this is equivalent to a maximum of 300 tons of tungsten ores. Though I hear of quotations below $17, I have found no difficulty in obtaining this figure wherever the buyer was actually ready to place his business. The foreign market continues to show an active demand for our ores and further business can be looked forward to with certainty. Ferro-tungsten has been sold at $2.60 per lb. tungsten contained."

Antimony Ore—Ore of 50% grade, for immediate delivery, was sold at $1.10 per unit.

Molybdenum Ore—Charles Hardy reports that molybdenum ore seems to be becoming more and more of a favorite with the ferroalloy manufacturers, and whereas the sales in this country were made previously to only one or two quarters, there are now a number of manufacturers actively inquiring for and buying molybdenite. This demand has influenced prices to such an extent that the latest sales were made at prices ranging from $1.50@1.75 per lb. MoS_2 contained in the ore.

Iron Trade Review

NEW YORK—Oct. 3

The iron and steel markets continue strong. A car shortage cut down shipments in the Pittsburgh district, and there has been some labor shortage.

Domestic buying of finished steel for delivery after Jan. 1 is not heavy. Following various sellers' refusals to consider forward contracts a good many consumers are now disposed to take the market as they find it. Now and then surprisingly early deliveries seem to be available, but such cases are only eddies in a generally strong current.

There are signs of fresh export buying for every-day rather than war purposes. It is now several months since the last considerable demand of this sort. Italy is a large general buyer, all apart from the Italian inquiry for 45,000 tons of billets for shells, on which delivery is asked as soon as it can be made. Wire, plates, sheets and tinplates are wanted in large quantities for various foreign markets.

There is a heavy demand for bessemer and basic iron with large sales, according to "Iron Age," and a good movement in foundry iron. One fairly large block of basic iron for last quarter and first quarter shipment has been sold at $19 or better, Valley furnace, and there has also been a fairly large sale of bessemer iron at $22 or better. A Cleveland furnace interest has sold 16,000 tons of basic to the American Steel Foundries at Sharon, Penn., and another interest has sold 12,000 tons of basic, 2,000 tons per month for the first half of 1917, at the average monthly market price. We also note a sale of 2,000 tons of bessemer for fairly prompt shipment at $22.50, Valley furnace. The Trumbull Steel Co., which is to build an openhearth steel plant at Warren, Ohio, has an inquiry out for 6,000 tons of basic iron per month for the first half of next year. While its steel plant will not be ready for operation before the latter part of next year, it is said that if the company buys this iron it will pile it, and the object in trying to get iron now is to have it ready for the steel plant when it is finished. We note a sale of 15,000 tons of basic to a Youngstown interest at $19, Valley furnace, to be delivered as soon as the seller can ship it. Quotations have been advanced and are now as follows: Basic, $19@19.25; standard bessemer, $22@22.50; No. 2 foundry, $18.50@19; malleable bessemer, $19@19.25; and gray forge, $18.25@18.50, all at Valley furnace, the freight to Pittsburgh and Cleveland districts being 95c. per ton

BIRMINGHAM, ALA.—Sept. 26

Business in foundry iron has been very active for the past four weeks, and there have been also some sales of basic pig. The tonnage sold since the present movement began late in August has been a little over 200,000 tons. Most of this is for fourth-quarter delivery but quite a number of contracts run into 1917. Prices have been on a basis of $14.50@15 per ton for No. 2 foundry, Birmingham. There is not much to be had at $14.50 now, and $15 seems to be the assured price for the rest of the year.

The steel works at Ensley are very busy and are turning out ingots as fast as possible. Coke is in strong demand and prices are firm.

PITTSBURGH—Oct. 3

Conditions in the steel market have been relatively quiet in the past week, but a fair volume of business has been done. The mills are quite reserved in the matter of selling and are confining their operations chiefly to the making of sales of definite tonnages for specific uses. It is stated that they could book a much larger tonnage if they were willing to accept ordinary open contracts.

Steel prices show a further hardening tendency. Following the Carnegie Steel Co.'s advance last Tuesday of $2 a ton on shapes, to 2.70c., some of the independents are quoting the advanced price on some of their inquiries, and on corresponding business are quoting 2.70c. on bars also, the Carnegie bar price remaining at 2.60c. The regular 3.00c. price on plates is becoming nominal, higher prices being usually quoted even for the second half of 1917. The Steel Corporation is stated to have actual specifications against its plate production for 13 months. The American Sheet and Tin Plate Co. has advanced its prices $2 a ton on blue annealed to 3c. basis, and $3 a ton on black and galvanized, to 3.15c. and 4.40c. respectively, all for bessemer, openhearth sheets being 10c. per 100 lb. higher. Independents are gradually withdrawing lower prices. It is expected that books will be opened shortly, at the advanced prices, for first-quarter or first-half contracts. The advance in wire products predicted in some quarters has not occurred as yet.

The Sinclair Oil Co. has let about two-thirds of the 60,000 tons of line pipe required for 800 mi. of oil line, two independents joining in the sales, at slightly below the market for small lots, but at a high price for such a large tonnage.

Pig Iron—Pig iron has continued to stiffen, with fairly heavy buying and with reduced offerings. It appears that the furnace have little unsold tonnage to the middle of next year, bessemer being especially scarce. Among buyers of basic have been Republic, Newport and Middletown. Basic is 50c. higher, at least 15,000 tons having been sold at $19.50, Valley, for delivery October to January, inclusive. The French government is figuring on 25,000 tons of basic, foreign inquiry having hitherto been almost wholly of bessemer. Offerings of bessemer at the reputed market and even at higher prices are very limited. Foundry is stiffening with fair demand and prospects of reduced make on account of the call for basic. The market is strong as follows: Bessemer, $22.50; basic, $19.50; malleable and foundry, $19@19.50; forge, $18.50@19, f.o.b. Valley furnaces, 95c. higher delivered Pittsburgh. W. P. Snyder & Co. report average prices realized on all market sales of Valley iron in 1,000-ton lots and over in September at $21.9346 for bessemer, an increase of 93c., and at $18.63 for basic, an increase of 63c. The average quoted price of foundry iron in September was $18.58, Valley

Steel—The scarcity of unfinished steel promises to grow still more acute. While $45@50 is regarded as nominally the market for billets and sheet bars there are practically no offerings and it is probable that more than $50 would be bid for billets. It is certain that more would be bid for slabs. The Edgewater Steel Co., which expects to complete two open-hearth furnaces by the end of this year, has already sold the prospective output of ingots, until its rolling-mill capacity becomes available at an indefinite date later. Rods are nominal at $55@60 for soft, prices running up to $90 for high carbon.

Ferroalloys

Ferromanganese—The market has been firming up after the recent rather sharp competition between domestic and foreign producers and $165 is now quoted on contract for either, the claim being made that no shading is now possible. Prompt is quoted at $165. Buyers seem to be well covered and are not active in the market

Ferrosilicon is slightly easier. High grade 50%, is quoted at $86 in carload lots and down to $81 in 600-ton lots. A sharp demand for bessemer ferrosilicon continues and prices have been advanced $1 per ton by Ohio makers to a basis of $31, furnace, for 10%. It is estimated that recent sales of this metal have totaled at least 5,000 tons, some of which has been for export, and there is unclosed inquiry for 5,000 to 6,000 tons now in the market. One or two good-sized lots for foreign buyers are included in the latter

Spiegeleisen has been more in demand for export, sales running up to 1,000 tons. The market is represented by about $10, at furnace, for 20% material.

Foreign Iron

British Exports of Iron and Steel—Advance information to "Iron Age" regarding British exports of iron and steel and manufactures thereof is that the total for August, 1916, was £5,986,292, which exceeds the value for August, 1915, by £2,152,568 and that for August, 1914, by £3,690,941. Imports of iron ore, scrap iron and steel increased noticeably, the total value being £1,266,585, or an increase of £597,240 over August, 1915.

Japanese Iron Production—The Japan "Times" states that since the restriction of iron and steel exports from the west, more strenuous efforts have been put forth to obtain iron ores in Japan. These have been successful and the total output for May showed an increase of 67% over last year and that for the five months of the year an increase of 12%. The expectation is that in a few years the country's iron and steel output will be increased 300 to 500%.

German Steel Production in July, according to the statement of the German Iron and Steel Union, was 1,366,107 metric tons, an increase of 46,789 tons over June. For the seven months ended July 31 the total was: Converter, 1,186,234; openhearth, 3,873,124; direct castings, 592,887; crucible, 62,540; electric, 100,249; total, 9,126,234 tons. This is 1,842,285 tons more than for the eight months in 1915, but 1,839,142 tons less than in 1914.

Coke

Inquiries are in the market for blast-furnace coke for the first half of next year and one contract for about 10,000 tons per month of high-grade coke has been closed for that delivery at $3 per net ton at oven. It is expected that other contracts will be closed early in October. Indications favor higher prices for furnace coke for the first half of next year than ruled in the second half of this year. The demand for prompt furnace coke is active, and high grades readily bring $3 and in some cases $3.10 and in a few instances $3.25 per net ton at oven.

Connellsville—Spot furnace coke is up 25c., there having been sales for several days at $3.50, with $3.65 reported as being occasionally obtained. Production is restricted by labor scarcity, while the high prices obtainable for coal make coke quotations higher for both spot and forward. There is still larger inquiry in the market, and two contracts, for 7,000 or 8,000 tons a month each, have been put through at $3.25, one for the first quarter and the other for the first half of next year. This is now the usual quoting price, but it is understood there are some options still out at $3 or less. We quote: Spot furnace, $3.50; contract, $3.25; spot and contract foundry, $3.50@3.75, per net ton at ovens.

Chemicals

NEW YORK—Oct. 4

The general market continues strong with heavy chemicals in good demand at steady prices.

Arsenic—Absence of new buyers has resulted in an easier market. Immediate delivery easily secured of car lots at 5¾c. per lb. with smaller quantities held at 6c. per lb. Red arsenic, however, is reported very scarce and firmly held at about 65c. per lb. for spot

Copper Sulphate—Market still steady with grade, quantity and brand the determining factors in fixing prices. Spot offerings of small crystals have been made at 8½c. per lb. with prime large crystals quoted at 10@10¼c. per lb., according to quantity.

Nitrate of Soda—Valparaiso advices indicate undoubtedly stronger market with prices on the upgrade. Domestic markets easy with prices still favoring the buyers. Quotations range from $2.90@2.95 per 100 lb. for both spot and future.

Potash—Earlier reports of extensive deposits of potash salts discovered in Cuba are still lacking confirmation. Muriate of potash very firm and quoted at from $400@420 per ton

Sulphuric Acid—Prices continued steady, although it is reported that some contracts for 66° acid in tanks have been offered at $22 per ton and might be further shaded on a long-time contract. Spot prices reported for 66° at 1½c. per lb. with 1c. per lb. asked for 60° acid sold for prompt shipment.

Nitric Acid—Carboys of 42° acid quoted at 7c. per lb. for spot. Acqua fortis quoted at ½c. per lb. less than pure nitric acid. On long-time contracts sellers are reported to shade prices ½c. per lb.

Assessments

Company	Delinq.	Sale	Amt.
Alpha, Nev	Oct. 25	Nov. 15	$0.03
Andes, Nev	Oct. 11	Nov. 1	0.02
Beaver Mines, Utah	Sept. 30	Oct. 21	0.0025
Blue Bell, Ida	Oct. 9	Nov. 9	0.002
Blue Bull, Nev	Oct. 16	Nov. 20	0.01
Blue Star, Ida	Sept. 25	Oct. 21	0.02
Boston Dev., Utah	Sept. 27	Oct. 14	0.03
Buffalo Cons., Utah	Sept. 23	Oct. 14	0.005
Bull Valley, Utah	Oct. 10	Oct. 31	0.004
Cash Boy, Nev	Sept. 1	Oct. 15	0.01
Chief Cons. Ext., Utah	Oct. 10	Nov. 1	0.002
Consolidated Imperial, Nev	Oct. 25	Nov. 15	0.01
Con. Virginia, Nev	Sept. 29	Oct. 20	0.05
Diam. Blk., Butte, Nev	Oct. 12	Nov. 18	0.01
Eagle Mountain, Ida	Oct. 2	Nov. 4	0.001
Four Timbers, Ida	Oct. 1	Nov. 1	0.002
Giant, Ida	Oct. 5	Nov. 9	0.003
Gold Bond, Utah	Sept. 29	Oct. 24	0.001
Goldstrike Bon., Utah	Sept. 25	Oct. 16	0.0025
Great Western, Nev	Sept. 26	Oct. 18	0.01
Idaho-Nevada, Ida	Sept. 14	Oct. 14	0.002
Independent, Ida	Oct. 7	Nov. 7	0.005
Leonora, Utah	Sept. 27	Oct. 16	0.005
Manhattan Cons., Nev	Oct. 9	Nov. 8	0.01
Military, Ida	Oct. 25	Nov. 25	0.0001
Monarch-Pgh., Nev	Oct. 23	Nov. 27	0.01
Murray Copper, Utah	Oct. 9	Nov. 8	0.001
New Balbie, Mich	Oct. 14		1.00
North Tintic, Utah	Oct. 10	Nov. 1	0.002
Ophir, Nev	Oct. 25	Nov. 15	0.05
Rio Grande Grubstake, Nev	Sept. 22	Oct. 31	0.002
Royal Copper, Ida	Sept. 22	Oct. 22	0.001
Seg. Belcher, Nev.	Oct. 30	Nov. 24	0.02
Sierra Nevada, Nev	Oct. 12	Nov. 2	0.10
Silver Pick, Nev	Sept. 25	Oct. 30	0.01
Smuggler, Utah	Sept. 20	Oct. 18	0.005
Spearhead, Nev	Oct. 2	Nov. 2	0.01
Tarbox, Mont.	Sept. 28	Oct. 28	0.005
Tonopah-Bonanza, Nev	Sept. 19	Oct. 16	0.01
Umatilla, Nev	Sept. 18	Oct. 24	0.0025
Uvada, Nev	Oct. 9	Oct. 26	0.02
Diamondfield Bl'k B'tte, Nev.	Oct. 12	Nov. 18	0.01

Stock Quotations

SAN FRANCISCO Oct. 3 Name of Comp.	Bid.
Alta	05
Andes	08
Best & Belcher	05
Bullion	01
Caledonia	30
Challenge Con.	‡08
Confidence	20
Cons. Imperial	01
Con Virginia	14
Gould & Curry	03
Hale & Norcross	08
Jacket-Cr. Pt.	05
Mexican	16
Occidental	70
Ophir	19
Overman	06
Savage	11
Seg Belcher	02
Sierra Nevada	22
Union Con	61
Utah Con	02
Belmont	4 60
Jim Butler	90
MacNamara	05
Midway	23
Mont.-Tonopah	21
North Star	16
Rescue Eula	24
West End Con	77
Atlanta	09
Blue Bell	‡01
Booth	12
C.O.D. Con	03
Comb. Frac	06
D'field B.B.	03
D'field Daisy	06
Jumbo Extension	36
Round Mountain	39
Sandstorm Kendall	03
Silver Pick	21
Central Eureka	04
Argo	10
Ariz. Central	15
Big Jim	1 37
Lazy Boy	10
Oatman No. Star	14
Tom Reed	2 00
United Eastern	3 62
United Western	06

LONDON	Sept. 21
Alaska-Mexican	£0 17s 6d
Alaska Tre'dwell	4 5 0
Burma Corp.	4 2 6
Cam & Motor	0 11 0
Camp Bird	0 7 6
El Oro	0 9 6
Esperanza	0 11 6
Mexico Mines	3 17 6
Nechi, pfd	0 12 9
Oroville	0 16 6
Santa Gert'dis	0 12 0
Tomboy	1 1 6

SALT LAKE Oct. 3 Name of Comp.	Bid
Big Four	1 00
Black Jack	09
Cardiff	7 50
Colorado Mining	19
Crown Point	06
Daly-Judge	7 80
Emma Con	3 50
Gold Chain	23
Grand Central	74
Iron Blossom	1 57½
Lower Mammoth	05
May Day	13
Opohongo	01½
Prince Con	1.35
Seven Troughs	03
Silver King Coal'n	2 97½
Silver King Con	3 70
Sioux Con	16
So. Hecla	2 05
Uncle Sam	04
Wilbert	06½
Yankee	16

COLO. SPRINGS	Oct. 3
Acacia	03
Cresson	6 12
Doctor Jack Pot	09½
Elkton Con	15
El Paso	44
Findlay	03½
Gold Sovereign	06
Golden Cycle	2 33
Granite	73
Isabella	21
Jack Pot	05
Jerry Johnson	‡01
Mary McKinney	31
Portland	1 00
Vindicator	1 96

TORONTO	Oct. 3
Adanac	‡25
Bailey	07½
Chambers Ferland	19
Coniagas	4 55
La Rose	58
Peterson Lake	23
Right of Way	05
Seneca Superior	29
T. & Hudson Bay	70 00
Temiskaming	64
Wettlaufer-Lor	11
Dome Exten	35
Dome Lake	56
Foley O'Brien	62½
Hollinger	6 75
Jupiter	27
McIntyre	1 46
Newray	70
Porcu. Crown	66
Vipond	36
West Dome	36

N. Y. EXCH. Oct. 3 Name of Comp.	Clg.
Alaska Gold M	12¼
Alaska Juneau	7
Am.Sm.&Ref.,com	113½
Am. Sm. & Ref., pf.	116½
Am. Sm. Sec., pf. A	96
Am. Sm. Sec., pf B	88
Am. Zinc	41⅜
Am. Zinc, pf.	75
Anaconda	96¼
Batopilas Min	1¼
Bethlehem Steel	550
Bethlehem Steel, pf.	137
Butte & Superior	64½
Chile Cop.	21¼
Chino	56¼
Colo. Fuel & Iron	60½
Crucible Steel	95
Dome Mines	25
Federal M. & S.	16
Federal M. & S., pf.	41
Great Nor., ore ctf	45⅜
Greene Cananea	51
Homestake	130
Inspiration Con.	66¼
International Nickel	54¼
Kennecott	55⅜
Lackawanna Steel	87¼
Miami Copper	38⅜
Nat'l Lead, com.	69⅜
National Lead, pf	116¼
Nev. Consol.	22⅜
Ontario Min	‡7
Quicksilver	2⅜
Quicksilver, pf	4
Ray Con	25½
Republic I&S, com.	81⅜
Republic I&S, pf.	112¼
Sloss-Sheffield	64¼
Tennessee Copper	24⅜
Utah Copper	95¼
U. S. Steel, com	117½
U. S. Steel, pf.	121¾
Va. Iron C. & C.	47½

N. Y. CURB	Oct. 3
Beaver Con.	42
Buffalo Mines	1 00
Butte & N. Y.	1½
Butte C. & Z.	6⅜
Caledonia	.59
Can. Cop. Corpn	1⅜
Cashboy	.07
Cerro de Pasco	39½
Con. Ariz. Sm.	1½
Con. Coppermines	2⅞
Con. Nev.-Utah	.28½
Crystal Cop.	1¼
First Nat. Cop.	5
Florence	.72
Goldfield Con.	60
Goldfield Merger	.07
Granite	39
Hecla Min	5⅜
Howe Sound	5
Jerome Verde	2¼
Joplin Ore & Spel.	‡52
Kerr Lake	4¾
Magma	18¾
Majestic	.62
McKinley-Dar-Sa	62
Mother Lode	.34½
Nevada Hills	20
N. Y. & Hond.	15¼
Nipissing Mines	8¼
Oro	.03
Ray Hercules	3⅜
Rochester Mines	54
St. Joseph Lead	18
Standard S. L.	1½
Stewart	25
Success	36
Tonopah	5
Tonopah Ex.	5¼
Tribullion	¼
United Verde Ext.	40½
United Zinc	4½
White Knob, pf.	1⅜
White Oaks	4⅞

BOSTON EXCH Oct. 3 Name of Comp.	Bid
Adventure	4¼
Ahmeek	105
Algomah	1¼
Allouez	69¼
Ariz. Com., ctfs.	13¼
Bonanza	40
Butte-Ballaklava	2
Calumet & Ariz.	76
Calumet & Hecla	585
Centennial	23
Copper Range	70
Daly West	2½
East Butte	16½
Franklin	8
Granby	92½
Hancock	11
Helvetia	35
Indiana	3
Island Cr'k, com.	44
Island Cr'k, pfd.	90
Isle Royale	33
Keweenaw	6¼
Lake	14½
La Salle	5
Mason Valley	4½
Mass	15
Mayflower	2¼
Michigan	4
Mohawk	93
New Arcadian	7
New Idria	13
North Butte	22
North Lake	2½
Ojibway	1¼
Old Colony	2
Old Dominion	71
Osceola	89¼
Quincy	90
St. Mary's M. L.	88
Santa Fe	2¼
Shannon	9½
Shattuck-Ariz.	30½
So. Lake	6⅜
So. Utah	.35
Superior	17
Superior & Bost.	4¼
Tamarack	40⅜
Trinity	7¼
Tuolumne	57
U. S. Smelting	75¼
U. S. Smelt'g, pf.	52
Utah Apex	4⅜
Utah Con	15
Utah Metal	8⅜
Victoria	4¼
Winona	5¼
Wolverine	48
Wyandot	1¾

BOSTON CURB	Oct. 3
Bingham Mines	11½
Boston Ely	97
Boston & Mont.	99
Butte & Lon'n Dev	75
Calaveras	5¼
Calumet-Corbin	.02½
Chief Con	2
Cortez	35
Crown Reserve	55
Davis-Daly	2¼
Eagle & Blue Bell	$1\frac{5}{16}$
Houghton Copper	1½
Iron Cap Cop., pf	5½
Mexican Metals	33
Mines of America	2½
Mojave Tungsten	4⅜
Nat. Zinc & Lead	80
Nevada-Douglas	1¼
New Baltic	1⅞
New Cornelia	17¼
Ohio Copper	12
Oneco	80
Raven Copper	‡07
Rex Cons.	29
Rilla	.14
Yukon Gold	2¼

‡Last Quotations.

Monthly Average Prices of Metals

SILVER

Month	New York			London		
	1914	1915	1916	1914	1915	1916
January	56.572	48.855	56.775	26.553	22.731	26.960
February	57.506	48.477	56.755	26.573	22.753	26.975
March	58.067	50.241	57.935	26.788	23.708	27.597
April	58.519	50.250	64.415	26.958	23.709	30.662
May	58.175	49.915	74.269	26.704	23.570	35.477
June	56.471	49.034	65.024	25.948	23.267	31.060
July	54.678	47.519	62.940	25.219	22.597	30.000
August	54.344	47.163	66.083	25.979	22.780	31.498
September	53.290	48.680	68.515	24.260	23.591	32.584
October	50.654	49.385	.....	23.199	23.925	.....
November	49.082	51.714	.....	22.703	25.094	.....
December	49.375	54.971	....	22.960	26.373	.....
Year	54.811	49.684		25.314	23.675	.

New York quotations cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

COPPER

Month	New York		London			
	Electrolytic		Standard		Electrolytic	
	1915	1916	1915	1916	1915	1916
Jan	13.641	24.008	60.756	88.083	65.719	116.167
Feb.	14.394	26.440	63.494	102.667	*	133.167
Mar.	14.787	26.310	66.152	107.714	*	136.000
April	16.811	27.895	75.096	124.319	*	137.389
May	18.506	28.625	77.600	135.457	*	152.522
June	19.477	26.601	82.574	112.432	95.333	137.455
July	18.796	23.865	76.011	95.119	91.409	125.500
Aug.	16.941	26.120	68.673	110.283	82.333	126.304
Sept.	17.502	26.855	68.915	113.905	85.250	134.071
Oct.	17.686	......	72.601	...	88.000	....
Nov.	18.627	......	77.744	......	93.273	..
Dec.	20.133	......	80.773	.....	100.43	...
Year.	17.275	......	72.532	....	....	....

TIN

Month	New York		London	
	1915	1916	1915	1916
January	34.260	41.825	156.550	175.548
February	37.415	42.717	176.925	181.107
March	48.426	50.741	180.141	193.609
April	47.884	51.230	166.225	199.736
May	38.790	49.125	162.675	196.511
June	40.288	42.231	167.636	179.466
July	37.423	38.510	167.080	168.357
August	34.389	38.565	151.440	169.870
September	33.125	38.830	152.625	171.345
October	33.080	....	151.554	.
November	39.224	....	167.670	..
December	38.779	....	167.000	...
Av. year	38.590	....	163.960	.....

LEAD

Month	New York		St. Louis		London	
	1915	1916	1915	1916	1915	1916
January	3.729	5.921	3.548	5.826	18.606	31.167
February	3.827	6.246	3.718	6.164	19.122	31.988
March	4.053	7.136	3.997	7.375	21.883	34.440
April	4.221	7.630	4.142	7.655	21.094	34.368
May	4.274	7.463	4.182	7.332	20.347	32.967
June	5.932	6.936	5.836	6.749	25.170	31.011
July	5.659	6.352	5.531	6.185	24.611	28.137
August	4.656	6.244	4.520	6.088	21.946	29.734
September	4.610	6.810	4.490	6.699	23.151	30.786
October	4.600	......	4.499	......	23.994	......
November	5.155	......	5.078	......	26.278	......
December	5.355	......	5.266	......	28.807	......
Year	4.673	......	4.567	......	22.917	......

SPELTER

Month	New York		St. Louis		London	
	1915	1916	1915	1916	1915	1916
Jan.	6.386	16.915	6.211	16.745	30.844	89.810
Feb.	8.436	18.420	8.255	18.260	39.819	97.762
Mar.	8.541	16.846	8.360	16.676	44.141	95.048
April	10.012	16.695	9.837	16.525	49.888	99.056
May	14.781	14.276	14.610	14.106	68.100	94.217
June	21.208	11.752	21.038	11.582	100.614	68.591
July	19.026	8.925	18.856	8.755	97.250	50.750
Aug.	12.781	8.730	12.611	8.560	67.786	51.587
Sept.	13.440	8.990	13.270	8.820	67.841	52.095
Oct.	12.800	......	12.596	....	66.536	...
Nov.	15.962	......	15.792	....	88.409	.....
Dec.	15.391	......	15.221	.....	89.400	....
Year	13.230	......	13.054	....	67.553	....

New York and St. Louis quotations, cents per pound, London, pounds sterling per long ton. * Not reported.

PIG IRON IN PITTSBURGH

Month	Bessemer‡		Basic‡		No. 2 Foundry	
	1915	1916	1915	1916	1915	1916
January	$14.59	$21.60	$13.45	$18.78	$13.90	$19.70
February	14.55	21.16	13.45	18.93	13.90	19.51
March	14.55	21.81	13.45	19.20	13.95	19.45
April	14.55	21.65	13.45	18.95	13.95	19.45
May	14.61	21.78	13.60	19.11	13.83	19.58
June	14.70	21.95	13.67	18.95	13.77	19.34
July	14.94	21.95	13.91	18.95	13.68	19.20
August	16.01	21.95	15.31	18.95	14.75	19.25
September	16.86	......	15.95	......	15.70	.....
October	16.95	......	15.96	......	15.80	.....
November	17.57	......	16.47	......	17.20	.....
December	19.97	......	18.44	......	18.95	.....
Year	$15.82	......	$14.76	.	$14.95	....

‡As reported by W. P. Snyder & Co.

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4193—**ANTIMONY PRODUCTION** [illegible] H[illegible] Province, S. China A. S. Wheler (B[illegible] and 115, I. M. M, 1916; 5 pp., [illegible] contributed remarks on paper [illegible]

4194—**BAUXITE AND ALUMIN**[illegible] W. C Phalen. (Mineral Re[illegible] 1915 Part I; 16 pp., illus.)

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Engineering and Mining Journal

VOLUME 102 OCTOBER 14, 1916 NUMBER 16

Institute Meeting in Arizona

By P. E. Barbour and R. D. Hall

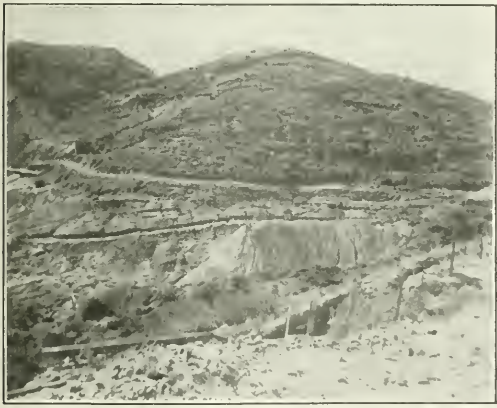
SYNOPSIS—Details of visit of the American Institute of Mining Engineers to the big mines and reduction works of Arizona, the Roosevelt Dam and the Grand Cañon. A special train of 14 cars, including two private cars of copper magnates, were required for the party. Incidents of the most successful trip of the Institute with the members at work and at play.

The 113th meeting of the American Institute of Mining Engineers came to a fitting end at the Grand Cañon, Arizona, Sept. 25. The visit of the Institute to Arizona was the most successful of a long list of successes of this kind, and after visiting so many wonderful mines, milling and smelting plants, and after having had such a strenuous good time, the Grand Cañon alone could be a climax.

A comparatively small party started from New York Sept. 14, but had increased sufficiently on reaching Chicago to be given an interesting drive through Washington and Jackson Parks and a banquet at La Salle Hotel. The private car "Anaconda," of B. B. Thayer, was attached to the A.I.M.E. special here and proceeded to El Paso, where the party was augmented by the addition of various Texas, Colorado and Arizona members, including the Arizona committee.

Sunday, the day of arrival, was spent visiting the city, its National Guard camps, Fort Bliss, the busy streets full of soldiers and the El Paso smeltery. This plant, originally a lead-smelting installation, has been transformed, owing to cessation of lead shipments from Mexico and the increase of copper shipments from Arizona, into a smelting plant in which copper is the leading product. One of the most interesting features of the remodeled and enlarged plant was the new and largest Peirce-Smith converter, 13 ft. diameter, which is taking three times as much air as its 11-ft. predecessor and is expected to establish a new record for copper converted.

Karl Eilers and P. A. Mosman, who had been in the West more than a month making a regular tour of the American Smelting and Refining Co.'s plants, conducted the party through the El Paso plant and continued with them to Arizona.



HILLSIDE, AT MIAMI, SHOWING "BLOCK FAULTING" DUE TO UNDERGROUND CAVING

PIVOTED CONVEYOR FOR WASTE AT OLD DOMINION SHAFT NEAR GLOBE, ARIZ.

On Sunday evening a most interesting banquet was served at the Toltec Club, about 175 being present. The menu consisted wholly of Mexican dishes the nature of which could not be always anticipated by those visiting guests who were not familiar with Mexican cooking. On each menu card was pinned a small Mexican sombrero, about 1½ in. diameter, which every guest promptly pinned on his or her coat lapel. A Mexican band dispensed music in true Mexican style throughout the evening and gave the Mexican atmosphere and helped to make the evening enjoyable.

After this banquet the party motored to its train and encountered the first of a series of carefully planned and most successfully executed arrangements by the Arizona committee. In a way big things would be expected of those prematurely gray young men who are guiding the destinies of the big Arizona properties, but even so, the most frequent comments regarding the trip related to the ever surprising perfection of the committee's arrangements. Elaborately illustrated booklets containing the program of the trip, many illustrations and data of Arizona mines and reduction works were distributed as the train started.

Entertainment and Instruction at Santa Rita

Early in the morning the party arrived at Santa Rita, N. M., to be awakened fittingly by the sound of blasts in the Chino opencuts. After breakfast bunting-decorated flat cars provided with seats took the party to the steam-shovel pits of the Chino Copper Co. On their return the guests were offered a choice of trips—a descent into the openpits, a visit to the iron mine at Fierro, an inspection of the new crushing plant on the road to Hurley, or a trip to the Empire Zinc Co.'s mine, mill and magnetic separator at Hanover.

Hordes of automobiles ("hordes" is the word) were at the service of members at every turn, and the most strenuous trip of the Institute was in full swing. At noon all returned to Santa Rita, where genial John Sully, the general manager, gave a barbecue on the concrete tennis courts, over which had been stretched a huge canvas tent. The excellent band of the Eleventh U. S. Cavalry, from Fort Bayard near-by, played most entertainingly before and during the dinner. At each plate at the dinner was a large specimen of Chino native copper. Not the least interesting part of the entertainment was furnished at the extemporized "Chino Bar, for Ladies and Gentlemen." It was a real bar, too. Mr. Sully explained that he had to do that because Arizona was dry and he knew a lot of his Arizona friends were coming to visit him.' Somebody had stolen a safety-first sign from the automobile roadway and hung it behind the bar, reading "Slow up," which admonition proved reasonably efficacious.

Outside the Chino office were many interesting specimens of ore and old relics of Spanish mining—the Santa Rita mines having been worked almost two centuries ago. There were old bullhide bags and rawhide ropes, chicken ladders and sets of mining timber framed in typical old Mexican style, with the caps resting on posts between two horns projecting from the posts. There were sheets of native copper, some of them 4 or 5 ft. across, and one chunk of chalcocite, recently found, weighing 1,300 lb.

When the time for leaving Santa Rita arrived, if Mr. Sully's Arizona friends expressed any regrets about leaving, they were again at ease when the automobiles landed the party at the Chino mill at Hurley, 10 mi. away, and "Sully's Second Free Thirst Quencher" was met.

The Chino mill was open to all visitors, and the interesting flotation work was explained and investigated with great interest. Souvenir bottles were given containing three layers of different colors—the black sulphide concentrates on the bottom, the green carbonate flotation concentrates next, and the red copper on top, which had been precipitated on iron, then "rumbled" off and floated.

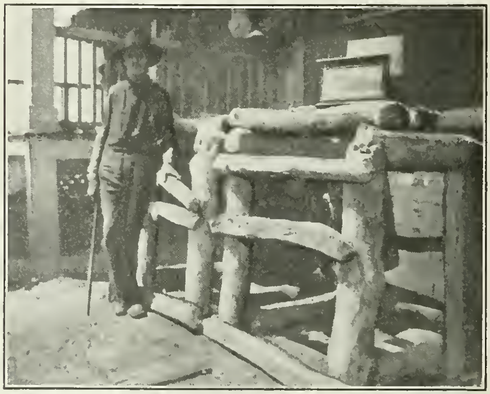
The visitors were much interested in the Chino type of concentrate car, also in the new type of cooling towers that are being added at the power plant to replace the old-style wooden towers now used.

After visiting the mill, the party was carried in automobiles to the series of tailings dams, which are so constructed that all the water is conserved and the tailings also. The latter are to be treated in a flotation plant now in the process of construction at that point.

After dinner in the dining car, an open-air dance was given on an elevated pavilion erected and lighted fo the occasion, the Eleventh U. S. Cavalry band again providing most acceptable music. When the train pulled out that night, a tired but happy party conceded it to have been "some day."

The Meetings and Visits at Douglas

Tuesday morning the A.I.M.E. special, of 14 cars, reached Douglas, where the Sixth U. S. Artillery band was playing martial music and automobiles were waiting to take the party to the Copper Queen smeltery. On entering the plant the dusty crowd was tempted by the spray cooling system, which looked like an inverted shower bath. This method of cooling power-plant water is becoming particularly popular in the Southwest. It is used also at the Inspiration and Miami plants. An addition is being built to the roaster building to accommodate four more units, which will make the number 20 in all.


TIMBERING FROM OLD SPANISH WORKINGS NEAR SANTA RITA, N. M.

Special interest was shown in the casting machines and the million-dollar pile of blister copper stacked up outside because the refinery in the East could not handle it. The oil-fired reverberatories also attracted attention. Pamphlets were distributed showing the flow sheet of the plant and data of equipment and operating details.

The A.I.M.E. train had been switched into the yard and took the party over to the Calumet & Arizona plant. The ore-bedding system and the reclaiming machine attracted much interest and aroused some discussion as to the loss by dusting during dropping the ore from the conveyors to the beds. This loss is admitted, but it is ore and is not considered serious. With the rich concentrates at Inspiration, however, specially designed cars were made to prevent any such loss in handling the products, and bedding and mixing are done in a covered building.

The new sulphuric-acid plant held interest for a considerable time. Much of the interior steel work was in place and one lead-lined chamber was almost completed. The Great Falls type of basic converter is used at this plant and also at the Copper Queen.

At noon a buffet lunch and hot coffee were served at tables under the blast-furnace dust chamber, which is a sufficient commentary on the cleanliness of the plant and its freedom from dust. The military band supplied popular music and when the A.I.M.E. train was taken back to Douglas and backed down to the Y.M.C.A. for the technical session, the band went along on its special car—a flat fitted up with seats and railings.

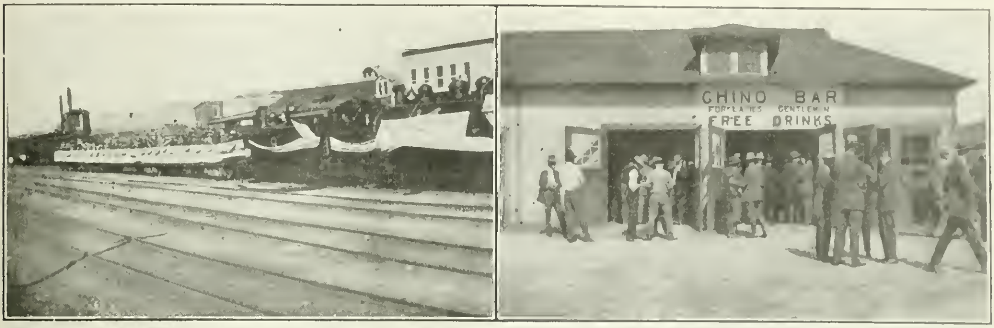
Artistic booklets of the smeltery were distributed showing various sections of the plant, plan and elevation of the sulphuric-acid plant, flow sheets and complete operating and equipment data.

Two technical sessions were held, afternoon and evening, and the usual welcoming speeches, etc., made.

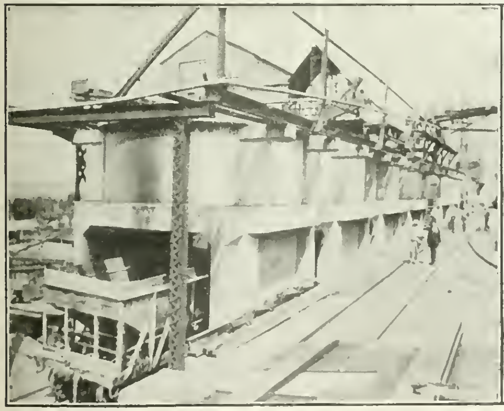
The Douglas meeting was opened by Dr. L. D. Ricketts, and Walter Douglas presided. J. C. Greenway, of the Calumet & Arizona Co., Warren, Ariz., made the address of welcome, saying, "Whatever of hospitality there is at hand, we offer you without measure." L. D. Ricketts responded, saying that he was both guest and host and therefore could not make an adequate reply. He called upon B. B. Thayer, who said that between six and eight of the happiest years of his life were spent in Arizona. Dr. James Douglas, he said, had done more for the Southwest than ever he had. The services of Dr. Douglas had been fittingly recognized in the naming of the town in which they were meeting. As in none of the smelteries of the region would you fail to find some of the handiwork of Dr. Ricketts, he proposed that some such thriving town as Douglas provide for the perpetuation of his name.

The paper of A. G. McGregor, on "Features of New Copper-Smelting Plants in Arizona," elicited the comment of Dr. Ricketts that the three lines of improvement in smelting had been cheaper cost in handling, larger units and decreased loss of copper. He felt that the chief loss is possibly in the discharge from calcine cars. Later the discussion reverted to the losses in unloading from railroad cars. S. J. Jennings, of the United States Smelting, Refining and Mining Co., declared the dry and high winds of Arizona might well carry off large quantities of dust. He pointed out that the volcanic dust resulting from the explosion of Krakatoa traveled twice around the world.

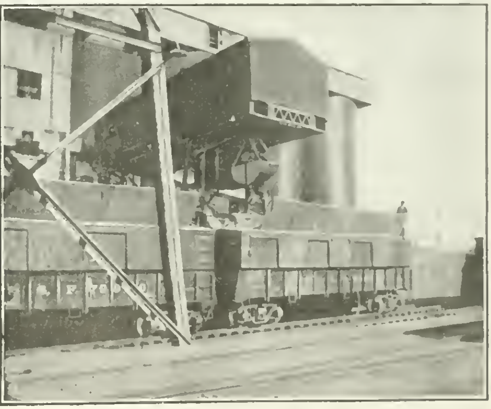
A. G. McGregor said that the need for the protection of the dumped material depended on its percentage of copper. Precautions were justified at the Miami plant because the material handled was of such high grade.



THE A. I. M. E. PARTY EN ROUTE TO INSPECT THE CHINO COPPER PROPERTY



CONCRETE CONCENTRATE BINS AT THE OLD DOMINION WORKS



CONCENTRATE CARS OF THE CHINO COPPER CO. AT HURLEY, N. M.

Dr. Ricketts condemned the dropping of material in the open and the practice of leaving bins uncovered. He showed that though in the past many losses were allowed to occur without explanation, we were now approaching a time when we would not permit any of these losses to occur. The Cottrell system is most successful in reducing the loss in dust. There is still a small loss when turning the converters up or down. In drying there are no losses, and the dust losses from the reverberatories are negligible and do not justify the installation of any collection system. In fact the reverberatory losses are about 0.18%. Of all losses, as he said before, none equal those from the discharge of the calcine cars.

Results with Basic-Lined Converters

F. N. Flynn's paper on "Smelting at the Arizona Copper Co.'s Works" aroused much discussion. L. O. Howard declared than the gross output of one converter at the Old Dominion smeltery at Globe—70 million pounds of copper—was only attained owing to the excellent grade of the matte and to the great care taken of the lining.

E. P. Mathewson, of the Anaconda Copper Mining Co., Anaconda, Mont., said that when converters of the Great Falls type are tilted, the tuyeres are not all equally covered and splashing results. But the silica is more readily distributed than in the Peirce-Smith type. The linings in the Northwest last almost indefinitely, but for the best results the silica must be kept low in the furnace and the ore should be magnetic in character.

Later the discussion turned to the dust losses, and Mr. Mathewson declared that "metallurgy is the art of making money from ore," and so good practice would never permit us to save anything out of which no profit could be made. By using large dust chambers the gas could be caused to travel at reduced speed and it could also be cooled sufficiently. But there was no advantage in excessive cooling such as might be obtained by drenching the gas with water, for if the sulphur dioxide is rendered too cool, it just rises to the top of the stack and rolls down on the surrounding territory, whereas if the temperature is high enough, the gas will rise and diffuse over a larger area, the physicists to the contrary notwithstanding. There is no market in the Northwest or the Southwest for much of the dust that goes out with the smoke.

Dr. James Douglas telegraphed his congratulations to the institute, and the meeting instructed Dr. Ricketts to make a suitable reply to his kindly greetings.

The Arizona drought was encountered here, but the Y.M.C.A. had large bowls of enticing looking but perfectly harmless punch labeled, "Arizonhauser," which was sufficient unto the need.

The ladies of the party were entertained at tea at the Country Club, and a general gathering there in the evening followed the technical session. B. B. Thayer held an informal reception of many members of the Montana National Guard stationed at Douglas.

The run to Bisbee was made during the night, and after breakfast another horde of automobiles, all duly tagged and numbered, were at hand for the various trips arranged. It is a standing joke in all the places visited thus far that almost every new auto means United Verde Extension money, and this was true also at Globe and Miami.

Four different trips were arranged for this day, it being possible for each party to make only one. The underground inspection of the Calumet & Arizona Mining Co. included a change of clothing at the Junction shaft and entrance through the concreted 5-compartment shaft to the 1,100-, 1,200- and 1,400-ft. levels and thence to the Briggs mine and the 30 and 93 stopes in the Tintown vein, at the southeastern end of the developed area, where rich oxidized ore occurs in a well-defined steep vein. Mining is by the square-set method and by underhand stoping with stringers.

In the 96 stope, in the large Briggs sulphide orebody east of the shaft, the ore is solid pyrite with chalcopyrite and a little bornite in irregular replacement bodies. A modified Mitchell slicing system is used.

In the Junction mine, 1,500 level, stope 88 is a very large pyrite, chalcopyrite and bornite body, which is mined by the Gilman cut-and-fill system. Both mining and filling operations were shown to the visitors. They also visited stope 48, which is located in a body of siliceous breccia cemented by pyrite and chalcopyrite and is mined by the cut-and-fill system. This is the largest cut-and-fill stope yet opened up.

Some of the visitors entered by the Briggs and returned by the Junction shaft. On reaching the surface everybody had a shower in the men's changehouse. New underground clothes, new sou'westers and new bath towels were provided—the Arizona committee had not overlooked anything for the comfort or interest of the party.

The Copper Queen mines have 150 mi. of workings, 75 of which have been driven recently and 50 of which are now open. Three different trips were arranged here.

The underground trip to the Neptune tunnel was arranged for those desiring to see the deposit of disseminated sulphides in the main porphyry stock of Sacramento Hill. The metamorphic limestone adjacent to the hill was visited and a body of enriched sulphides along the famous Dividend fault, which is being mined by top-slicing, was shown to those who made this trip.

Sacramento Division of Copper Queen

The underground trip to the Sacramento division was arranged for those desiring to see the following features: Orebodies in the main contact zone around Sacramento Hill and in limestone showing all stages of primary mineralization, enrichment, impoverishment and oxidation; good examples of the prevalent methods of square-setting and top-slicing in the district; and in addition, the main ore-hoisting shaft, recently concreted while in operation.

The surface and underground mechanical trip was principally for those interested in the mechanical equipment in use in the camp. The Sacramento main hoisting shaft of the Copper Queen, recently concreted while in operation, together with the surface ore-loading plant, and hoisting engines were visited first, followed by inspection of the central power house, the central tool-sharpening plant and the central sawmill of the Copper Queen, the Oliver power plant and the Junction power plant of the Calumet & Arizona, together with the great underground pumping stations of the Calumet & Arizona in the concrete Junction shaft, from which practically all the water in the district is pumped.

Ore from the Sacramento shaft is conveyed down an inclined belt conveyor to the ore-bedding system under cover in the gulch below. Looking down on these long roofs, Kuno Doerr, manager of the El Paso smeltery, asked what they were and being informed it was the bedding plant exclaimed: "Ah! Here are some gentlemen in the mining business: they bed their ore before sending it to the smelter."

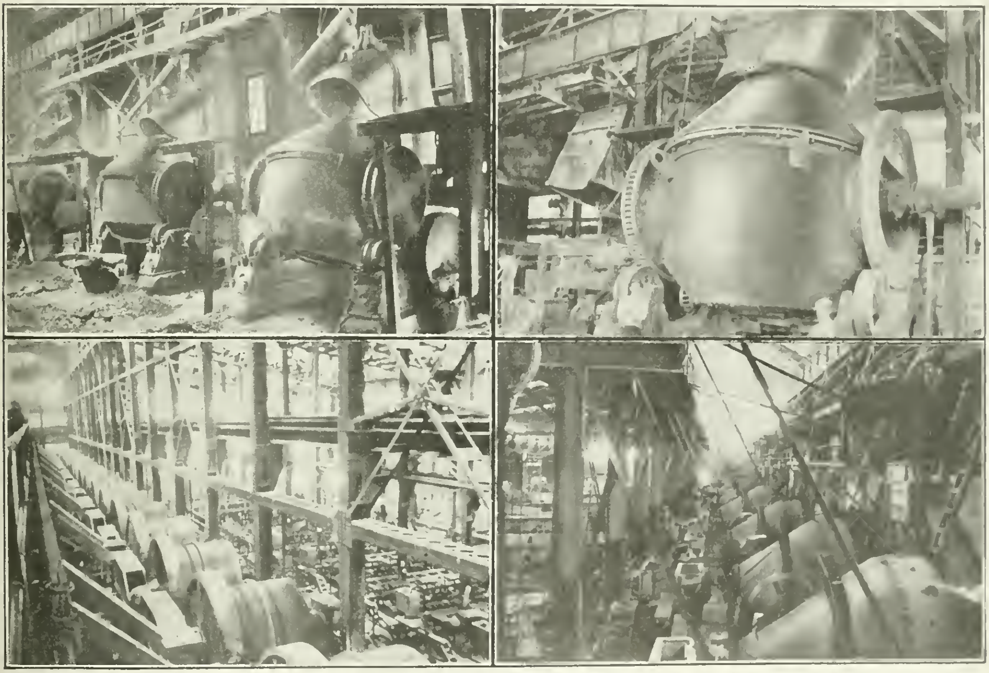
Many visited, during the afternoon, the Copper Queen experimental plant where, under the guiding hand of G. D. Van Arsdale, of Phelps, Dodge & Co., the sulphidizing and flotation of Morenci carbonate tailings were being tried out.

The technical session in the afternoon was held in a new and remarkable high-school building. The discussion tended largely toward the sociological side of mining, and the meeting adjourned early in preparation for the evening's banquet.

It was brought out at the technical session that the Copper Queen mines 10 tons of ore for each foot of development work done. Mr. Goodale said that the Anaconda mined 9 tons of ore for each foot of development work. Later, at the Inspiration, the data given showed that with their system of mining and under their peculiar conditions 29 tons per foot of development was mined.

In the discussion on the "Geology of the Warren Mining District," contributed by Y. S. Bonillas, J. B. Tenney and Leon Feuchère, F. L. Ransome said that while the dikes at Ray and at Globe may be identical, it is not safe to assume their identity without at least more reconnoissance between those points. L. C. Graton said that it was generally understood that you could prove any theory at Bisbee, the geologic indications favoring the most divergent views. He added that in no other district had such careful microscopic work been done.

The article on "Coöperative Effort in Mining," by Joseph P. Hodgson, was discussed by J. A. Ede, of the Illinois Zinc Co., La Salle, Ill., and by C. W. Goodale, of the Anaconda Copper Mining Co., Butte, Mont. The latter said that success in the promotion of safety could not be attained if the whole reliance was placed on the vigilance of shift bosses, for it was impossible to provide so many of these officials that their work would be sufficient. It has therefore been the practice of the Anaconda company to lay men off for 7 days for working under unsafe ground. The period of suspension is made 14 days for the second offense and the man who is caught exposing himself to such risk for the third time is discharged. Thus the evil is corrected at its source. The smelting accidents are not so readily reduced as those around the mines; the hazards at the smelting plants were so many and various that the process of education was not so easy as in the mines.



INTERIOR VIEWS AT SOME REDUCTION PLANTS VISITED IN ARIZONA

The upper views show Great Falls type converters at the Calumet & Arizona smeltery at Douglas and at the Old Dominion smeltery at Globe. The lower views show regrinding equipment—the left hand being the Marcy mill installation at Inspiration and the right hand the Hardinge mill installation at Miami

Mr. Hodgson stated that it was useless to waste time attempting to teach men who were so set in their ways that they could no longer learn anything. It was [illegible] to put some young fellow under instruction for 7 to 14 days, in which time he would learn to handle the work and understand the system. D. W. Brunton stated that the speed in driving headings had been increased from 250 to 750 ft. a month by carefully training the men who performed the work. Three shifts and three drills were used and the headings driven measured 7x8 ft. The increase was the natural outcome of careful training.

Banquet at the Warren Country Club

At Bisbee the Calumet & Arizona company distributed another well-printed, interesting and informative booklet illustrative and descriptive of the mines. A banquet was served at the Warren Country Club during the evening The headquarters of this organization are beautifully situated at the mouth of the cañon overlooking the broad San Pedro valley. Just behind the clubhouse was the camp of the Twenty-Second U. S. Infantry and the District of Columbia militia. A battalion parade was given for the members before the dinner, which banquet needs favorable comment because it was wonderfully well done considering the number served and the difficulties encountered in catering in the desert.

The speech making was especially pleasing, which ordinarily is not the case. Philip N. Moore, vice-president of the A.I.M.E., made an excellent toastmaster and introduced the following toasts and speakers: "Welcome to Arizona," C. T. Knapp; "Arizona, Old and New," L. D. Ricketts; "Arizona Present," Walter Douglas; "The American Mining Congress," Carl Scholz; "Why We Are Here," Colonel Tillson, Twenty-Second U. S. Infantry; and "Ave et Vale," by John Mason Ross.

Dr. Ricketts' speech was largely an appreciation of Dr. James Douglas. Walter Douglas in introducing his toast expressed confidence in the ultimate outcome in Arizona when the period of somewhat rash experiment in government came to an end. He spoke in a somewhat different vein to the lawyers regarding the prohibition law, which he did not in any way regret, though it appeared at first sight an interference with personal liberty. Carl Scholz declared the American Mining Congress aimed to keep a line between the cranks and the crooks and to prevent the disturbing effect which the ill-considered plans of the first and the dishonesty of the second visited on the mining public in all parts of the country.

In introducing Colonel Tillson, Mr. Moore said that he had noticed that the middle names of all military men began with "D" and stood for "discreet." but nevertheless it might be that the colonel would tell why they were here. The colonel justified Mr. Moore's observation by saying it was a soldier's duty to go where he was sent and do what he was told; that he had been sent there and told to make a speech, and that therefore he was there to speak and the others to suffer. But the latter did not prove true, because he made the most-polished and pleasing speech of the evening. At the proper time the special train drew up near the club, the party broke up and the members entrained and started for Globe, Walte Douglas' private car "Nacozari" being attached here.

The party arrived at Globe about 10 a.m. Thursday, Sept. 21. Here also many automobiles were waiting to take the visitors to the Old Dominion reduction works. One of the most noticeable features of the surface equipment is the pivoted inclined belt conveyor for handling the waste rock from the mine. The feed end of the conveyer is pivoted, and the discharge end can be swung through a wide arc, thus making cheap disposal of the waste possible.

The Great Falls type basic converter which made 70,000,000 lb. of copper without relining attracted much attention, as did the flue-dust-and-gas measuring and testing arrangement at the base of the big stack. Owing to the increased amount of fine concentrates and the sulphur content, it is anticipated that this plant will at an early date be remodeled or replaced with roasting and reverberatory-smelting equipment.

In the afternoon, while the ladies were being entertained at the Cobre Valle Country Club, a technical session was held, followed by another in the evening.

Methods of Controlling Mine Fires

The papers on mining and stoping methods did not bring out much discussion, but it was around the paper on "Mine-Fire Methods Employed by the United Verde Copper Co.," by Robert E. Tally, that most of the discussion centered.

It was the opinion of those who had done most underground fire fighting that the only way to extinguish such a fire was to put water on it. To be able to do this, the Copper Queen devised a motor-driven blower mounted on a truck equipped with 1,500 ft. of wire and 500 ft. of 10-in. air pipe. This car has a regular station and can be quickly dispatched to any point from which a fire alarm is sounded. The air blown in beats back the smoke and in several cases this outfit has enabled the men to reach the actual fire and quench it with water.

C. W. Goodale read C. L. Berrien's discussion of the paper on mine fires, which emphasized the importance of using the main shafts as downcasts so that men could escape safely up these. It was admitted that this was an unfortunate arrangement in a cold climate, for when being hoisted, the men were met with the keen air of the surface while still covered with the perspiration engendered by the hot workings. He spoke of drilling holes from the surface to reach fires below. This, another speaker declared, might work well in Butte where the rock to be thus penetrated is hard, but would not do well in the United Verde where the rock is soft and could hardly be drilled. At the United Verde mine the material is so soft the air driven in under the plenum method can always find an adequate way out. At Butte, drilling and watering are, however, quite feasible according to this speaker. His opinion was that the heating at Bisbee was always from the chemical action of the pyrite and from the absence of ventilation. However, he could not be sure that the carelessness of the miners was not sometimes the cause. J. A. Ede regarded the matter from experience gained in coal mines, and he condemned the use of water in extinguishing mine fires.

Dr. Rudolf Gahl read his paper on the "History of the Flotation Process at Inspiration" and stated that since he had written it he had learned several matters that would cause the work at the mill to be somewhat changed, limestone precipitation being used for carbonates and silicates. He said that all the work could be done without tables, but it would involve the use of expensive oils. However, he added that table middlings would be given flotation treatment.

E. P. Mathewson said that though the impeller machines made a tougher froth than those of the pneumatic type, this was not necessarily a disadvantage, for while the froth may be harder to collect, the material is less likely to fall back. He stated that he floated sands and slimes separately and did not feel that the two could be satisfactorily floated together.

It was this same speaker who read the paper by F. Laist and A. E. Wiggin on "Flotation Concentration at Anaconda, Mont." In the discussion O. C. Ralston wanted to know if the mixture used at the Anaconda plant was that found most desirable. In reply Mr. Mathewson said he was ready to be convinced that there were others more desirable. He said he omitted wood creosote when floating sands, but found it necessary for slimes. He stated that he had manufactured sludge acid, which he used as a flotation agent, from crude oil and he found it more expensive to make than to buy. It was, he said, just as good for flotation purposes.

It was stated that caustic soda at the Old Dominion cut insoluble residues down from 25% to 20% and a fraction. It saves water and increases the extraction.

SOME MEMBERS OF THE A. I. M. E. PARTY IN ARIZONA

1—E. W. Mills, superintendent, and J. F. Manning, mining engineer, of the Seoul Mining Co. of Chosen. 2—Mr. and Mrs. E. P. Mathewson, of Anaconda, Mont. 3—Norman Carmichael, manager of Arizona Copper Co., and B. B. Gottsberger, manager of Miami Copper Co. 4—Mrs. Bradley Stoughton, Secretary Stoughton and Sidney J. Jennings about to go underground at Sacramento shaft at Bisbee. 5—Charles E. Mills, manager of Inspiration Consolidated Copper Co. 6—John C. Greenway, manager of Calumet & Arizona Mining Co. and New Cornelia Copper Co. 7—H. A. Buchler, state geologist of Missouri, and Philip N. Moore, of St. Louis, one of the vice-presidents of the American Institute of Mining Engineers

Alkaline or neutral solutions are preferable in the Globe district, whereas acid solutions give the best results at most other places. Caustic soda is a marked help at the Old Dominion despite the fact that the pulp is already somewhat alkaline.

O. C. Ralston said that sodium resinate was being used at Chino, not so much for the purpose of a deflocculant as for the fact that it gave a good life to the froth. Thus made more permanent, it did not die and refuse to go over the discharge board.

He wanted to know how much oil should be used and if its quantity should be regulated by the amount of water to be used or the quantity of ore to be treated. Of course it was shown that the character of the oil had much to do with the quantity used. Everybody agreed that colloidal matter was harder to float satisfactorily than granular matter. Ralston declared that colloidal material appeared impossible of satisfactory treatment by flotation, but a distinction was urged between colloidal mineral and colloidal gangue.

The evening session ended with a paper read by Walter A. Schmidt on the results obtained by the Cottrell process of electrical precipitation at the International Smelting Co.'s plant at Inspiration, Ariz., and the Riverside Portland Cement Co. at Riverside, Calif. He illustrated his remarks with lantern slides and then, with an elaborate model of the system employed.

INTEREST IN THE MIAMI DISTRICT

Friday was Inspiration day. A stub train with great limberness in navigating the sharp curves is run from Globe to the various plants in the Miami district. The Inspiration automatic ore-hoisting plant was actually awe-inspiring. Underground the landing stations, the car-dumping and loading stations were built in massive concrete and brought forth frequent comparisons with the New York subway. The rolling dump empties five 5-ton cars at a time. The ore goes from this bin to an automatic loader, which fills a skip-weighing pocket that is automatically tripped when the skip stops in its loading position and the ore is discharged into the skip. It is not again handled except by machinery until the final concentrates are made.

The Inspiration mill is a marvel—not only for what it is accomplishing, but for its design and appearance. It has been adequately described by H. Kenyon Burch, its designer, in his paper before the Institute at this meeting. From the mill the train seesawed down the jig-backs to the smeltery and then down to Miami, where another fleet of automobiles carried all up the hill to the Miami Copper Co.'s clubhouse, where lunch was served. The lunch was prepared in Los Angeles, for this part of the desert gave no facilities, and a caterer was imported with it.

After lunch the ladies had a bowling contest—adjourned later to enjoy a swim in the pool underneath the club room when the technical session began. This clubhouse is a veritable oasis in every way and afforded by far a more comfortable place for a technical session than any other hitherto provided. The paper on the results obtained from the Marathon mill brought out much discussion and contrary opinion, despite the conviction of F. C. Blickensderfer that the Marathon was producing startling results in fine grinding. C. W. Merrill was of the opinion that grinding with linear-contact would be far superior to that with spherical-contact and that a new grinding era might be about to be ushered in by the Marathon principle. Charles Legrand's paper on the Diesel-engine power plant at the Burro Mountain Copper Co. at Tyrone was of much interest, especially as the Miami, on the strength of the Tyrone results, is constructing an addition to its power plant to contain Diesel units. Extensive crushing experiments are being made at Miami, but B. B. Gottsberger said it would be months before conclusive results would be reached. The Miami mill was visited, of course, as well as the surface plants, and a few people went underground. Both the Inspiration and Miami distributed booklets containing photographs, flow sheets and copious data. A banquet at Globe that evening attended by nearly 300 concluded this part of the trip. The dinner was served in the auditorium of the high-school building.

The banquet was followed by speech making, Sidney J. Jennings presiding, fitly, as toastmaster. The toasts and speakers were: "Safety First," by John E. Bacon, a local surgeon; "The Growth of the Globe District," by Dr. L. D. Ricketts; "Why the Young Engineer Should Join the Institute," by E. P. Mathewson; and "The Utilization of Waste Products," by F. G. Cottrell. Mr. Cottrell said that the Bureau of Mines should keep on the scouting line a little ahead of the present, looking for new methods of treatment. He said that the gaseous output of a converter was from 20 to 25 times as great as the slag drawn off. We had looked in the past on recovery of metals as a problem of solids; we had learned later to attack them as liquids; perhaps in the future we shall seek to find our treatment problems in the gas.

THE END OF THE TRIP

Sunrise Saturday morning saw the whole party in automobiles bound over the Apache Trail to the Roosevelt dam and Phœnix.

Sunday morning the train, several hours late, arrived in Grand Cañon. Thanks to the delay it was decided to defer departure to the next day so that the stop here was longer than scheduled.

It was a happy thought to end the trip there. The Arizona committee had provided a most strenuous program. No opportunity was given for waits, and there were no dull spots. The party was whisked from one thing to another in the ubiquitous automobile until the limit was nearly reached. And the serene calm grandeur of the Cañon furnished a welcome rest to both mind and body. The monument to John Wesley Powell, on the brink of the Cañon at Maricopa Point, is a fitting commentary to the courage and daring of that fearless explorer, the father of our Geological Survey.

The party had been dwindling since leaving Globe, members going on various errands east, south and west, so that only three cars left the Cañon Monday night. Tuesday morning and also Tuesday noon found the pilgrims still waiting at Williams, Ariz., for the connecting train, which is somewhere in the desert behind a derailment and is more hours late than the railroad agent has yet been willing to admit, and this story comes to an end here to enable the writers to go out and see Bradley Stoughton play ball, the trip having been the most remarkable and successful in the history of the Institute.

Smelting Practice at Clifton*

SYNOPSIS—Eight coal-fired Herreshoff furnaces calcine from 65 to 80 tons each per day. Matte smelting is conducted in three reverberatories with 22x100-ft. hearths. Direct charges constitute 75% and fettling material 25% of the total charge. Coarse-crushed fettling material of 2½-in. diameter is piled up to the roof charging holes and reposes at an angle of about 45°. Matte from the reverberatories is blown in three 12-ft. converters of the Great Falls type and the copper cast in casting machines.

Previous to the construction of the new smeltery finished in February, 1914, the average annual production of the Arizona Copper Co. for 10 years ended with 1914 was 32,665,905 lb. of copper. Some idea of the recent growth of plant output is gained from the statement that the production for four months up to June of 1916 was 15,964,840 lb., while for June alone it was 4,900,000 lb.

Complete details of the movement of materials within the plant are best obtained from the flow sheet, Fig. 1.

Roaster equipment consists of eight Herreshoff furnaces with steel shells 21 ft. 7 in. in outside diameter. The first nine concrete hearths built were reinforced with iron rods laid in the top and bottom courses. Reinforcing in those with inner drop holes weighed 3,093 lb., and those with outer drops 2,148 lb. When fully heated, the fourth and fifth hearths, with heavy reinforcement, rose 6 in. at the center of the arch, which necessitated chipping off some of the concrete from the center of the hearths. In later construction ½-in. diameter reinforcing rods were used. This reduced the weight of iron to 1,172 and 1,373 lb. respectively for inner and outer drop hearths.

Slag-Concrete Hearths Satisfactory

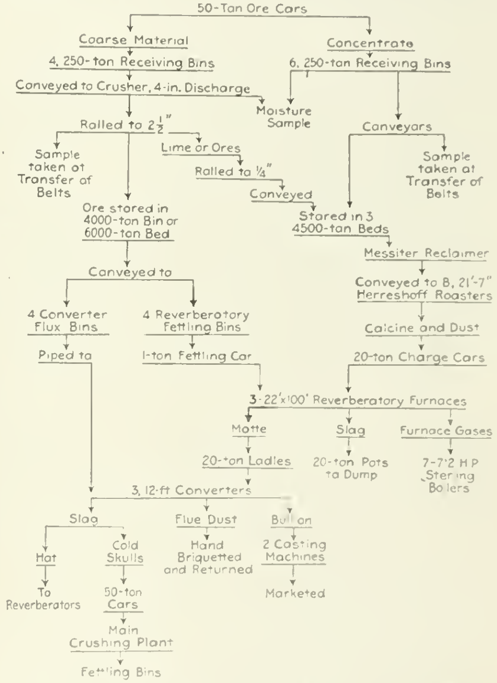
Slag-concrete hearths are preferred, providing the slag is highly siliceous. All concrete hearths have given entire satisfaction. They have been in service since May 3, 1914, without any repairs.

Provision is made for cooling the central columns and rabble arms with air supplied from a motor-driven fan, but during the last 18 months cooling air has not been required.

The roaster charge has varied from ore, limerock, and concentrate mixtures with 19.2% sulphur and 10.7% copper, to all concentrates with 30.7% sulphur and 15.8% copper, with fuel requirements varying from a maximum of 40 lb. of coal per ton of calcines to none when roasting all concentrate. The units of sulphur burned off have ranged from 7.5 to 17.1, the usual practice being to leave equal quantities of sulphur and copper in the calcine, because of the oxidized ore used in reverberatory fettling.

Heavy crude oil was first used as fuel, but with poor results, because with the low draft maintained burners could not be obtained of suitable size to burn continuously the small quantity of oil necessary to furnish this deficiency of heat and distribute it properly over the hearth. The flame was admitted through one door on the third or fourth hearth from the top. A burner that would stay lighted in these comparatively cold hearths produced an intense flame, and if kept running long enough to ignite the charge to the temperature desired, the brick hearth over the burner became too hot and the charge fused on the hearth directly in front of the burners. Calcine produced was not uniform, because the sulphur had to be controlled by burning oil intermittently, which resulted in first a hot furnace and low sulphur, then a cold furnace with high sulphur.

Coal-fired dutch-ovens with 12 sq.ft. of grate area have been adopted for supplying additional fuel required for roasting. Two ovens for each furnace admit the flame on the fifth hearth from the top. With these the roast can be quickly and closely regulated, and the furnace repairs have been greatly reduced as compared with oil-burning conditions.



FLOW SHEET, ARIZONA COPPER CO SMELTERY

Ignition usually takes place on the fourth hearth from the top, and the temperature of the charge rises to 1,200 or 1,300° F. on the two lower hearths. With one reverberatory running, each roaster operated normally makes 65 tons of calcine per day. When two reverberatories are taking charge, each roaster has to supply 80 tons of calcine. Results show that while removing the same [illegible] of sulphur per ton, a furnace will consume [illegible] ton when producing 60 than when producing 80 [illegible] calcine. Monthly averages of 113 tons [illegible] furnace day show a very high [illegible] nace dampers are kept closed just to the point of smoking. Gases leaving the furnaces first enter a hopper-bottomed header-flue, through which they travel at a velocity of 6 or 7 ft. per sec., at 325 to 425° F. temperature, and then pass into a large dust chamber. Dust recovered from this chamber amounts to 0.8 per cent. of the dry charge to roasters.

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*Excerpt from "Smelting at the Arizona Copper Co.'s Works," a paper presented at the Arizona meeting of the A. I. M. E., September, 1916, by F. N. Flynn, superintendent of the smelting department, Arizona Copper Co., Clifton, Ariz.

MATTE SMELTING IN OIL-FIRED FURNACES

Smelting for production of matte is all done in reverberatories, either one or two furnaces being operated as required. Three furnaces set parallel the long way and 26 ft. apart, each with a hearth area 22x100 ft., are available, one of these always being a spare. The hearth in No. 3 furnace is crushed silica fused in on a slag bottom. Furnaces Nos. 1 and 2 have hearths of crushed silica fused in on bottoms of broken quartz. Roofs were all originally built with 1 in. to the foot rise in the arch. When the roof of No. 1 furnace was rebuilt, the arch was given a rise of 1¼ in. to the foot. Six-inch holes, spaced on 24-in. centers, left in the roofs along the side walls and across the back, allow fettling material to be piped into the furnaces from trough-shaped bins built vertically over these holes. Five-inch diameter pipes on fettling bins are being changed to 8-in., to permit using coarser material without choking the pipe openings.

Two parallel charge tracks cross the furnaces near the back in a direction at right angles to their length. Fifteen-ton charges of calcine, at a temperature of 1,050 to 1,150° F., are dropped through one water-jacketed charge hole in the center of the roof on either track, but 90% of all charges are dropped from the back track. This part of the charge dropped through the roof is designated "direct charge." Of the total solid charge smelted 75% is introduced in this way.

BAD RESULTS OF CHARGING COLD MATERIALS

Bad furnace conditions are always expected if such cold material as crude ore, slag or limerock of any size, or anything coarse, like siliceous ore agglomerated with converter slag, either cold or warm, is dropped as direct charge without mixing it well with hot calcine. Ore, limerock or clinker produces "charge floaters." Cold slag sinks and makes sticky furnace bottoms. When it is necessary to add cold or coarse material to the direct charge, the best results are obtained when they are well mixed with hot calcines, in the calcine charge cars, but better still in the roasting furnaces.

Bed mixtures to be roasted are made of the required composition to produce a slag, when smelted, in which the ratio of oxygen in acids to oxygen in bases will fall between 2 and 2.25. A vast difference, however, is found in the smelting properties of calcines made from these mixtures, regardless of the similarity between their analyses or the analyses of the slags they produce. Calcine made from concentrate or sulphide ores of ½-in. size smelts readily, whereas if the calcine is an artificial mixture made of siliceous oxidized ore crushed to this size and mixed with an excessive proportion of limerock, the charges melt more slowly. The results from the two following mixtures will fairly illustrate this point:

Class of Material	Mix 103% of Total	Mix 120% of Total
Sulphide concentrate	100.0	70.7
Siliceous ore, low sulphur	....	4.8
Siliceous oxide ore	....	12.9
Limerock	...	11.6
Total	100.0	100.0

Mix No.	Analysis SiO_2, %	 Al_2O_3, %	 Fe, %	 CaO, %	 S, %	 Cu, %	Oxygen Ratio
103	18.3	4.6	28.2	0.7	29.0	14.10	1.43
120	20.7	4.7	24.1	7.6	22.5	10.98	1.45

A daily average of 365 tons of calcine per furnace was smelted during the time that mix 103 was on the charge. In comparison, 200 tons per furnace day was barely maintained while the charge consisted of calcine from mix 120. The practice is to crush siliceous ore as fine as $\frac{3}{16}$ in. for roaster beds and endeavor to keep the sulphide material as high as 75% of the total bed mixture. Ore and limerock mixtures require a much higher oil ratio than calcine from straight concentrate.

In other words, the greatest percentage of oxidized material that is permissible to smelt in the reverberatory furnace is found to be:

	Tons per Furnace Day	%	
Direct charge	300	25	Oxidized ore and limerock
Fettling	100	100	Oxidized ore
Total	400	44	Oxidized ore equivalent

Above 44% oxidized ore, the charge could undoubtedly be better handled in a blast furnace. The charges spread better when the furnace is nearly full of matte, and also when the copper and sulphur in the calcine are equal. Matte under 40% copper is favorable for higher tonnage.

Ore and byproducts crushed to a 2½-in. size for fettling constitute the remaining 25% of the solid charge smelted. It is customary after each skim to feed these materials from bridge-wall to shaft in the following proportions:

Furnace	Section No.	%	Material
Back	1	25	Old smelter slag Converter slag skulls
Back	2	50	Less siliceous ore
Middle	3	12	Less siliceous ore
Middle	4	8	Less siliceous ore
Front	5	4	More siliceous ore
Shaft	..	1	Silica

	Analysis SiO_2, %	 Al_2O_3, %	 Fe, %	 CaO, %	 MgO, %	 S, %	 Cu, %	Oxygen Ratio
Converter-slag skulls	19.6	3.9	47.2	0.9	..	3.6	9.00	0.89
Old smelter slag	37.2	8.9	22.0	10.3	5.2	0.3	3.56	2.12
Less siliceous ore	42.6	7.7	18.0	3.0	2.5	1.0	6.80	3.74
More siliceous ore	65.0	12.2	5.6	0.8	0.6	1.9	3.78	19.43
Silica	84.4	6.3	3.1	0.5	..	2.6	0.74	46.34
Approximate average	40.4	7.5	21.5	3.5	2.4	1.3	6.49	3.08

Prior to July, 1914, the height of fettling was carried not to exceed 6 in. above the slag line. This height was gradually increased until October, 1914, when the practice of fettling to the holes in the roof was commenced and later successfully adopted after the size of fettling material was increased from ¾ in. to the present 2½-in. size. The coarse size stands better. It reposes at an angle of 45° above and 45° to 60° below the slag line.

The results achieved in performing fettling operations as practiced here depend upon the relative location and manner in which the material is dropped, as well as the amount of fines in it and its chemical and physical composition, as may be concluded from the following account of experience with different fettling materials.

Slag and byproducts, crushed fine, work unsatisfactorily in any part of the furnace. However, if crushed coarse, results are good when such material is charged in the back of the furnace.

Less siliceous fine ore is not good fettling in any place in the furnace. It does not stand, and requires care to keep it from running out into the furnace. Crushed coarse, it makes good fettling wherever used.

More siliceous fine ore mixed with coarse byproduct makes a bad combination. The only place the more siliceous fine ore alone can be used with any degree of success is on the bridge-wall.

More siliceous coarse ore is not so acceptable as less siliceous coarse ore, except in the front half of the furnace, because it makes too much siliceous scum on top of the slag.

Coarse raw concentrate is good in the back half of the furnace, but does not stand so well nor so high as coarser material. It gives bad results in the front half because it melts easily to a magnetic mush.

Fettling with hot calcine can only be done with any degree of success in Section No. 1, and then only slightly above the slag line. At that elevation it runs out over the furnace bottom. An attempt was made to fettle the entire furnace with calcine, but was abandoned when the tonnage dropped to less than half capacity. Calcine gave poorer results than any other material experimented with.

Pyrite in the front half melts easily to a magnetic mush. In the back half when mixed with siliceous oxide ore it works well.

The ideal fettling material was found to be less siliceous copper-sulphide ore containing 5 to 10% sulphur.

In other words, basic or sulphide materials are charged near the firing end because of their lower fusing points. If charged in the front portion, where the temperature is lower, they melt with sufficient ease to make a thick, mushy, semifused slag, and in the case of pyrite make quantities of magnetite. Siliceous ores with 60% silica produce a scum which blankets the slag and causes higher oil ratio and lower tonnage. If the siliceous ores contain much copper in oxidized form, the scum will assay from 0.7 to 1.3% copper, whereas if the copper is present, as a sulphide the scum will assay much lower.

The most important development as regards fettling has been along the line of coarser crushing and greater height of material to protect the side walls without encroaching on the furnace bottom area.

OIL-FIRING REVERBERATORY CONDITIONS

Fuel is 14 Bé, 18,000 B.t.u., California crude oil, pumped at 120 lb. pressure and delivered through steam heaters at a temperature of 170° F. to six burners and atomized with converter air. Two hundred and forty to 365 bbl. of oil is burned per furnace-day. This variation covers a one-furnace schedule when hard firing for high tonnage is required, or two furnaces with light firing and correspondingly low tonnage smelted.

Furnace-throat draft (inside the furnace) is 0.12 to 0.16 in. of water, and in header-flue common to all furnaces, draft is 0.50 in. water. Gases leave the furnaces at temperatures from 1,800 to 2,000° F. Seven Stirling boilers are available for reverberatory waste heat, each 712-hp. capacity, and all connected in multiple through cross-over flues from the header-flue.

Converter slag is poured through the back wall of the furnace, at the center, through a launder discharging at the height of the oil burners. Magnetite builds up under the discharge of the launder, but the bridge wall on either side of it requires fettling.

REAL FLUXING VALUE OF CONVERTER SLAG

Considerable has been written regarding the fluxing value of converter slag poured into reverberatory furnaces. The prevailing opinion seems to be that very little fluxing value is within one's control. It is argued that the basic converter slag does not act upon the charge resting on the slag surface, does not mix with the trisilicate slag, and passes through the furnace like a submarine as a monosilicate, emerging near the skimming end. The technical reason advanced for these arguments is the relatively high specific gravity of the basic converter slag. The writer has proved to his own satisfaction that practically all the iron present in liquid converter slag other than iron in the magnetic state is effective as flux. The effect of liquid converter slag was vividly shown on one occasion, when a furnace had been tamped with moist quartz from floor to roof along the walls, and when fused was largely filled with hot converter slag and little regular charge. Within 24 hours there was little quartz remaining.

The results given in Table 1 were selected for comparison because they show the extreme variation in the material treated in this department. Limited storage capacity at the smeltery required two furnaces to be operated a part of the time to handle receipts. Additional charge needed for the month that two reverberatories were operated was composed of siliceous oxidized ores and limerock, and represents a temporary condition. The concentrator additions, now almost finished, will in the future supply sufficient concentrates to make the proportions of total material treated fall somewhere within the percentage limits given in the examples.

TABLE 1. REVERBERATORY-FURNACE CHARGE DATA

	One Reverberatory	Two Reverberatories
Dry tons direct charge per furnace-day	402.5	262.7
Dry tons fettling per furnace-day (ores)	81.9	65.7
Dry tons fettling per furnace-day (byproduct)	25.0	38.7
Dry tons total solid charge smelted per furnace-day	512.4	367.1
Percentage of fettling to total solid charge	21.45	28.3
Analysis of direct charge:		
SiO_2, %	19.8	21.7
Al_2O_3, %	5.4	4.9
Fe, %	32.3	26.6
CaO, %	2.3	7.7
S, %	13.7	13.6
Cu, %	15.55	13.24
Oxygen ratio	1.32	1.41
Analysis of fettling (ores and byproducts):		
SiO_2, %	38.8	39.5
Al_2O_3, %	7.6	8.0
Fe, %	23.4	25.5
CaO, %	1.7	4.0
S, %	9.1	3.0
Cu, %	6.65	5.52
Oxygen ratio	3.36	2.93
Total tons hot converter slag to reverberatories	2,119.00	2,862.00
Analysis of reverberatory slag:		
SiO_2, %	35.6	38.0
Al_2O_3, %	9.7	9.0
FeO, %	49.7	39.4
CaO, %	2.4	8.1
MgO, %	0.6	1.5
Cu, %	0.51	0.45
Oxygen ratio	2.04	2.06
Analysis of matte, % Cu	37.43	37.70
Matte fall, %	31.68	27.1
Sulphur volatilized in furnace, %	24.14	25.7
Bbl. oil burned per ton solid charge smelted	0.653	0.778
Bbl. oil burned chargeable to steam	0.315	0.349
Bbl. oil burned account smelting	0.338	0.429

CONTROL OF MAGNETITE IN MATTE BLOWING

The production of magnetite in the converters is, within reasonable limits, controlled by the converting practice. The converter slag poured into the reverberatory furnace should not contain any magnetite visible to the eye. The safest practice is to reject the last 2 cu. ft. of slag when pouring. The rejected slag with the [illegible] skull will eventually enter the furnace as fettling material, where its detrimental effect to the furnace is temporarily turned to some good, because of its [illegible] properties. Its tendency to stick to the side [illegible] with [illegible] ore is quite noticeable when the [illegible] is removed from the walls with the furnace out of service. By this practice, magnetite is made to perform a somewhat similar service in the reverberatory furnace that it does in the protective coating in a basic converter. Unfortunately only a small portion of the total magnetite production can be so used.

Some metallurgists prefer to make a small quantity of magnetite on each converter charge, contending that in this way the coating remains of more constant thickness. They accomplish this by blowing a few minutes on the start or finish, either or both, but usually at the start, with a shortage of silica. It is believed that by intentionally making magnetite with every charge, the quantity made must be very large as compared with the small amount that can be made to stick to the walls by so haphazard a practice going on continuously. Our practice is to coat the shells when the lines of brickwork can be seen through the thin coating. And when a shell is being coated, no attempt is made to do anything with the matte other than form the coating. When coated, the magnetite and copper mush is dumped on the floor under the shell, and later it is charged in small quantities at intervals in other charges. When coated, a shell is never blown without a large excess of silica.

TABLE 2. CONVERTER-PRACTICE DATA

Converter Division	One Reverberatory	Two Reverberatories
Tons reverberatory not matte treated	5,293.0	5,903.0
Cu in reverberatory not matte treated, %	37.43	37.70
Tons siliceous ore used for flux	820.0	1,356.0
Analysis of siliceous ore used:		
SiO_2, %	64.5	65.3
Al_2O_3, %	10.6	11.6
Fe, %	5.2	5.7
CaO, %	0.2	0.5
S, %	0.5	1.7
Cu, %	6.45	4.29
Oxygen ratio	25.30	22.65
Analysis of converter slag produced, % SiO_2	19.6	19.6
Tons copper bullion produced	1,800.0	2,450.0
Cu in bullion, %	99.60	99.55
Tons copper produced per converter-day running time	43.9	51.4
Minutes blowing per ton copper	33.0	28.0
Average tons bullion per charge	6.429	8.524
Average time of blowing a charge	3 hr. 54 min.	3 hr. 59 min.
Tons cold new material treated per ton bullion	0.462	0.592
Tons cold byproduct re-treated at converters per ton bullion	0.849	0.577
Blast, pounds pressure	13.0	13.0
Cu.ft. air per converter per minute	6,738.0	5,445.0
Cu.ft. air per ton bullion produced	220,949.0	152,499.0
Cu.ft. air per ton iron and sulphur eliminated	135,043.0	96,145.0
Oxygen efficiency, calculated from blower displacement and requirements of Fe and S eliminated, %	60.63	84.09
Total Material Treated—All Divisions:		
Dry tons concentrates	13,227.0	13,360.0
Dry tons ores	4,069.0	7,303.0
Dry tons limerock	391.0	2,130.0
Dry tons new material, total	17,687.0	22,793.0
Dry tons byproducts treated at reverberatories	924.0	*2,317.0
Concentrates, % of total new material treated	74.78	58.62
Ores, % of total new material treated	23.01	32.04
Limerock, % of total new material treated	2.21	9.34

*Including reverberatory slag skulls.

Although siliceous ore is used for flux, 350 lb. of 80% silica is used to granulate the final slag on the copper finish, to insure the removal of the last traces of iron from the copper with the more active silica. Since this quartz, with any magnetite that it has collected, remains in the converter for the next charge, the magnetite is in contact with the quartz particles from the start of the blow.

The converting division is equipped with five 12-ft. Great Falls-type shells lined with magnesite brick; three converter stands, each operated by an independent motor (the fourth stand is under construction); two 10-ton cranes; two straight-line casting machines, each with 39 copper molds. Two stands are regularly used, for which air at 13 lb. pressure is supplied from the power house by two or three Nordberg blowing engines.

When converting matte of over 40% copper, only a small amount of cold matte shells and cleanings from the floor can be used; but with lower-grade matte, all matte shells, converter flue dust and any converter byproducts made except converter-slag skulls can be handled in this division.

Molten copper is transferred from converters to casting machines in cast-steel ladles lined with fines screened from ores regularly used as converter fluxes. Bars are cast in molds made of converter copper. A 1¼-in. cast-iron splash plate covers half of the bottom area, and an average of 73 tons of bullion is cast per mold. Bars weigh 240 lb. each, and 35 min. is required for casting a charge weighing 7 tons. Considerable chipping of bullion bars is necessary to remove edges and fine shot due to blowing to gas finish of 99.60% copper.

Data in Table 2 show the variation in practice depending on whether one or two reverberatory furnaces are in operation.

The Growth of the Globe District, Arizona

At the banquet to the visiting members of the A. I. M. E. at Globe, Ariz., on the evening of Sept. 22, Dr. Ricketts responded to the toast, "The Growth of the Globe District," and told in detail of the vast development of the section as a mining center. Dr. Ricketts said:

While copper and silver in the Globe district may have been known at an earlier date, the earliest actual records show that the Globe and Globe Ledge claims were located as silver mines in 1873. They were not worked, however, and in 1875 some rich silver mines were discovered, the Globe district was organized, and silver ores were milled and silver bullion shipped.

The first copper was produced at Wheatfields from ore from the Hoosier claim, which was smelted in Mexican adobe furnaces in 1878. The campaign was but a short one, and some 40 tons of black-copper pigs was the result. A little later on, John Williams, Sr., worked the Carrie mine and smeltery. His ore was a quartzite containing 6% copper and little or no iron. It is said that he purchased his flux from the big iron outcrop on the Globe claim and that he made a profit. Incidentally it is said that the only impurity in the hematite was red oxide of copper to the extent of about 25%.

This, it is said, was the discovery of the first important orebody in the district. This and other mining claims, consolidated into what is now known as the Old Dominion, were bought by Baltimore and Boston people and worked quite extensively, considering the fact that the coke had to be brought in from Willcox, 140 mi. distant, in wagons, and the black-copper pigs had to be hauled back.

My first visit to the camp was in 1890, when Dr. Douglas began the purchase of claims which later formed the United Globe mines. At this time Professor Walker was superintendent of the Old Dominion mine. A little later some rich and very siliceous and aluminous ores were found in the region near what is now the Miami camp. The Black Warrior shipped rich chrysocolla ore to the Old Dominion smeltery in 1895, and later the Keystone and Live Oak, which were located in about 1897, began to ship even more siliceous material to the same works.

The railway from Bowie, several years in building, reached Globe in the latter part of 1898.

In 1903 the Old Dominion Copper Mining and Smelting Co. of New Jersey was practically bankrupt. The Old Dominion Copper Mining and Smelting Co. of Maine was formed and acquired most of the stock of the New Jersey company and all the stock of the United Globe mines. In exchange for the latter stock and with treasury stock bought for cash, gentlemen associated with Phelps, Dodge & Co. took control. A more liberal policy was adopted, profits for the time being were put back into the mine and works, and in four years' time the stock rose from less than $5 to over $60 per share. Ever since that time this mine has been prosperous and profitable, and in your visit you noticed the splendid shape it is in and the great ability of the management.

Returning to the new district near Miami, in 1903 and 1904, Mr. Coplen, in behalf of himself and others, bonded and purchased a few mining claims, which became the beginning of the Inspiration group, and he opened up a small block of lean disseminated ore. In 1907, J. Parke Channing bonded the Miami group of claims and developed for himself and his principals the great Miami mine.

Shortly after others purchased the Coplen property and many other claims and formed it into the Inspiration Copper Co. and started development on a considerable scale. Hovland and Smith also took over the Live Oak group of claims and likewise began development; while parties affiliated with the Miami shareholders took over the Keystone group. The Miami company, after developing their mine, undertook the construction of their splendid plant, which up to that date excelled anything that had ever been built. As it was necessary for them to sell their concentrates they made a long-time contract with Cananea on very favorable terms. A little later, in 1911 as I recall it, the International Smelting and Refining Co. closed a long-time contract for Inspiration concentrates, and later on interests affiliated with this company purchased the Live Oak group and consolidated with the Inspiration Copper Co. into what is known as Inspiration Consolidated Copper Co. This consolidation occurred in March, 1912, and C. E. Mills accepted the management of the property.

At first it was planned to use gravity concentrates, and construction was begun on a building designed for that process. Late in 1912, however, Dr. Gregory, of the Minerals Separation Co., advised us that his firm had had splendid results on our ore in their laboratory by flotation. It was therefore arranged that he was to send us a 50-ton machine to Inspiration. Dr. Gahl's most able paper[1] tells the rest of the flotation story.

After taking the two long-term contracts from Miami and Inspiration, it became evident to the companies interested that the high freight rates to Cananea made it desirable to provide local treatment, and the International smeltery now in operation at Miami was decided upon and built.

In 10 short years the output of the Globe district has sprung from about 30,000,000 lb. of copper a year to about 230,000,000 lb. a year, and the works you have seen today have been put in operation.

In closing this history, gentlemen, I cannot help telling an anecdote. Both Mills and I once worked for Phelps, Dodge & Co. for many years. For some reason many believe that I still work for them, though I left those good friends 10 years ago. Today I met a gentleman who knew us both in the old days, and we were looking over the splendid work at Inspiration, when he said, "What I can't understand is, how did you let Mills get away from you?" Gentlemen, I had not overlooked a bet. Referring to the puns of a newspaper cartoonist, I had early felt that Mr. Mills was indubitably to be a "spire" in Inspiration.

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Gold Dredging in Montana

The history and development of the gold-dredging industry in Montana is dealt with in a comprehensive manner by Hennen Jennings in a paper recently published by the Bureau of Mines.[2]

The evolution of design, from the type of spoon dredges operated by hand in New Zealand as early as 1865 to the modern high-powered dredge with close-connected buckets of large capacity, is briefly but clearly described; the limitation of text in this respect being more than compensated for by the judicious selection of illustrations.

Due credit is given to California as the state which by seniority and production holds first place in American gold dredging, with a yield of about $71,000,000 to the end of 1914; and the claim of Montana as the holder of second place, with a yield of about $6,800,000 to the end of 1914, is well supported.

The rush of miners to Alder Gulch in the early 60's; the skimming of the richest gold deposits by pan, rocker and sluice; the robbers and activities of the Virginia City vigilance committee; the more prosaic gleaning of the second harvest of gold by ground sluices and other means; and finally the advent of the corporation dredges, working with cold-blooded mathematical precision on areas of predetermined value—all these are more or less vividly portrayed.

A large part of the paper is devoted to the operations of the Conrey Placer Mining Co., which constitute an important factor in the development of gold dredging in Montana. Statistical details, cost data and recovery figures are given, chiefly in tabulated form, which will doubtless be of much value for comparison and as an aid to future design. The paper concludes with a summary of other dredging activities in Montana, a glimpse of possibilities in South America, and a few general remarks, supplemented by a selected bibliography of dredging.

Following Mr. Jennings' paper is a chapter by Charles Janin, on "Placer-Mining Methods and Operating Costs," describing many operations employed in different parts of the world for the recovery of placer gold.

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Japanese Mineral Production

One of the features of the report on Japanese exports and imports for the first six months of 1916 is the evasion of specific information concerning the imports of lead and zinc ores and exports of their corresponding metals. In the accompanying table, imports of these ores are lumped together with those of other ores and the value of the total is given as "ores except iron." Exports of the metals are likewise lumped as "all other metals except iron and brass."

The figures of the following table are according to the monthly returns of the foreign trade of Japan published by the Department of Finance.

JAPANESE EXPORTS AND IMPORTS OF ORES AND METALS FOR SIX MONTHS OF 1916

	First Half 1916	1915	1914
Imports:			
Ores except iron, value in yen...	6,748,596	218,446	196,049
Lead, ingots and slabs, M tons...	11,649	6,644	7,267
Zinc, ingots and slabs, M tons...	1,707	1,688	2,137
Zinc, sheets, M tons............	78	280	1,967
Tin, ingots and slabs, M tons....	389	677	575
Brass and bronze, M tons........	21,121	580	90
Exports:			
Zinc ores, M tons...............	1,579	3,136	.....
Other ores, value in yen.........	1,452,000	342,537	.....
Copper, ingots and slabs, M tons	25,711	30,072	.....
Antimony, M tons...............	6,065	4,151	1,158
All other metals except iron and brass, value in yen...........	10,955,168	1,167,089	334,450

⁂

Uranium as a Substitute for Tungsten in making high-speed tool steel has been the subject of tests made by the Standard Chemical Co., Pittsburgh. Some results of these tests are reported to the "Iron Trade Review" by the company. One tool, fed at the rate of $\frac{1}{16}$ in. per revolution at a cutting speed of 74 ft. per min., with a cut ⅝ in. in depth, went a distance of 12 in. before regrinding was necessary. A tool turning a locomotive crank pin, operating at a speed of 103 ft. per min., with a feed of [illegible] in. and cut ⅝ in. in depth, went 8 in. before it was reground. On a locomotive axle, a tool with a [illegible]-in. feed and a cutting speed of 75 ft. per min., went a distance of 14 in. on the first and 3 in. on the second lap before it was reground. The depth of the cut on this [illegible] according to the Standard company's report, was ¼ in. [illegible] 12-in. shaft, 22 ft. long, a tool fed at a rate of $\frac{1}{16}$ in. to [illegible] at a speed of 38 ft. per min., with a depth of cut [illegible] in. [illegible] 127 in. It took three hours to conduct this test. After the tool had gone 105 in., the cutting speed was increased to [illegible] ft. per min.

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[1] "History of the Flotation Process at Inspiration," by Rudolf Gahl, Bulletin, A. I. M. E., September, 1916.

[2] Bulletin No. 121, U. S. Bureau of Mines, "The History and Development of Gold Dredging in Montana, with a chapter on Placer-Mining Methods and Operating Costs." (Papers read at the Second Pan American Scientific Congress held in Washington, Dec. 27, 1915, to Jan. 8, 1916.)

Mineral Production of Ontario

The returns of production for the first six months of 1916, made to the Ontario Bureau of Mines by the metalliferous mines and works of the province, are summarized in the accompanying table, which also gives comparative quantities and values for the corresponding period of 1915:

SUMMARY OF ONTARIO MINERAL PRODUCTION

	Quantity		Value	
	1915	1916	1915	1916
	Oz.	Oz.		
Gold	173,021	235,060	$3,570,072	$4,822,740
Silver	11,101,909	10,267,743	5,188,763	6,188,269
	Lb.	Lb.		
Copper	....	77,795	....	14,368
Cobalt (metallic)	....	121,817	....	103,677
Nickel (metallic)	....	13,933	....	5,899
Molybdenite (concentrates)	....	12,631	....	13,075
Cobalt and nickel oxides	141,500	401,408	56,812	204,638
	Tons	Tons		
Copper in matte	8,523	11,426	1,704,600	2,285,096
Nickel in matte	15,182	20,651	7,591,000	10,325,766
Iron ore	134,077	80,698	288,296	243,268
Pig iron	225,940	295,349	2,856,040	4,424,496

The production for the six months ended June 30, 1916, shows a material increase in value of all metals over that for the first six months of 1915, with the single exception of iron ore.

If the present rate of production of gold is maintained, Ontario should reach the $10,000,000 mark for 1916, as compared with $8,500,000 for 1915. Of the total yield the Porcupine camp contributed all but $545,434 produced by the Crœsus in Munro township, the Rognon near Dryden, the Tough Oakes at Kirkland Lake and the Canadian Exploration Co., at Long Lake, near Sudbury. The Hollinger Consolidated and Dome mines are the big producers of the Porcupine camp. Before the year is out Boston Creek will probably be contributing to Ontario's gold production. Development is proceeding on some of the more promising claims at Kowkash, east of Lake Nipigon on the National Transcontinental Ry.

Since the beginning of 1916 the price of silver has advanced considerably, the average being 62½c. per oz., low 56½c. and high 77¼c. As a result production has been stimulated, and the value, as compared with 1915 figures, shows a considerable increase. Although the ounces sold were less than for the corresponding six months' period of 1915, the total production was greater, over 1,000,000 oz. remaining to be marketed. Undoubtedly the life of the Cobalt camp will be prolonged as the result of introducing flotation treatment for handling low-grade dumps and slimes. Nipissing still leads in output, with a valuation of $1,766,561. The Mining Corporation of Canada (Cobalt Lake and Townsite City) is the next large producer, followed by Kerr Lake, Coniagas, McKinley-Darragh-Savage, Seneca-Superior, etc., in the order named.

With the outbreak of war the European market for cobalt oxide was suddenly cut off. However, new markets and new uses for the metal have improved the situation. High-grade steels are now produced from cobalt alloys. Metallic cobalt production is greatly in excess of last year.

NICKEL AND NICKEL-COPPER COMPOUNDS

Metallic nickel from Cobalt ores is produced at the refining works of the Deloro Smelting and Reduction Co., Ltd., formerly known as the Deloro Mining and Reduction Co. The output shows an increase over the 1915 production, which was not marketed during the six months' period under consideration.

Apart from the nickel-copper deposits of Sudbury, there has been a revival of copper mining in Ontario, partly due to the high price of the metal. The old Tip Top mine and other properties near Mine Centre, in the district of Rainy River, are now producing. The Rand Syndicate is operating near Timagami. The Sable River Copper Co. at Massey has erected a mill and is using the flotation process for the treatment of copper ore.

The smelteries of the Canadian Copper Co. at Copper Cliff and the Mond Nickel Co. at Coniston are turning out nickel-copper matte at an unprecedented rate. The production, as compared with the first six months of 1915, shows an increase of nearly 40%. The valuation of the metallic contents of the matte has been made on a basis of 10c. per lb. for copper and 25c. for nickel. The figures given for metallic copper and nickel separately show that the prices were over 18 and 42c. per lb. respectively.

In addition to the companies mentioned the Alexo mine, near Porquis Junction, produces a small amount of nickel-copper ore, which is treated at the Coniston smeltery.

Molybdenite occurs widely in Ontario, but is mined chiefly in Renfrew County. It is wanted at the present time for use in the manufacture of high-speed tool steel, and for this purpose molybdenum will probably replace tungsten to some extent. The demand for molybdenum steel to be used in munition factories comes largely from the allied nations, Great Britain, France and Russia. Molybdenite concentrates containing 85% or more of MoS_2 are worth about $1 per lb. Ferromolybdenum is now (September) being manufactured for the first time in Canada by the Orillia Molybdenum Co. at Orillia, and the Tivani Electric Steel Co. at Belleville.

The only shipments of iron ore were from the Magpie mine, operated by the Algoma Steel Corporation, of Sault Ste. Marie. Although iron-ore production shows a decrease as compared with the same period in 1915, that of pig iron shows a material increase.

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Mineral Production of Peru

In an address of the President of Peru, delivered before the Peruvian Congress on July 28 last, the following information regarding mineral production in 1914 and 1915 was given (*U. S. Commerce Reports*, Sept. 25, 1916), the figures in parentheses being for 1914: Copper, 54,319 metric tons (27,090); petroleum, 285,000 metric tons (252,666); silver, 293,000 kg. (286,600); gold, 1,670 kg. (1,500); coal, 289,000 metric tons (283,860); vanadium ore (45%), 3,145 metric tons (14); tungsten ore (65%), 371 (196); lead, 2,750 (3,048); salt, 25,729 (25,933); antimony ore (45%), 406; molybdenum ore (82%), 274 metric tons; mercury, 700 kg. (700); zinc, 19 metric tons.

In 1914, 11,187 kg. of bismuth and 1,236 metric tons of borates were produced, but there was no production of these in 1915. The value of the mineral production was $26,324,008 in 1915 and $20,285,932 the preceding year.

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Clay Mining in the United States flourished in 1915. Curtailment of American imports of high-grade fire clay from Germany as a result of the war in Europe seriously affected the manufacture of crucibles and lead pencils in this country The United States Geological Survey, in reporting this state of affairs, says that efforts were successful in locating a domestic supply of clays suitable for use in these industries in Arkansas, Illinois, Missouri and Ohio. The imports of clay decreased considerably in quantity and value, and were the smallest in quantity since 1908 and the lowest in value since 1905.

Motor-Truck Operation in Arizona*

Two Alco 3½-ton motor trucks were used by Young Bros. while operating at the Mammoth Collins mine at Shultz, Ariz. One was equipped with an oil tank holding 1,075 gal. The other was fitted with a stake body and used to carry machinery, wood, rails, pipe and all classes of miscellaneous supplies. The bodies were made of oak with maple flooring and were attached to the frame of the chassis by U-bolts, to avoid drilling the main members of the frame.

Most of the hauling was done from Tucson, a distance of 47½ mi. During the first three months, part of the road was in bad condition and the tire cost was excessive. After this part was repaired, the road was in fair condition, but never good. There were no excessive grades or bad sand, but wagon ruts, too narrow for the truck wheels and of a different gage, caused heavy tire loss; while chuck holes, sharp curves and stones, both embedded and loose, were objectionable features. During wet weather the trucks could not get sufficient traction to climb some of the hills and were likely to stick in the mud in certain places, so that no attempt was made to run them unless they were on the road when the rain started. This lost time amounted to about 5% of the total, but whenever possible, it was utilized in making minor repairs.

The price of gasoline was from 17 to 21c. per gal. Rubber tires were used throughout. Drivers were paid $4.50 to $5 per shift, and a return trip to Tucson was counted as two shifts even when made in one day. Drivers were provided with a room in Tucson and were paid for all time lost due to causes beyond their control. Trucks were loaded one way only.

Speedometers were placed on both trucks, but the excessive vibration soon caused them to fail. For this reason and because no account was taken of the distance covered in picking up a miscellaneous load or in other minor ways, the mileage given is under the actual distance traveled. Some of the weights had to be estimated, but care was taken to have the number of ton-miles low rather than high, to avoid underestimating the costs. The cost of hauling from Tucson to the mines was $12 per ton with the trucks, while the best possible team price was $15. Teams made one return trip a week, while the truck regularly made one in two days and could always, and many times did, do it in one day. The loss of time due to wet weather would be about half as much with teams as with trucks.

MOTOR-TRUCK OPERATING DATA

Total distance traveled by trucks, mi.	23,000
Total work done by trucks, ton-miles	42,700
Average distance covered per gal. gasoline, mi.	4.5
Average distance covered per gal. lubricating oil, mi.	128
Average speed, loaded, mi. per hr.	7
Average speed, light, mi. per hr.	7.8

DETAILS OF COSTS OF OPERATION

	Total Cost	% of Total	Per Truck-Mile	Per Ton-Mile
Wages of drivers	$2,623.32	23.91	$0.1141	$0.0614
Wages of helpers	286.50	2.62	.0125	.0067
Repairs, labor	581.74	5.30	.0253	.0136
Repairs, lost time	156.15	1.42	.0068	.0037
Oils, grease and waste	579.17	3.46	.0165	.0089
Gasoline	1,610.49	14.68	.0700	.0377
Tires	2,445.75	22.30	.1063	.0573
New parts	515.08	4.69	.0224	.0121
Miscellaneous supplies	348.82	3.18	.0152	.0082
Incidental expense	226.21	2.06	.0098	.0053
Depreciation	1,796.80	16.38	.0781	.0421
Total	$10,970.03	100.00	$0.4770	$0.2570

The table of detailed costs given covered the period from Aug. 21, 1913, to Aug. 15, 1914, the only time in which the trucks were continuously employed. From Aug. 15, 1914, to Mar. 30, 1916, they were used intermittently, but the figures for this period have been excluded as not being representative. If included, they would somewhat lower the cost per ton-mile. Just prior to the close of the period covered by the cost figures, the trucks were overhauled and put in good condition; new rear wheels were put on and new tires secured. The cost of all this was charged to operation. Allowance for extra tires on hand would reduce the cost per ton mile approximately ¾c., leaving a net cost of about 25c. With loads on the return trip this cost per ton-mile would be lowered at least 10%.

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*Excerpts from an article on "Motor-Truck Operation at Mammoth Collins Mine, Shultz, Ariz.," by Wilbert G. McBride, Long Beach, Calif., presented at the Arizona meeting of the A. I. M. E., September, 1916.

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Malay States Metal Exports

The exports of block tin from the Federated Malay States for June, 1916, amounted to 6,258 piculs (picul = 133.5 lb.), compared with 5,599 in June, 1915. Exports of tin ore (70% of gross weight) amounted to 51,118 piculs, compared with 62,404 in June, 1915, according to *Daily Commerce and Trade Reports.* Exports of block tin for the first six months of 1916 amounted to 39,119 piculs, compared with 34,282 in the corresponding period of 1915. Exports of tin ore amounted to 325,863 piculs, compared with 357,455 in the first six months of 1915.

Exports of wolfram from the Federated Malay States for June, 1916, amounted to 370 piculs, producing a total for the year to date of 2,795 piculs, compared with 1,917 during the corresponding period of the preceding year. Exports of gold for June, 1916, were 1,170 oz., producing a total to date of 8,074 oz.

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The Nation and Its Engineers

Appreciating the benefits that might come from the close coöperation of the country's engineers and the administrators of the Government, representative engineers gathered at a luncheon at India House, New York, on Sept. 28, to discuss the possibilities of taking some action. One of the plans proposed was to form a separate organization for the purpose of bringing the engineer forward to a position of influence in the affairs of the Government. One of the principal necessities is to advise Congress concerning engineering questions, upon which it cannot be expected to be well informed. The problems of civilization are becoming more and more technical in their character. The United States is growing as a great industrial nation. The engineer has been modestly keeping himself in the background, though he is the prime factor in the industrial progress of the country. As such he should be a directing factor.

The engineers present at the luncheon included: Clemens Herschel, president, American Society of Civil Engineers; Dr. Charles L. Parsons, secretary, American Chemical Society; Dr. H. S. Drinker, president, Lehigh University; C. F. Rand, E. G. Spilsbury, W. S. Gifford, Frank J. Sprague, Dr. L. H. Baekeland; H. W. Buck, president, American Institute of Electrical Engineers; Calvin W. Rice, secretary, American Society of Mechanical Engineers; L. P. Alford, editor, *American Machinist*; W. R. Ingalls, editor, *Engineering and Mining Journal*.

Charles Whiting Baker, editor *Engineering News*; Alvin I. Findley, editor, *Iron Age*; J. Merritt Matthews; E. J. Mehren, editor, *Engineering Record*; Dr. A. R. Ledoux; F. L. Hutchinson, secretary, American Institute of Electrical Engineers; Dr. D. S. Jacobus, president, American Society of Mechanical Engineers; Thomas Robins, Lawrence Addicks; Dr. Charles H. Herty, president, American Chemical Society; Charles Warren Hunt, secretary, American Society of Civil Engineers; Gano Dunn, Grosvenor Clarkson, W. L. Saunders.

The action taken consisted in authorizing the appointment of a committee of five to consider ways and means. No announcement has yet been made of the personnel of the committee.

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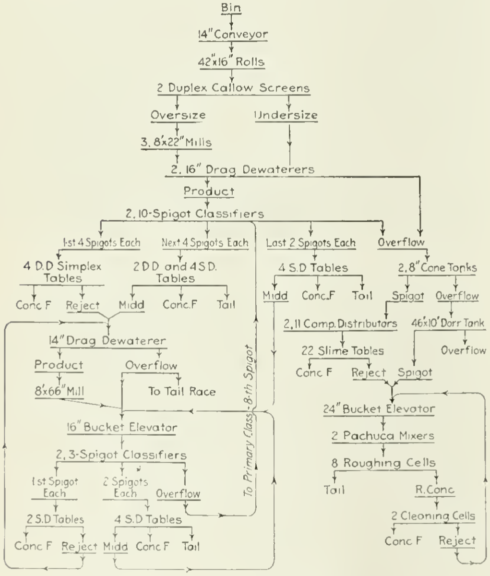
Miami Copper Co. Data

The Miami Copper Co. presented to the members of the A. I. M. E., at the time of their recent visit to Arizona, a pamphlet containing many data of interest regarding their operations.



FLOW SHEET OF MIAMI MILL

Haulage levels are developed 150 ft. apart vertically. These consist of drifts 7x8 ft. in the clear, placed 50 ft. apart horizontally. Of a present daily production of 5,455 tons, 1,506 tons is procured from top-slicing, 3,518 tons from shrinkage stoping and 431 tons from development work. A total of 639 men are employed on the surface and underground to mine this, making a production of 8.54 tons per man. The haulage levels are laid with 45-lb. rails at 24-in. gage. Trains of 30 to 40 cars having a capacity of 3⅓ tons each are hauled by 6-ton electric locomotives. The ore is dumped into bins on each level and hoisted to the surface in 7½-ton skips operating in balance in a four-compartment shaft. Two compartments are used for the skips, one for a cage for handling men and supplies and one for a ladderway and pipeway. This hoist has a capacity of 500 tons per hr. Artificial ventilation is required and is supplied by two 60,000-cu.ft. fans.

In the coarse-crushing department the ore is dumped into a bin of 1,000 tons' capacity and from there over a grizzly having a 2-in. opening. The oversize goes to a Kennedy No. 7½ gyratory crusher, where a reduction to 3½ in. occurs. A trommel 4 ft. diameter and 10 ft. long, with manganese screen having a ¾-in. opening, removes the undersize. Traylor 55x20-in. rolls operating at 100 r.p.m. reduce all material to 2 in. Secondary Traylor 42x16-in. rolls operating at 115 r.p.m. effect a final reduction to ¾ in. Trommels 4 ft. diameter and 7½ ft. long with ¾-in. opening return any oversize to the circuit. An inclined elevator 30 in. wide 258 ft. long, having an inclination of 3½ in. per ft. and operating at a speed of 460 ft. per min., carries the crushed ore to a horizontal conveyor 30 in. wide 329 ft. long running 360 ft. per min., which distributes it to a series of cylindrical mill bins having an aggregate capacity of 11,000 tons.

In the fine-crushing department an inclined conveyor 14 in. wide 25 ft. long running at 200 ft. per min. takes the feed from the mill bins and delivers the ore to 42x16-in. Traylor rolls. Crushing has been dry to this point, at which water is added in the proportion of ½ ton to 1 ton ore. The steels on these rolls have a life of 101 days. The roll product goes to Callow screens, opening 0.029 in.; 20% goes through. The screens have an efficiency of 60% and a life of 53 days. Hardinge mills 8 ft. by 22 in. operated at a speed of 21 r.p.m. by a 150-hp. motor continue the reduction process. Pebbles to the extent of 1.14 lb. per ton of ore are used in some of the mills. Others use 2-in. manganoid-steel balls in the ratio of 1.21 lb. balls per ton of feed. The ore ground per mill per day with balls is 284 tons, while that ground with pebbles is 174.

Secondary Hardinge mill reduction is accomplished in 8-ft. by 66-in. mills operated by 75 hp. motors at 28 r.p.m. for the pebble mills; 250 tons of feed per 24 hr. is accommodated with a pebble consumption of 0.44 lb. per ton of feed. The ball mills are actuated by 150-hp. motors at 20.5 r.p.m. with a feed of 330 tons per 24 hr. and a steel consumption of 1.03 lb. per ton of feed.

In the flotation department 0.43 lb. oil is used per ton of ore. The oil mixture at present is composed of 50% coal tar, 35% creosote, 10% pine oil and 5% cresol.

During the first half of 1916 an average daily tonnage of 4,722 was treated running 2.09% copper. Of this amount 74.06% was recovered, leaving 0.56% in the tailings, which are being stored for future re-treatment. The concentrate runs 41.74% in copper. A total of 12.97 kw.-hr. is used per ton of ore milled. There are 209 men employed in the milling process, which is equivalent to 22.62 tons per man.

Total water requirements are 1,428 gal. per ton, of which 1,096 gal., or 76.8%, is reclaimed from previous use. This is equivalent to a fresh-water requirement of 332 gal. per ton.

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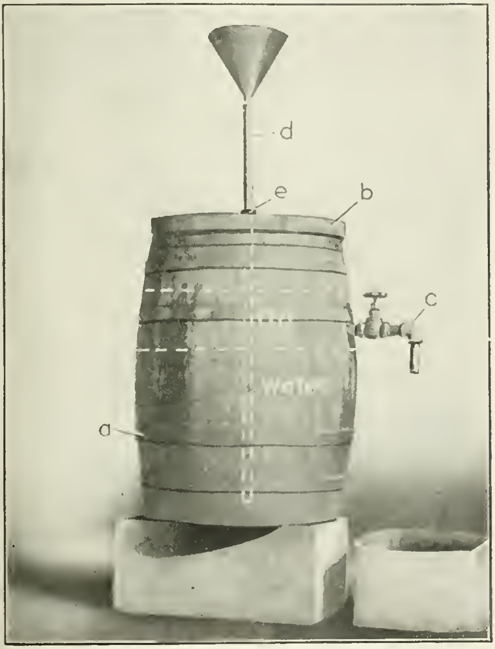
The Refractoriness of Fireclay lowered directly as the superimposed weight upon the clay, according to recent experiments by J. W. Mellor and B. J. Moore ("Trans. Eng. Ceram. Soc.," Vol. 15, p. 117). The advisability of making firebrick carry as little load as possible is thus emphasized.

Details of Milling and Smelting

An Effective Oil Filter

By Walter S. Weeks*

A great deal of lubricating oil is often lost about the engines and compressors of a mine because of the absence of an oil filter. A simple and effective filter may be made as shown in the illustration, in which *a* is a small barrel or tank, *c* is a faucet three-fourths of the way up from the base, *b* is a wooden cover through the center of which is inserted an iron pipe *d* extending to within 3 in. of the bottom of the barrel. The pipe is held in place by the collar *e*.



A BARREL OIL FILTER

The barrel is half filled with water. The dirty oil is poured into the top of the pipe through a funnel. The dirt settles to the bottom of the barrel while the cleaned oil rises to the top of the water and can be drawn through the faucet. The pipe should extend a foot or so above the top of the barrel to afford a sufficiently long column of oil to balance the head of oil and water in the barrel.

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The Loss of Ore or Concentrates in shipment on railroad cars can be reduced by putting a thick layer of straw in the bottom of the car before introducing the concentrate. The subsequent weight of the concentrate compresses the straw into a mat through which little material escapes.

Surface-Plant Illumination

With the approach of winter the proper illumination of mills, smelteries and surface plants becomes of increasing importance from a safety and efficiency standpoint. Different authorities estimate that from 10 to 25% of all industrial accidents are caused, at least indirectly, by the lack of proper illumination; but generally the other circumstances connected with the occurrence of such accidents tend to obscure recognition of this cause, says an editorial in *The Anode* for September, 1916. For instance, a man is found at night injured through having been caught in belts or gears; the immediate necessity is to see that he is properly cared for, and full investigation of the accident may not take place until the next day. When this occurs, the lighting conditions will naturally not be the same as when the accident happened, and the fact that the man was not able to see what he was doing because of a shadow cast by a post or some piece of machinery will not be evident; indeed, the injured man himself may never have recognized the circumstance.

All working places should be properly lighted, but in many cases it would seem that men go on working under poor lighting conditions because they fail to recognize the difficulty under which they are laboring and the possibility of improving them. The following more common instances of poor lighting are therefore cited in the hope that foremen and men will recognize such defects where they exist, and have them improved.

Everyone is aware of the difficulty of seeing when passing from a brilliantly lighted place into one that is comparatively dark, but a similar condition on a poorly lighted stairway leading from a well-lighted platform often escapes the attention it should be given. Where such dark places exist under daylight conditions, a coating of whitewash on the walls or framing will often do much to lighten up the surroundings and make it possible for a man to see things that otherwise he could not. Entrances to buildings or tunnels under flues and dust chambers, particularly where tracks are in use, are instances of places where good light is greatly needed.

Most places that are used by numbers of men are well lighted, but those that are less frequently visited, such as those into which an oiler has to go, are generally not so well lighted, and yet these are just the places where the most serious accidents occur. The necessity for plenty of light on the operating floor of a large department is always apparent, but the need for the same amount of light under roasting furnaces, or in similar places where gears are situated, is not so well recognized, although the necessity is the same in both places.

In the lighting of machines or places where men have to go to operate apparatus, reliance is often placed upon a strong light coming from one direction only. This serves to throw one side of the machine into strong relief, but leaves the other in a dark shadow, and it may be that the side so shadowed should be just as well lighted as the other. In such cases the operator coming from the well-lighted side into the shadow may be so affected by the stronger light that he is unable to see clearly and may make some mistake in his work. To rectify both the casting of strong shadows and the trying glare of unduly strong light, the light should be diffused, as much as possible, from a number of lamps well distributed.

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*Associate professor of mining, University of California, Berkeley.

In the plants, yards and around tracks, deep shadows at nighttime are a constant source of danger. Obstacles, holes or depressions in the ground, which ordinarily would cause little risk of accident, when hidden by shadows cause men to stumble and fall. Insufficient light or shadows around tracks may make conditions obscure to the drivers of locomotives on the industrial haulage system and cause accidents.

Dust and fume, settling on lamp globes, will often accumulate to such an extent that the light of the lamp becomes quite dim and ineffective, yet nobody takes the trouble to remove it until some other adjustment to the lamp is needed, and then perhaps some of the accumulation is shaken off.

Removing lamps from one place for use in another is a practice that all should discontinue and discourage. There are always supplies of new lamps available, and the only reason why any man should remove a lamp bulb, already in use in one socket to replace one that may have been burned out in another place is that he is too lazy to ask for it. The absence of a light to which he has been accustomed may easily be the cause of an accident to any man, and recognition of the fact should be sufficient reason to all men not to remove lights.

Flotation at Morenci*

At the time of remodeling and enlarging the No. 6 concentration plant of the Arizona Copper Co. at Morenci, the work was in progress nearly a year before the Inspiration experiments with flotation.

Meanwhile the Inspiration experiments started with semi-mysterious compounds and continued with simple reagents. A drum of cresylic acid and some pine oil were obtained for Morenci tests and a small can of cresylic acid was arranged so as to drip into the tailings where the latter plunged into the creek bed. A black mineral froth formed, persisting for several yards; and at the next plunge it became white again. Investigation showed that the instant dropping of the mineral was due to a town sewer which discharged into the creek.

By adding cresylic acid to the feed of a regrinding Hardinge mill, a rough froth concentrate was obtained, assaying over 45% copper, in which chalcocite and bornite predominated.

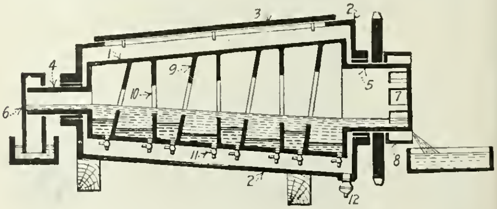
A small mechanical-agitation frothing machine was installed and with a feed of colloid separator fines it gave an extraction of more than 79% of the total copper and more than 92% of the available sulphide copper. Later, a Flinn-Towne pneumatic flotation unit was removed from Cananea and installed at Morenci and experiments demonstrated clearly that the flotation process would be suited to the recovery of slimed copper sulphides in the Morenci ores. A tube-grate cell was tested with such success that a large three-stage machine with a capacity of 400 tons per day, called the "C—B" machine, was designed and made. Operating during the month of April, 1915, with an average daily tonnage of 209, and working under the handicap of partially clogged tubes, blower troubles, etc., the average recovery of sulphide copper was 65% and it was proved that the copper in the mill tailing could be reduced to 0.5% or less, of which 0.25 to 0.30% was oxidized and beyond reach of flotation.

Robbins Barrel Amalgamator

Experience with a straight-barrel amalgamator having demonstrated that efficient work was impeded by the collection of a layer of heavy concentrates upon the mercury surface, the present invention was designed to overcome this trouble. The apparatus is intended to bring pulped gold ores into intimate contact with mercury, so as to extract the gold in the form of amalgam, and to possess great capacity while requiring little attention.

The tapered barrel 1, shown in the accompanying illustration, is inclosed in the outer casing 2, which is provided with a removable door 3 suitably fastened to it. The barrel rotates on its inlet and outlet tubes, 4 and 5 respectively. To inlet tube 4 is attached the rotary scoop 6, common in most forms of tube mills. The outer end of the outlet tube 5 is closed, and the discharge flow is allowed by apertures 7 around the circumference of the tube. These apertures are protected by the guard ring 8, properly spaced from the apertures to allow a free discharge, the purpose of this arrangement being to prevent theft of amalgam.

The interior of the barrel is divided by a series of partitions 9 to form a number of sections or ungulæ, these partitions being set alternately at right angles to the barrel axle and inclined to it as shown. Openings 10 in the partitions constitute the inlet and outlet of each section in the series extending the length of the barrel. Referring to the illustration, it will be noticed that the volume of any given section is greater on one side of the barrel axis than on the other. It is therefore obvious that with a given volume of mercury in any section the surface of the mercury will rise and fall considerably as the barrel rotates.



ROBBINS BARREL AMALGAMATOR

This variation of level results in a more perfect settling of gold, whereas the alternate expansion and contraction of the width of mercury line in the section exerts a sort of kneading action on the layer of heavy concentrates above the mercury. Eventually this action brushes the concentrates through the discharge orifices 10 into the next chamber of the series as the mercury level rises. Discharge of the mercury for recovery of the gold is effected by opening the drainage cocks 11 and 12.

This apparatus is the invention of Percy A. Robbins, of Timmins, Ont., to whom a U. S. patent, No. 1,190,012, was granted on July 4, 1916.

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*Abstract of paper presented by David Cole, Arizona meeting, A. I. M. E., September, 1916.

Company Reports

The Ducktown Sulphur, Copper and Iron Co. Ltd., Ducktown, Tenn., reports for the year ended Dec. 31, 1915, a mining profit of £68,884 and a net after London expenses of £59,235. No statistics of production are given.

Carn Brea and Tincroft Mines in Carn Brea, Cornwall, reports for the half-year ended June 30, 1916, receipts of $196,320, total working costs of $171,796 and royalties of $6,585, leaving a net profit of $17,939. During the period 32,016 tons was crushed, from which an average of 21.22 lb. black tin was obtained. The cost per ton of ore treated was $5. A total of 1,122 ft. of development was performed, distributed as follows: Raising, 251 ft.; winzing, 148 ft.; crosscutting, 10 ft.; driving on lode, 713 ft. Development work has reached a depth of 1,250 ft., at which depth 443 ft. of lateral development has been performed. In the stopes the vein width varies from 6 to 12 ft. and the values run from 17 to 40 lb. tin per ton. During the period 98 men, boys and girls were employed on the surface, 240 for dressing and 246 men and boys underground, making a total of 584 on the payroll. Sixty-four are on leave, serving in the British forces.

Beaver Consolidated Mines official report for the quarter ended Aug. 31 summarizes progress as follows: Mine development aggregated 1,617 lin.ft. with a station cut at the 1,600-ft. level. Stoping operations excavated 2,077 cu.yd. Experiments with oil-flotation have not yet demonstrated the advisability of installing a flotation plant. A total of 313,905.73 oz. silver is in storage or transit. Cash on hand totals $43,020.57.

At Kirkland Lake the 360-acre property held under option from the Kirkland Lake Gold Mining Co. is being developed with encouraging results. The shaft on the McKane claim has reached a depth of 288 ft. On the 100-ft. level a 4-ft. vein drifted upon for 191 ft. gave average assays of $15 per ton. Prospecting results proving unsatisfactory on the 200 level, the drifts were started on the 288 level. A 5-ft. vein was thus encountered 19 ft. south of the shaft, from which channel assays averaged $11 per ton. Continuation of the crosscut developed 10 ft. of porphyry averaging $7 per ton and encountered another vein, paralleling the first, this second vein being 12 ft. wide, from which channel assays averaged $12.80 per ton. This is an important discovery, and the shaft will therefore be extended to the 400-ft. level and prospecting continued.

Wolverine Mining Co. reports for the year ended June 30, 1916, a production of 6,641,492 lb. of copper, as compared with 3,435,459 lb. for the previous year. The price received was 20.62c. per lb., compared with 14.09c., a total of $1,369,285 compared with $484,061. All operating expenses were $626,459 and $7,609 was spent for construction, leaving a net profit of $735,218. Dividends for the period to the amount of $660,000 were paid, as compared with $360,000 for the previous fiscal year. Rock hoisted was 391,898 tons; stamped, 388,898. The yield of the rock was 17.07 lb. per ton, and the cost per ton of ore milled was $1.39. The cost of refined copper was 8.11c., while the smelting, marketing and office expenses cost 9.43c. Drifting, sinking, crosscutting and raising amounted to 3,105 ft., compared with 625 ft. in 1914-15. Tonnage production was increased 108% over the previous year with a reduction in cost of 26%. This speaks well for the flexibility of the plant and the ability of the organization. Since its opening in 1891, the mine has produced 151,303,110 lb. of copper, and it is estimated by the management that there are still 12 years of life before the reserves within the property lines are exhausted. It will be necessary, however, to consider the question of a change in the method of sand disposal in the near future.

Poderosa Mining Co., Ltd., operating in Chile, reports for the year ended Dec. 31, 1915, net receipts from sales of ore, interest and transfer fees of £60,033, from which mining and general expenses in Chile, London office expenses and income tax of £38,445 were paid. From the balance depreciation of £4,211 and mine development expenses of £352 have been allocated, leaving a net surplus for the year of £17,026, and reducing the balance to date to the debit of revenue account to £3,279. During the year 3,734 tons of copper ore, of an average assay of 21.86% copper and 5.93 oz. of silver, have been shipped to the smelters, as compared with 5,289 tons, assaying 18.23% copper and 3.95 oz. of silver in 1914. The mines have been pretty well stripped of high-grade ore to give the year's output of 1,392 ton of ore, and the continuance of even a moderate output is dependent on new discoveries. There may be 5,000 tons of 8% ore in the 6 and 7 south levels and the dumps probably contain 138,600 tons carrying 5,000 tons of fine copper, about one-half of which is recoverable by water concentration. A concentration plant has been in operation since April, 1915, treating 1,904 tons of mine ore and 2,573 tons of dump ore with an extraction of 58%.

The Mount Morgan Gold Mining Co., Mount Morgan, Queensland, Australia, for the half-year ended May 28, 1916, reports that revenue from all sources amounted to $6,146,889. Expenses charged off were $4,753,132, thereby leaving a balance of $1,393,757, of which $1,215,000 was paid in dividends. All ore treated amounted to 156,059 tons, yielding 8,307 tons of copper and 120,131 oz. of gold. Of this ore, 413 tons were miscellaneous ores. The mines produced 427,057 tons of ore. Ore reserves are estimated to contain 951,400 tons of high-grade, 2,827,700 tons of medium-grade ore, 360,300 tons of low grade and 129,200 tons of basic—a total of 4,268,600 tons. Development work totaled 1,808 ft. and consisted of 1,002 ft. of drifts, 105 ft. of recessing, 583 ft. of sinking and 118 ft. of raising.

The rotary roasters have been put into commission with satisfying operation. The sintering of flotation concentrates which has been a source of trouble on account of their fineness has been overcome. The following table gives details of concentration results:

	Weight tons	Assays copper, %	Assays gold dwt.	Recovery copper, %	Recovery gold %
Ore treated	72,074	2.17	1.99	....	....
Table concentrates produced	17,281	2.88	8.76	31.86	42.07
Flotation concentrates produced	4,790	19.22	27.34	58.86	36.40
Total concentrates produced	22,071	6.43	12.79	90.72	78.47

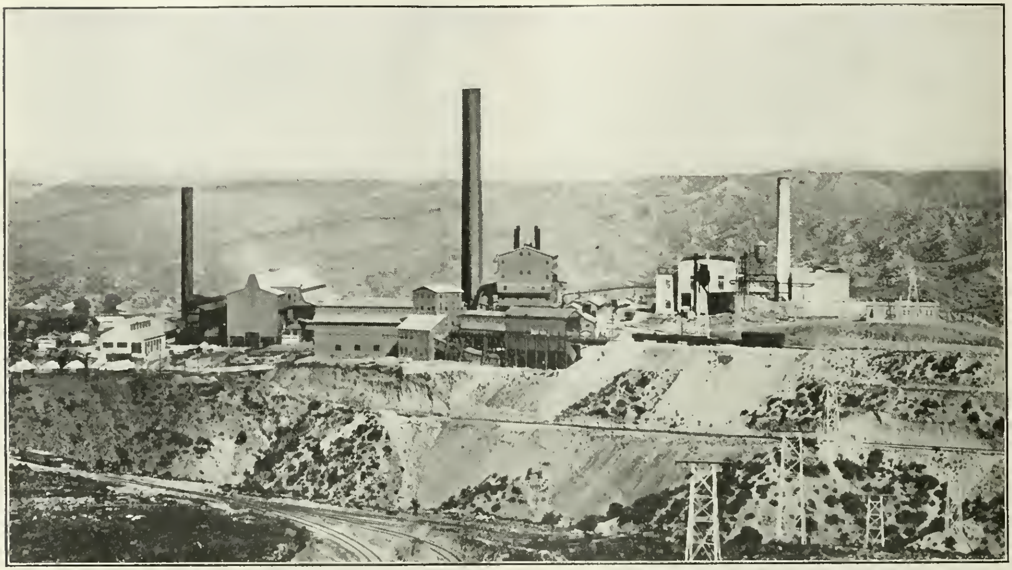
The working cost of Mount Morgan ore treated, inclusive of development and estimated realization charges, amounted to $11.65 per ton.

Broken Hill South Silver Mining Co., Broken Hill, N. S. W., Australia, report for the half-year ended June 30, 1916, shows a balance from the working account of $585,581 and receipts of $1,682,018. After providing for all other charges and income, the net balance for the year was $1,096,437. The mine produced 92,553 tons of ore averaging 14.5% Pb, 6.8 oz. Ag and 13.4% Zn. Of this ore 95.9% was mined on contract, 0.8% by miners on wages and 3.3% from development work. The average earnings of contract miners were $4.18 per 8-hr. shift and of truckers $3.47 per shift. There were 400 surface employees of whom 381 were in daily attendance, and 857 underground employees of whom 757 were in daily attendance. All employees totaled 1,257 and averaged 1,138 in daily attendance. There was 34,797 cu.yd. of loose material sent below to fill stopes at a cost of 86c. per ton of material used for filling, or 32c. per ton of ore extracted. The following gives a tabulation of the classification effected by the concentrating plant:

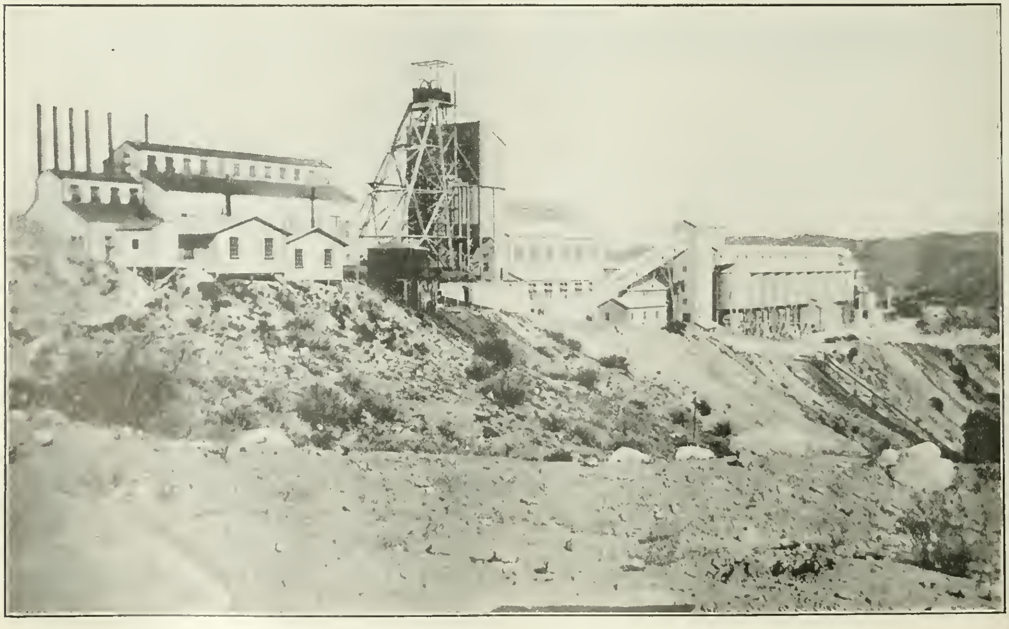
	Net Weight, Tons	Proportion	Assay, Value, % Pb	Assay, Value, oz. Ag	Assay, Value, % Zn	Proportion of Metal Contents % Pb	Proportion of Metal Contents % Ag	Proportion of Metal Contents % Zn
Concentrates	16,985	18.6	59.8	21.2	9.6	76.6	57.5	13.2
Tailings:								
Zinc	51,157	55.9	3.1	3.0	16.3	11.9	24.6	67.7
Quartz	9,618	10.5	1.1	1.6	5.8	1.0	2.4	4.5
Slimes	13,770	15.0	10.2	7.0	13.0	10.5	15.5	14.6
Total ore	91,530	100.0	14.5	6.8	13.4	100.0	100.0	100.0

Working costs amounted to $6.38 per ton and consisted of $4.14 for mining, 31c. for filling stopes, 70c. for development and $1.23 for concentrating. Total mine cost per ton of concentrates was $34.42. In treating this ore 19,834,100 gal. of water was consumed. Owing to the refusal of a section of the underground employees to carry out the arrangements made in the compulsory conferences, a strike occurred in January and February, entailing a complete cessation of production for nine weeks and four days. As a result of the strike the working week was reduced to 44 hours instead of 48. Th[illegible] through wage increases and reduction of time, an additional expense of $224,532 per year.

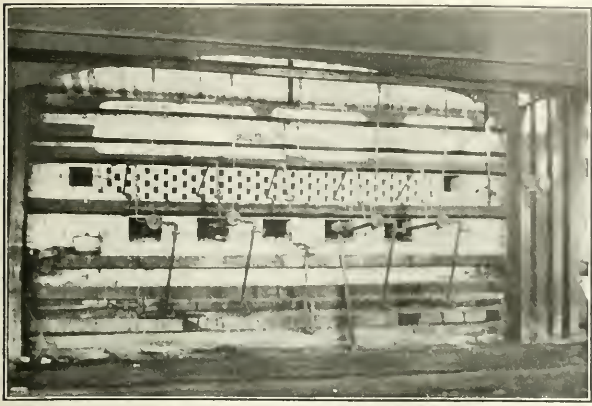
Photographs from the Field



PLANT OF THE INTERNATIONAL SMELTING CO. AT MIAMI, ARIZ.



MIAMI COPPER CO.'S HEADFRAME—MILL AND CONCENTRATE BINS IN BACKGROUND

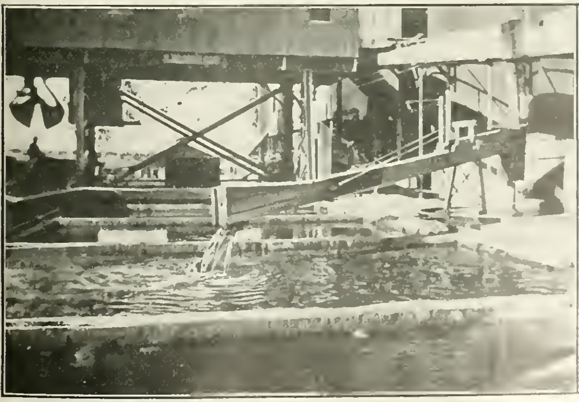


END OF OIL-FIRED REVERBERATORY AT DOUGLAS

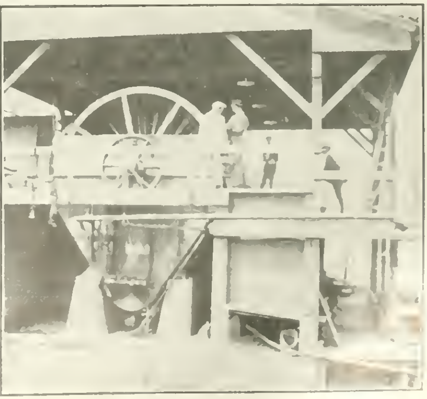
AN INSPIRATION HOISTING SHEAVE

C. Q. EXPERIMENTAL MILL AT LOWELL

LOADING BIN FOR INSPIRATION CONCENTRATES



DISCHARGE LAUNDER AND DISTRIBUTOR AT CHINO MILL



OLIVER FILTER AT OLD DOMINION MILL

Rescue Operations in Mines*

The Bureau of Mines has just issued, in handbook form, a pamphlet that is the result of serious studies covering a period of considerable time on what the bureau believes to be the best method in rescue and recovery operations in both coal and metal mines after fires and explosions. It outlines a method of procedure for the operators and miners to follow in such emergencies and explains just what part the Bureau of Mines is expected to take in such work.

The bureau has no authority to enforce any of its recommendations or to enforce any provision of state laws. After a mine disaster is investigated by the bureau, a report is prepared. If the operator desires, a copy of the report is furnished for his confidential information. As a rule, the recommendations of the bureau have been followed.

The manual does not preach on what might have been, nor does it advise a policy of observant hesitation; but it gets right down to business on the assumption that some men still live and can be reached by systematic effort and teamwork. The first part of the book deals with operations in coal mines and the second part with operations in metal mines. In each case a summary is given of some of the things to do. An important item is: *"Place experienced men to guard all entrances and keep a record of all happenings."*

The manual is indexed and is of convenient pocket size. The limited free edition is likely to be exhausted in a brief space of time, but the book is well worth the 10c. (25c. bound in stiff covers) for which it may be obtained from the Superintendent of Documents at Washington, D. C.

Alaska Gold Mines Co.

The *Boston News Bureau* reports that it seems to be the settled conviction of those closest to the Alaska Gold Mines Co. management that for at least several months nothing need be expected in the way of operating returns better than those now being reported. During the first 10 days of September the average assay value of the ore was $1.51 per ton, but for the entire month the average dropped to $1.30 per ton, indicating rather poor results for the last 20 days.

There is a large accumulation of low-grade ore broken down in the upper-level stopes, and this material must be got out of the way and milled—as there is a small profit in the operation—before opportunity is given for opening up stopes in the lower levels in a manner which it is believed will yield a larger return per ton of ore handled.

Officials of the company are convinced that the original scheme of opening up the stopes was a mistake, in that it resulted in an excessive caving of the hanging-wall material, which was low in grade; but as there is over 2,000,000 tons of this low-grade ore already broken down in the upper levels, quite a period must elapse before any new scheme of mining can be put into effect. The new plan of mining will probably involve an additional cost of 5c. per ton.

Present indications are that the mine will never be able to produce the expected tonnage of ore that will grade up to $1.75 per ton, so that early estimates as to prospective profits must be revised downward.

Hayden, Stone & Co., in their own circular letter say that "Alaska, in September, milled 135,760 tons; the heads ran $1.30 per ton. The grade of the ore, while somewhat less than in the previous month, was above the average of the year, as a whole. The tonnage was less than in previous months, due, as Manager Thane explains, to exceedingly heavy storms during the middle of the month, which resulted in such enormous flows of water that haulage was interfered with until drainage ditches could be enlarged to take care of the same.

"The progress at such a property as the Alaska Gold Mines is bound to be interrupted from time to time by events that cannot be foreseen, so that, followed from month to month, there seems at times to be comparatively little gain. The property has now, however, reached the point where a little broader range can be taken, and viewed from this standpoint, it will be seen that material progress has been made.

"In September of a year ago, Alaska treated 131,862 tons, but the ore in that month carried but 89c. per ton in gold. While September of this year, for reasons explained above, does not show any great gain in tonnage, it would seem to be evident, by the gain in the value, that the management is gradually acquiring satisfactory control over mining conditions."

STATEMENT OF THE OWNERSHIP, MANAGEMENT, ETC., REQUIRED BY THE ACT OF CONGRESS OF AUGUST 24, 1912,

of Engineering and Mining Journal, published weekly at New York, N. Y., for October 1, 1916.

State of New York } ss.
County of New York }

Before me, a Notary Public in and for the State and County aforesaid, personally appeared Chester W. Dibble, who, having been duly sworn according to law, deposes and says that he is the Vice-President of Hill Publishing Co., Publishers of Engineering and Mining Journal, and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management, etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in section 443, Postal Laws and Regulations, printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor and business manager are:

Publisher, Hill Publishing Company, 10th Ave. at 36th St., New York, N. Y.
Editor, Walter Renton Ingalls, 10th Ave. at 36th St., New York, N. Y.
Managing Editor, Percy E. Barbour, 10th Ave. at 36th St., New York, N. Y.
Business Manager, Lee E. Ives, 10th Ave. at 36th St., New York, N. Y.

2. That the owners are:

Hill Publishing Company, 10th Ave. at 36th St., New York, N. Y.

Owners of 1% or more of Stock Issued

Estate of John A. Hill, 10th Ave. at 36th St., New York.
Arthur J. Baldwin, 10th Ave. at 36th St., New York.
Fred R. Low, 10th Ave. at 36th St., New York, N. Y.
John McGhie, 10th Ave. at 36th St., New York, N. Y.
Fred S. Weatherby, 1600 Beacon St., Brookline, Mass.
Frederick A. Halsey, 356 W. 120th St., New York, N. Y.
G. Eugene Sly, 50 Union Sq., New York, N. Y.
Frederick W. Gross, 215 E. 11th St., Erie, Penn.
Emma B. Hill, 80 Munn Ave., East Orange, N. J.

The remaining stock is owned by 91 stockholders who own less than 1% each, 73 of whom are employees of the company.

3. That the known bondholders, mortgagees and other security holders owning or holding 1 per cent. or more of total amount of bonds, mortgages or other securities are: Mortgage on building, Dime Savings Bank, Brooklyn, N. Y.

4. That the two paragraphs next above, giving the names of the owners, stockholders and security holders contain not only the list of stockholders and security holders as they appear upon the books of the company, but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association or corporation has any interest direct or indirect in the said stock, bonds or other securities than as so stated by him.

CHESTER W. DIBBLE,
Vice-President, Hill Publishing Co.

Sworn to and subscribed before me, this 29th day of September, 1916.

[Seal.] RICHARD L. MURPHY.
(My commission expires March 30, 1917.)

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*United States Bureau of Mines, special pamphlet, "Rescue and Recovery Operations in Mines after Fires and Explosions," by James W. Paul and H. M. Wolflin, August, 1916.

Correspondence and Discussion

Some Practical Notes on Mine Surveying

I have read with keen interest and appreciation, W. F. Boericke's article in the *Journal* of Aug. 19, 1916, which is indeed practical in every respect. I do not wish to criticize his article in any way, but I would like to put before his consideration the use of the plane table in stope mapping.

I have been mine surveyor on one of the largest gold-copper mines of Chosen, and on all occasions of stope mapping I have used the plane table, perhaps sometimes in conjunction with a prismatic compass. The ore deposits were exceedingly irregular, being of the contact metamorphic type; the stopes therefore were similarly irregular. Two Orientals were my assistants, and occasionally I would select an Oriental miner to assist.

The table that I used was approximately 18 in. square, provided with the simpler form of alidade and a compass. I took with me underground a 2H pencil, scale and eraser. Pinned to the table with thumb-tacks was a sheet of cross-section paper (a square-inch divided into hundredths). Stationed at the table with one assistant, it was a quick and satisfactory process to sight with the simple alidade to a candle which was held by the other assistant, who also held the zero end of the steel tape (a "metallic" tape would have served just as well). As each sight was taken and the line made on the paper, the assistant with me read off the lengths. The table station was marked on the paper by an ordinary pin firmly planted into the table. The result was that I had my stope already plotted, in plan, when I came to surface. Tracings of the larger-scale mine plans were then laid over this stope map, and the stope's relation to the workings both above and below was readily seen. I usually worked, for these particular stope maps, on a scale of 1 in. = 20 ft.

If I had difficulty in tying the stope in to the mine map, a quick traverse with the prismatic compass would be satisfactory, the notes of the compass traverse being "booked" on the table. When the stope was long and direct sights all around its periphery obscured by pillars, a plane-table travese was made in a similar way to the table's use on the surface.

I found that these stope maps tied in remarkably well with the general working plans and were in many cases very useful to the mine superintendent when he wished to "spot" a chute raise from the level below or a winze from the level above.

There are two disadvantages, in my opinion, with respect to the use of a plane table underground: (1) The table is a bit clumsy, even when it is dismantled from the tripod; (2) any steep sights that are encountered both above and below the horizontal demand either a clinometer or very good judgment to convert the slope distance to the true plan length. I obtained a fairly good idea of what to subtract from the stope distance to bring it to the true horizontal or plan length, but when it was considered that the vertical angle was between 20° and 30°, I measured it with the compass, which had a clinometer attachment.

The plane table can thus be used to great advantage by the sampler or in conjunction with him, the numbers of his samples being marked in their correct position on the plane table plan. He has then only to make a note of the width and any other remarks that are necessary, and need not make a lengthy description or perhaps a crude sketch in his notebook, showing the position of each sample. For a flat deposit, such as Mr. Boericke mentions, I should imagine the plane table would be particularly applicable.

It will be found necessary to have a waterproof covering, so that when the table is to be carried through wet parts of the mine, the paper is not ruined. Incidentally this may be cited as another disadvantage of using the plane table underground—the impossibility of working in wet stopes—but there is usually a dry spot that is advantageous for working purposes. I am interested to know whether this method of stope surveying is extensively used by mine surveyors. A. ALEC JONES.

London, E. C., Sept. 7, 1916.

*

Carranza's Latest Mining Decree

I take the liberty to inclose a translation of the mining law of Sept. 11, 1916, decreed by Gen. Venustiano Carranza, First Chief of the Constitutionalist Army of Mexico.

The preamble to the decree, as you will see, states that the important mining properties in Mexico are held by foreign capitalists, who gamble with their mining stocks and will not work, notwithstanding that the foreign interests in Mexico run no danger and are being effectually protected; that either the number of workmen which the government will designate and which will depend on the size of the mining fields will have to be given employment, or that the properties will be confiscated.

The investment of capital in years past made it necessary to secure large mining fields. The abnormally heavy taxing of the products and of the mining fields is a direct attack on the foreign capital invested in mines in Mexico. The new decree is practically a forfeiture, as under present circumstances it is impossible to reduce these fields in size, as this would require careful and tedious examinations and surveys.

In many of the mining districts in Mexico it is at present absolutely impossible to carry on mining operations, or even to visit the mines. In fact our Government in Washington tells us emphatically to stay out of Mexico, and recent events prove that there are founded reasons for that advice.

The *Engineering and Mining Journal* is widely read in Mexico, and its views and opinions have weight there. Will it not favor us who have interests in Mexico by making it plain to the de facto government of that country that the regulations of the decree cannot be complied with; that most of the stock of American companies owning mining property in Mexico is not held by capitalists; that the conditions in the mining regions of Mexico generally are not what Mr. Carranza states and may think that they are; that foreign operators would certainly work if they could, but that in most cases every attempt to do so has resulted in the loss of mining material, of products and of supplies, and that neither now nor for probably a long time will owners be able to realize on any stock they may hold? B. W.

New York, Oct. 2, 1916.

Mining Law of Sept. 14, 1916 from "El Pueblo", Mexico City, Sept. 16, 1916. All concessions of mines in the republic are required to work their grants. Pertenencias will be declared void if work is stopped for two uninterrupted months or for three interrupted months during the year.

I, Venustiano Carranza, First Chief of the Constitutionalist Army, in charge of the Executive Power of the Republic, exercising the faculties with which I am invested, considering:

That it is a principle of public right, not only admitted by authors of treaties, but also the common and constant practice of the most advanced nations, that the state shall intervene and exercise the proper functions of its institution when the established interests of the individual, of the nation or of humanity so exact, either to safeguard or to procure his progressive development, and that it shall give both matters most careful examination in order to make legitimate and to regulate accordingly the march of government.

That the intervention of the state when the established interests of associates are in danger shall be in proportion to the requirements of their importance, according to the nature of these interests and the special circumstances of time and place, in order that it may be opportune and appropriate; and that therefore it should cover the ground when individual and corporate activity is unable to reach the proposed end, and in such a manner that the state may not intervene when only individual interests are concerned which do not affect any general interest.

That in the mining laws of Mexico which were in force before the present law and before the one which preceded it, the working of mines was considered a public benefit, in accord with the principle above mentioned, and mines were granted on condition, which had to be fulfilled, that a certain number of workmen had to be maintained in the small number of pertenencias (or units of mining field) which were given in each grant, so that the work would not be suspended longer than a certain time; making this benefit consist in that for the good of the nation all the metalliferous veins had to be worked and in the advantages which such work would bring to the public exchequer, it being considered unsuitable for the development of the mining industry and therefore for the general industry of the country that this branch of the national wealth be subject exclusively to the will of the concessionaries, who could in such a case paralyze it at will.

That the mining law now in force, reserving to the nation the ownership of the mines, in granting right of possession to private parties or corporations, thought it well, however, to subject them only to the payment of a tax, leaving to the individual initiative of the concessionaires the working of the same, so that it was left to their decision whether the mines would be worked or would indefinitely be left dormant.

That this law, which not only had for result that it favored only the large speculations, made impossible the working of the mines by miners without capital and concentrated all important business in the hands of foreign capitalists, who mostly instead of doing useful work, limit themselves to gambling on the stock exchange, has occasioned the grave inconvenience that large extensions of mining fields and metalliferous veins can under cover of this law be withdrawn from a development fruitful to public interest.

That over and above these evils, the greater part of the mining concessions have occasioned another of grave penetration under the circumstances through which the republic is passing on account of the strife which the Constitutionalist government has had to sustain first against the usurpation of Huerta and later against the reaction which brought about the division of the triumphant army; namely, the evil which consits in the stopping of the work in the mines; in this manner leaving without means of subsistence the greater part of the mining population and depriving the exchequer of the resources which this industry ordinarily produced.

That the manner of proceeding of the greater part of the mining operators which has been referred to is in the present case so much more dangerous as it helps the movement to increase the obstacles which this government has to overcome in order to bring order and insure peace because they hereby help its enemies to continue the unpatriotic work of seeking help from foreign governments, inciting them to intervene in matters pertaining to the country, under the pretext of saving foreign interests, interests which run no danger and which this government has been and is abundantly disposed to protect effectually and to give whatever guaranties they can rationally exact.

That in view of what has been above stated it is necessary to remedy seasonably the indicated evils and to do so to take the steps which the public interests demands, as a painful experience has shown in an unmistakable manner that if individual action is left in this case to its own free initiative it severely injures the vested interests of the country.

Therefore, I have thought well to decree, as follows:

Art. 1. All mine concessionaires are obliged to work their mines or will be liable to forfeiture if their workings are idle for more than two continuous months or for three interrupted months during the year.

Art. 2. The mine concessionaires who have a just cause to stop work, have to get from the Department of Fomento the corresponding permit, which will only be granted if the cause is well proven and for a time which in no case will exceed three months, unless after this time is past the cause remains and makes work completely impossible, because in that case the time will be prolonged for the strictly necessary time.

Art. 3. The Department of Fomento, listening to the interested parties, will determine in each case that new concessions are given or in those which already have been given and which have not been worked, the number of workmen, which as a minimum must be employed by each mining concessionaire in his workings, taking into account the number of pertenencias of each concession.

Art. 4. The concessionaires who have been or are working their mines must employ in their work as many workmen as they have been using or were using at the time that work was stopped: without prejudice (without refusal) by the Department of Fomento, to hear the said concessionaires and to change this number according to the necessities of the work mentioned.

Art. 5. The forfeiture of a mining grant having been declared by the Department of Fomento, the fact shall be immediately made known to the Department of Finance, so that it may be resolved whether the mine referred to shall be declared open to new denouncement by the public, or whether it shall be worked for account of the nation, in which case someone will be named to administrate the mine and to continue the respective work.

Art. 6. This law will be in force from the date of its publication.

Constitution and Reform. Given in the City of Mexico in the National Palace, on the 14th day of September, Nineteen Hundred and Sixteen.

(Signed) V. CARRANZA.

Flotation at Santa Gertrudis

In an editorial in the *Journal* of Sept. 23 you refer to the success of flotation on silver ore at the above mine under the heading of "Cyanidation of Flotation Concentrates."

As a matter of fact, concentration of the ore by flotation was not nearly so successful as the treatment of the concentrate by cyanide. Most of the "ore" is old oxidized stope filling assaying about 10 oz. silver per ton, from which, by straight cyanidation, a recovery of about 90% is made, as mentioned in the recent paper by Hugh Rose, published in the *Bulletin* of the American Institute of Mining Engineers.

In cyaniding the flotation concentrates in the laboratory, a recovery of 98% was obtained without roasting or otherwise removing the oil. To test the theory that oil consumes cyanide, various mixtures of oils were agitated for 72 hr. in cyanide solution, and we found there was no consumption of cyanide due to the oils. It is obvious that when one has to treat both concentrates and tailings by cyanide, nothing is gained by concentrating.

However, as you say, there are probably silver ores, especially those containing base metals, to which flotation can be successfully applied in districts not too remote from a smelter, provided the smelter is running and there are freight trains also running, a condition not likely to prevail in Mexico soon. As an instance of suitable ores I might refer to those of El Tigre mine in Sonora and the Real del Monte at Pachuca. W. MOTHERWELL.

Salt Lake City, Sept. 29, 1916.

Dust Losses in Copper Smelting

On page 396 of the *Journal* of Aug. 26, there is an interesting article by Dr. L. D. Ricketts, on "Dust Losses in Copper Smelting," in which we note that mention is made of the use of ten General Electric transformers for 50,000, 75,000 and 100,000 volts.

We take the liberty of calling your attention to the fact that the transformers used in this installation were manufactured by the Westinghouse Electric and Manufacturing Co., and we would appreciate it if you would make a correction to this effect, as we believe you desire to be accurate in statements of this kind. M. C. TURPIN.

East Pittsburgh, Penn., Sept. 20, 1916.

Revision of the Mining Law

The Mining and Metallurgical Society of America has instituted a referendum among its own members, and also among all the other mining societies, associations, etc., of the United States—both national and local—upon the following questionnaire:

1. Shall it be aimed to preserve to the maximum possible extent the phraseology of our present mining law and its principles of administration, thus retaining the benefit of some of the wealth of legal definitions that have been rendered at great cost?

2. Shall the new mining law be made to cover all classes of valuable mineral deposits other than coal, and shall that intention be defined so clearly that there will be no misunderstanding of it?

3. Shall actual discovery of a valuable mineral deposit be necessary to a valid location of a claim?

4. Or shall the new law authorize mineral locations without discovery in any part of the public lands officially classed as mineral; and mineral locations upon discovery in any part of the public lands whether officially classed as mineral or nonmineral?

5. Shall there further be a provision permitting bona fide prospecting on land classified as nonmineral and protecting the prospector in the meanwhile?

6. Shall Article 4, if adopted, be further limited so that patent may not be secured until a discovery has been made?

7. Or shall discovery or nondiscovery be immaterial in patenting?

8. Or shall there be required a considerably larger payment for land patented without discovery than with it?

9. If Article 6 be adopted, shall there be the proviso that only one discovery need be made for a group of contiguous claims of one ownership?

10. Shall mineral claims hereafter located be 660 ft. square; that is, 10 acres in size and square in form?

11. Or shall they be 1,320 ft. square; that is, 40 acres?

12. Or shall the claim unit be 660 ft. square, with the proviso that when four units be located in a square of 1,320 ft. sides only the exterior corners (or lines) need be staked?

13. When the proposed square claims are located on surveyed land, shall they be required to be sub-divisions of the surveyed sections?

14. If not located on surveyed land, shall it be required that the boundaries run north and south and east and west?

15. Shall the number of claims locatable by one person or association be limited or unlimited?

16. If limited, what shall be the limit?

17. Shall existing regulations concerning the marking, notice and record of location be continued?

18. Shall there be the requirement that within 90 days after the date of location, record thereof shall be made in the United States Land Office of the district?

19. Or shall the time allowed for recording be more or less than 90 days? If so, what?

20. Shall the annual assessment work be at the present rate, namely, $100 per 20-acre claim; that is, $5 per acre?

21. Shall it be provided that an equivalent sum of money may be paid into the United States Land Office in lieu of the performance of assessment work?

22. Or shall it be provided that an increased sum of money—say $7.50 per acre—may be paid into the United States Land Office in lieu of the performance of assessment work?

23. Shall a person or association holding a group of contiguous claims be permitted to do the assessment work upon one claim and thereby hold the group, the amount of such work to be equivalent to $5 per acre for each claim of the group?

24. Shall a person or association doing assessment work in any one year to the value of more than $50 per 10-acre claim be given credit for the excess in succeeding years, provided, however, that no fractions of $50 shall be considered for this purpose? (If the claim unit be 40 acres, these figures would be raised to $200.)

25. Shall there be emphatic provisions to insure the honest performance of annual assessment work?

26. Shall it be provided that in performing assessment work labor shall be reckoned at the current rate of wages for miners in the district? Or at some other rate; and if so, what?"

27. Shall it be required that every holder of a claim shall file annually a record of his assessment work, accompanied by vouchers, in the Land Office of the district?

28. Shall proceedings for patent remain as now?

29. Shall proceedings for patent remain as now with the proviso that only the exterior boundaries of a group of claims need be monumented?

30. Shall proceedings for patent remain as now with proviso that absence of records in the Land Office of conflicting locations shall be taken as prima facie evidence that none exist that are valid?

31. Article V of the memorandum adopted by the New York Section reads as follows

> Subject to the existing extralateral rights of mining claimants or patentees, the holder or patentee of a mining claim located hereafter to have the exclusive right of possession and enjoyment of the surface held by him and of the minerals under it, bounded by vertical planes passing through surface boundaries of said land, but not the right to follow any mineral deposit beyond said planes. And the holders or patentees of claims heretofore located to have similar exclusive possession of all the mineral in said claims that is not covered by any existing extralateral rights.

The above article abolishes extralateral right in so far as any claims hereafter to be located are concerned. The extralateral rights of existing claims may not be taken away, however, wherefore any new location and grant of patent may be made only with the reservation of such rights. The rights of existing claims having been thus expressly preserved, the last sentence of this article confers upon previously located claims the rights to everything comprised within the vertical projection downward of their side lines that is not legally claimed by anybody else, this being thus an addition to the original extralateral rights.

The above article has received general approval, with scarcely any criticism. The following question is therefore put directly to the membership.

Do you approve Article V of the New York memorandum, or not?

32. Shall it be provided that final entry and payment be made for such claims within seven years after date of location, exclusive of the time covered by pending adverse claims? Shall the time allowed for this purpose be more or less than seven years; if so what?

33. Shall the new law provide for appeals from decisions of the United States Land Office to a court of competent jurisdiction?

The Committee on Mining Law, to which the Council referred the memorandum adopted by the New York Section on Apr. 19, 1916, has not made any formal report as yet; but the following is summarized from communications received from the several members of the committee and is here published as being illuminating with respect to some of the matters that are included in the above questionnaire.

EXCERPTS FROM THE CORRESPONDENCE OF THE COMMITTEE

The identity of the authors of these communications being confidential, they are here indicated by letters rather than by names.

A. Since I am convinced of the vital importance of the mineral industry in our national affairs and believe that the day may come when this industry will show a declining tendency, and since I believe further that it has been and is a serious error in policy for our Government so to dispose of agricultural, ranching, town-site and desert lands, as to retain neither the title to the minerals beneath them nor the right to permit their exploration for minerals by any bona fide prospector, so now I am in favor of the adoption of a principle somewhat as follows (and this will be found entirely in accord with many former declarations of principle by Congress):

Title to ores and minerals beneath the surface shall be conveyed only by and under the laws relating to [illegible] minerals, and no other form of patent shall be [illegible] to convey valuable minerals except sand, earth, [illegible] building stone, whether said land be at any [illegible] as mineral or nonmineral. Furthermore, [illegible] case the surface proprietor should have the preference and certain privileges in connection with the location and operation of mines of whatever sort which may be contained in his land, yet he shall never have the right to obstruct the entry upon his premises and the operations of any prospector who desires to search for minerals, provided that said prospector by his operations shall not injure or destroy buildings, ditches, roads, etc., and must always compensate the surface proprietor for the value of land occupied and for damages to the surface, etc., all of which shall be subject to appraisal by appraisers appointed by the court.

I am very thoroughly convinced of the importance of this principle. When our public domain is exhausted, as it soon will be, there will no longer be ground for the prospector. He will be hounded from private territory as he is now practically from national forests. Unless he is given some open and recognized right of entry on privately owned land, mineral discoveries will in a few years or decades dwindle to the vanishing point.

I am not in favor of 10-acre unit claims, but do believe that in every district where the land has been subdivided by United States land surveys the unit should be any 40-acre tract or established lot or fraction indicated on the township plat and no other, that the number of claims located by a person or association in any one district should have some limit, and that final entry should be made within seven years.

Registration should be required in both the United States Land Office and the office of the county clerk and recorder, or else the Land Office should be required to file notice with the county clerk and recorder within 60 days.

I am sure that many of our members do not keep clearly in mind the difference between location of a claim for the purpose of prospecting it and final entry for the sake of acquiring a patent. That this is true is indicated by much of the discussion and by the further fact that while the memorandum of the New York Section as drawn provides for location without discovery on land that may be classified as mineral, it does not anywhere provide that a discovery is necessary before issuance of a patent. It certainly is not my idea to make it possible for anyone to get patent to a piece of land under the mining laws without actually finding ore, but I do believe that the prospector should have exclusive possession of his location while he is trying in good faith to make a discovery.

B. I am inclined to agree with the propositions to permit location without discovery upon any classified mineral land, and with discovery upon any land, but if these are adopted, would it be wise to allow payments to be made to the Land Office in lieu of the performance of assessment work?

It was my opinion at first that abuses of this privilege would surely occur. Locations for purposes other than mining would be made on land not classed as mineral and the locator might be very willing to hold the land at a cost of $5 per acre, paid to the Land Office, when he had no reason whatever for believing that it would ever produce mineral; but on the other hand the Government would be receiving a fair income from the land, and if the locator were compelled to make final entry within a fixed time, say seven years, and then only on affidavit in the present form, he would be unable to get good title through an evasion of the law. The present form in applying for patent reads as follows:

> That there is a true fissure vein, lode or ledge with well-defined walls carrying gouge, within said claim, having an average width of...... feet, running in a ...... and ...... and containing quartzose vein matter carrying iron and copper pyrites, and there is blocked out or in sight ...... tons of ore therein of an average value of ...... dollars per ton.
>
> That there has been a large amount of money expended on said .... vein, lode or ledge, mining ground, claim and premises by said corporation, the applicant for patent herein, and by its grantors, to wit: .... dollars in running a tunnel .... feet long with drifts, crosscuts and stopes therefrom; and there has been extracted from said vein, lode or ledge more than, to wit: .... tons of ore of the value of about .... dollars per ton.—"Rickets on Mines," 1911, p. 393.

(By the way, I have had no experience in getting patents on "disseminated orebodies." How have the patentees got around the specification describing a "true fissure vein?")

We can imagine a case where a locator discovers valuable mineral on land that had not been classed as mineral, and for self-protection he would locate other claims on adjoining ground for a wagon road, rope tramway or other means of outlet to a railroad, wagon road or river, and with no indications that would lead him to explore the ground for mineral. With the privilege of paying $5 per acre to the Land Office, he would be able to head off adventurers who might try to harass him. The agents of the Forestry Service would doubtless oppose a plan that would permit such locations, and with reason, for this would allow locators to take up valuable timber land, with a view of realizing on the timber.

C. The only novel suggestions that I have to make are with respect to a number of claims locatable by one person, and proceedings for patenting. As to the former, the plan I suggest is similar to that sometimes adopted by foreign countries in the matter of concessions. They give a similar right to explore a large section of territory within a specified period, but require that a smaller section be finally selected and the remainder relinquished for the use of the Government or others. It strikes me that in view of the fact that in the future mining operations in this country will have to deal more largely with extensive low-grade deposits than with the small high-grade veins which are readily discoverable upon the surface, an opportunity should be given the locator of claims to include within his original locations sufficient territory to cover all of any given deposit which could be worked economically as a unit. It strikes me that two years would be sufficient time in which to determine what part of the original location could be advantageously worked in this manner, and that the remainder should then be thrown open to exploration by other parties. I have suggested 15 claims of 40 acres each, equal to 600 acres, which even for "porphyry coppers" ought to be large enough.

Two years will probably be sufficient, too, for the determination of the strike and dip of smaller veins, enabling one to learn what claims he should hold in order to protect his vein upon its dip.

With reference to patenting, inasmuch as the claims under the proposed new law would have no extralateral rights, it would be unnecessary to define accurately the lines of interior claims, but because the public-land surveys are usually inaccurate, it is desirable that the exterior boundaries should be accurately marked upon the ground. Second, it has been contended that claims should not pass to final entry without the discovery of mineral within their boundaries. The only reason that I can see for this requirement is to prevent the acquisition of land under the mineral-land laws for purposes other than mining. On the other hand, there may be several strong geological reasons for the belief that valuable mineral deposits exist beneath the surface of a certain claim and yet, in the orderly working of the mine, it may not be convenient to actually expose such deposits within the seven-year limit.

I approve the recommendation of another member that hereafter grants of land under any law other than the mineral-land laws shall not convey title to valuable mineral deposits underlying such land; but that all public lands so granted hereafter shall be subject to exploration by citizens of the United States for the discovery of mineral deposits; that the owner of the surface have preference over others in such exploration; and that he shall be properly compensated for any injury that his land or improvements may sustain by reason of such exploration by others than himself.

I do not approve the suggestion that in lieu of annual assessment work an equivalent sum may be paid into the Land Office, but I believe the payment of a 50% greater sum should be allowed.

In patenting a group of contiguous claims no survey should be required except such as is necessary to mark exterior boundaries. Should no discovery of mineral have been made within the limits of a claim before final entry, the price charged for the land should be $100 instead of $5 per acre.

D. I believe in the separation of surface and mineral rights. It works well in Mexico.

I favor abolishment of the demand for a discovery, and I go further. A colleague says, "It . . . is not my idea to make it possible for anyone to get patent to a piece of land under the mining laws without actually finding ore." I want to enter the strongest kind of a plea against any such limitation. In patent proceedings the demand for a discovery has been the curse of camps like Bisbee. Under Secretary Fisher for a while it practically put a stop to patenting there. To permit locating without discovery would be to accord legal sanction to a practice that is all but universal in camps with blind surface. The trouble that has been caused by the discovery clause has chiefly been in patenting. If the distinction be drawn, permitting possessory title without discovery, but demanding it before title in fee can be granted, we had better let the law stand as it now is.

Consider a case: X is developing a group of 12 claims, three wide and four long, and gets ore in two claims at opposite corners of the group. He has not found ore in the other 10, but has hopes and spends some money every year in searching for it. He wants to patent in a group, but can only patent two because he cannot show valuable mineral on the rest. Seven years pass; he has found no mineral, but is still searching. It is now proposed to compel him to make entry in seven years. If he must first find mineral, he will lose his ground and see his two productive claims isolated and perhaps stranded high on a ridge crest.

Take a real case: Tom Higgins owned much of the outlying ground that the Calumet & Arizona took over in Bisbee. There was no ore on the surface, and none was found for several hundred feet below. He was poor but held on, and finally after more than 10 years he sold to Mr. Cole for much money. He is a Los Angeles millionaire today. Under the proposal to make him find ore within seven years he would now be Tom Higgins, shift boss or foreman, with only his pay. All his faith and courage would have availed him nothing.

No, I am most emphatically in favor of granting a patent to the man who performs his work in good faith, whether he has found mineral or not. Otherwise a camp like Bisbee would be a checkerboard of patented and unpatented claims. It would make a practical dead letter of the permission to concentrate development or assessment work on a single claim for the benefit of a group, unless the original discovery work was an actual discovery.

It costs more to acquire public land under the mineral act than in any other way. For a full claim the cost now is about $10 per acre, including work. Some fractions in Bisbee have cost at the rate of $7,000 per acre to patent.

If you divorce surface and mineral rights, you get rid of the town-site locator, timber grabber, etc.

I suggest: "Actual discovery of a valuable mineral deposit shall not be necessary to the valid location of a claim, nor shall the failure to find such deposit within seven years, or less if patent be desired sooner, prevent the owner from making final entry thereon, provided he has fulfilled in good faith the requirements of the law regarding assessment work, etc." This is very important, and I am glad that another member raised the question.

I am in favor of the 10-acre claim, square in form, conforming with subdivisions of sections on surveyed land and having N-S and E-W lines on unsurveyed. The smaller the unit claim is the easier it is to locate just the ground one wants. I like the hectare.

There ought to be some limit to the number of claims locatable by one man, but where would you draw it? A limit fair to Oatman might be disastrous in Miami, Bisbee or Grass Valley. I am against a specific numerical limit, but in favor of producing a limiting effect by rigorously enforcing all laws about assessment work, monumenting, recording, etc.

Existing regulations about monumenting should be stricter. All monuments should be as permanent as a Mexican *mojonera* and should be plainly marked and recognizable from the description on record in the recorder's office, and in the local Land Office. It will do little good to prescribe Land Office records if the ground cannot be identified from them.

Notice should be recorded within 90 days as now, but failure to do so should forfeit the ground. That is ample time in the main territory of the United States. I do not know about Alaska. Every prospector knows where to find the county recorder; he knows less of the Land Office. I presume the recording of identical data in the two places is to be specified. Why not let the recorder forward a certified copy of the location notice to the Land Office as soon as the record is made? He could collect the Land Office fee also. This would save the simple-minded some bewilderment.

I am strongly in favor of permitting the concentration of assessment work in one claim of a group, of crediting excess work in one year to a subsequent year and of permitting an equivalent sum to be paid into the Land Office in lieu of work.

Holders of claims doing assessment work should be required to file an affidavit of labor with vouchers. When a man does his own work, it is up to his conscience to say what is a day's work, so there should be a minimum footage prescribed for blasting and for picking ground, since it is a common trick to do annual labor in soft talus and gulch wash.

The main lines of patent procedure may as well remain as now. But how about the advertising of the application? At present the claimant is required to advertise for 60 days at his own expense for someone to dispute his title. If the law be rigidly enforced to procure clear monumenting and recording in the Land Office as requisite to a clear title, the mineral surveyor could be supplied with records of unpatented claims by that office as he is with maps of patented ones by the Surveyor General's office. Lack of records of conflicting locations should be taken as prima facie evidence that none exists that is valid. Under such conditions would it be necessary to retain the provision for advertising? If it is retained, need it be for 60 days? Improvements for a 10-acre claim would be $250 instead of $500.

E. The suggestions that the mineral rights should not pass except under laws relating to mines and minerals and no other form of patent shall convey valuable minerals, with certain exceptions, appeals to me as wise. Perhaps provisions and regulations with regard to the right of a prospector to go on land owned by others should be included.

I fear that a requirement that the claims shall conform to the legal subdivisions on surveyed land would prove to be a hardship in many cases, involving considerable added expense and frequently involving distinctly added uncertainty. The Imperial Valley in California was surveyed many years ago. It was an open, treeless, shrubless plain over much of its extent. When settlement started there, it was found extremely difficult to locate the section corners. A second survey was made, incompletely covering the district, and the entrymen tried to use one survey or the other, often not knowing what they were using. Endless complications followed and the Government in the end surveyed tracts located by the different people and gave them lot or tract numbers and abandoned the attempt of using sections or parts thereof. I know a case where a man was farming a tract of land and all the records would indicate that the land he owned was located a mile or two away. Eventually these things were straightened out with reasonable justice to the people interested, but the process was long and tedious and expensive for the settlers and the Government.

Much of the mineral land of the United States is unsurveyed, and where it is surveyed it would be frequently the work of days for a surveyor acquainted with the country to locate a properly established corner and occasionally the nearest corner would be found several miles away. The old surveys were not accurately done always, and later on some other surveyor might find another corner in another direction. Surveying from a particular tract to one of these corners might indicate that the ground desired should be described in one way, while surveying from the other corner might indicate it should be described in another way. The moving of a man's ground a few hundred feet might be vital. As a whole my opinion is that the use of the legal subdivisions on surveyed land would prove unsatisfactory. If the use of legal subdivisions is abandoned, it seems that there should be no provision requiring that the boundaries of claims run north and south and east and west. As to the size of the claims, I would prefer 1,320 or 1,500 ft. square.

I would not limit the number of claims that any individual could locate, but I think added effort should be made to enforce assessment work being done yearly.

E. D. Gardner has some good arguments why mineral discovery should be made prior to location. Would it not be practicable to insist, in case mineral discovery was not made prior to location, that work should be prosecuted continuously on the claims or on a group until discovery is made?

F. The requirement in our present laws of the antecedent discovery has been one of the greatest sources of abuse. The fact that it has generally been abandoned by common consent is the best reason why now it should be abandoned legally. It will be well enough to require it still on land not classified as mineral, but let the Land Office see to it that a real discovery is made. I think there should further be a prospecting right. Suppose a man had reason to believe that he might find ore in depth in some classified Government land, and desired to drill for it. He should be given the right to do so and should be protected in the meanwhile.

On land classified as mineral, claims should be locatable without discovery. Require the annual assessment work to be honestly performed and duly recorded, making delinquency in this matter as much of a cloud on title as is nonpayment of taxes on any real estate. This would check land-grabbers waiting for the unearned increment.

I am strongly in favor of the square 10-acre claim, conforming to public-land survey lines, if possible, but with north and south lines anyway. The small claim is most elastic. It enables a man to take up a small piece of land if that is all he needs. If he needs more, all he has to do is to locate more tens. What is the difference between locating four tens and one forty? If it be merely the trouble of monumenting, etc., let it be provided that when anybody locates four 10-acre claims in a 40-acre square he need mark only the exterior corners and lines of the group.

As to north-and-south lines, the purpose is manifestly to do away (in new districts) with the crisscross patchwork of a present mining-camp claim map. If somebody had to locate on a vein striking NW-SE, he would simply set his north-and-south square claims in steps. There might be some waste corners, but with 10-acre claims this would not be a serious matter. It is one of the advantages of the small claim.

Chronology of Mining for September, 1916

Sept. 5—Interstate Commerce Commission ordered changes in rates and practices in shipping iron ore from lower Lake Erie ports to western Pennsylvania, Ohio and West Virginia.—New flotation plant of Buffalo Mines Co. put into operation.

Sept. 6—United States Steel common stock reached and passed par for first time in its existence.

Sept. 8—International Nickel Co. announced Port Colborne, Ont., as site for its new refinery.

Sept. 11—First section of Anaconda's new electrolytic zinc plant at Great Falls placed in operation.

Sept. 14—Claims of H. E. Lee against California Trona Co.'s Searles Lake locations dismissed by the court.

Sept. 15—Calumet & Hecla distributed to stockholders its holdings of Tamarack, amounting to about 20,000 shares.—Superior Copper Co. declared initial dividend.

Sept. 19—Eight Mother Lode mines in Amador County, California, closed on account of strike.

Sept. 23—Sale of 118,000,000 lb. copper by American producers to British Ministry of Munitions.

Sept. 24—Fire started in Clay mine of Arizona Copper Co.

Sept. 25—Arizona Commercial declared initial dividend.

Sept. 29—Decision in case of Minerals Separation, Ltd., vs. Miami Copper Co. rendered in United States District Court.

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Comprehensive Court Decision

By A. L. H. Street*

The recently announced decision of the United States District Court for the District of Montana in the case of Clark-Montana Realty Co. vs. Butte & Superior Mining Co., 233 Federal Reporter, 547, lays down a score of principles of mining law covering a wide range, as shown by the following summary of the more important points decided:

Discovery of a mine with intent to claim the underlying minerals being the principal element of a valid mine location, a location in Montana is not to be deemed to be void because the declaratory statement, required by the state law to be recorded, was defectively verified. "These statutes are of no more force and effect than miners' rules. Both are authorized by the one Federal statute. The better, if not prevailing, rule always has been that, if the recordation law does not expressly provide forfeiture for failure to record, the location is valid though not recorded."

When no adverse claim is filed against an application for a patent covering a mining claim, the patent is not conclusive against the rights of the locator of an adjoining claim as to conflicting area. The Federal Land Department does not determine priorities. A prior locator may abandon a conflict area without giving rise to any presumption to his prejudice respecting the remainder of his claim.

"Locations are of surface, including veins. In so far as there is no conflict, if the United States does not avoid a location for defective compliance with local rules, and issues patent, the patent vests all the extralateral rights appropriate to the veins within that surface and as of the date of discovery, of which no third party can complain."

When, on the trial of a suit to quiet title to lode-mining land, the defendant admits that the apex of a certain vein crosses the common side line of the conflicting claims, that from its apex in plaintiff's claim it extends on its dip under defendant's claim, and that the body of ore in dispute under both claims and in places bisected on the strike by the common side line is in such vein, the burden falls on defendant to prove a prior location and to show that another vein having its apex in defendant's claim united with the first-mentioned vein above a part of the ore claimed.

There can be but one set of end lines for a mining claim, and if the located end lines fixed extralateral rights upon one vein, they fixed them upon all veins.

The damages recoverable for innocent removal of ore in place belonging to another are to be measured on the basis of the amount which the defendant ought to have received for the removed minerals, less the reasonable cost of mining and marketing, or the actual cost if less than the reasonable cost. The value of tailings are not to be considered if they had no market value at the time of the removal of the minerals.

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Calumet & Arizona Mines

The Calumet & Arizona Mining Co. is at present operating five mines in the Warren District, Ariz. The data given below in regard to these mines was prepared for the recent A. I. M. E. visitors.

DATA OF THE MINES COMPOSING THE CALUMET & ARIZONA GROUP

	Oliver	Cole	Hoatson	Junction	Briggs	Total
Date started shaft sinking	1903	1903	1905	1903	1902	.
First ore shipped	Nov., 1904	Oct., 1905	Nov., 1906	June, 1907	Dec., 1910	..
Number of men	150	350	50	640	340	1,530
Depth of shaft	1,375.5 ft.	1,480 ft	1,680 ft.	1,837.5 ft.	1,630 ft.	8,003 ft
Tonnage, present	250	500	200	1,350	650	2,950
Equipment—headframe	75-ft. steel	Steel	Steel	75-ft. steel	Timber	.
Hp. boilers	1,500	1,000	4,500	3,250	500	10,750
Hoist	4-cylinder, 16x42 in.	4-cylinder 16x42-in. (idle)	17x48-in. (idle)	4-cylinder, 16x42 in. 2-cylinder, 18x42 in.	18x42-in. Corliss	..
Compressor	Two-stage, 3,500 cu.ft. Single-stage, 950 cu.ft.	...	...	Assorted*		...
Generator	2,100-kw. (total)	...	...	...	...	2,100-kw.
Pump	Nordberg jet condenser and 3 double-acting plunger	Two 14x26-in. Two 7x18-in.	...	Assorted†	...	...
Water pumped, gal. per min.	...	500 gal.	...	3,500 gal.	...	4,000

*Nordberg two-stage, 5,080 cu.ft. per min.; Nordberg two-stage, 3,500 cu.ft per min.; Ingersoll single-stage, 888 cu.ft per min.; total, 9,468 cu.ft. per min. †Pumps—1,800 level: One 18&28&47&12x24 Prescott duplex pot-form slide-valve triple-exp., capacity 1,500 gal. per min.; one 15&23&39&10x24, same type, capacity 1,000 gal.; one 15&23&39&12½x24 Prescott duplex pot-form rolling-valve triple-exp., capacity 1,500 gal. These three pumps all have independent jet condensers. They throw 800 ft to the 1,000-level sump. There is also ordered one 6¾x24 Prescott duplex power pump with direct-connected 100-r.p.m. motor, capacity 1,488 gal. per min. against 2,200-ft. head. At 1,500 level: One 15&23&39&14½x24 Prescott Messabe type, rolling-valve, triple-exp., 2,245 gal. per min., independent jet condenser; one 18&34&8x36 Prescott cross-compound Corliss Messabe type, 1,500 gal. per min., attached condenser; one 16&30&14½x24 Prescott Messabe type slide-valve compound, independent jet condenser. These pumps all throw 500 ft. to the 1,000-level sump. At 1,000 level: Three 15&23&39&10x24 Prescott pot-form, slide-valve, triple-exp., 1,000 gal. per min. each, independent jet condensers; two 20&38&6½x36 Prescott cross-compound, Corliss, pot-form, capacity 1,000 gal. per min. each, attached condensers. These pumps all throw to the surface

VARIOUS MINING METHODS EMPLOYED

	Oliver	Cole	Hoatson	Junction	Briggs
Soft carbonate and oxide ore.	Square-set Cut-and-fill	Square-set Cut-and-fill Top-slicing	Square-set	Square-set	Overhand stoping
Sulphide ore	... ...	Mitchell slicing Shrinkage	Shrinkage Cut-and-fill	Gilman Cut-and-fill	Square-set Mitchell slicing

On account of the diversity of character of the ore, many mining methods are employed in these mines as shown in the above table.

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The Atomic Weight of Dysprosium has recently been [illegible] determined by C. W. Balke and E. W. Engle. According to [illegible] paper before the American Chemical Society, the [illegible] sulphate separation was used on the original mate[illegible] followed by fractional crystallization of bromate, eth[illegible] and nitrate. Dysprosium oxide was placed in a [illegible] weighed, dissolved in HCl and the chloride dehy[illegible] and weighed in the flask. Five determinations [illegible] from 164.116 to 164.257. The mean of the five, 16[illegible] [illegible] higher than the present accepted va[illegible]

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*Attorney at law, 829 Security Building, Minneapolis, Minn.

Editorials

Revision of the Mining Law

The Mining and Metallurgical Society of America is conducting a referendum of its membership on points involved in the proposed revision of the mining law of the United States and has requested all the other mining societies, state associations of mine operators, etc., to obtain a similar expression of the opinion of their memberships. The questionnaire that has been issued is published elsewhere in this issue. It is hoped that there will be a very full expression of opinion. If our readers who are not members of some regular organization through which they would naturally record their views care to write us on the subject, we shall be glad to summarize and report their opinions. Simply cut out the page of this issue on which the questions appear, write "yes" or "no" in the margin and mail to us. If anybody be concerned over the mutilation of his file, we shall have pleasure in replacing it, gratuitously, if requested to do so previous to the end of October.

The purpose of this referendum is to obtain data, based on a general consensus of opinion, to assist in the drafting of a new mining law, to be introduced in the next session of Congress. This follows the actions culminating in the convention in Washington last December and the subsequent hearings before the Committee on Mines and Mining of the House of Representatives. The mining societies had been asking for a commission to draft a new mining law. Congress in effect told them that it would not authorize a commission and if the mining men wanted a new law, to draft it themselves, Congress being disposed to enact what the majority wanted, but being indisposed to try to find out. This put the burden upon the mining men, and the Mining and Metallurgical Society of America having previously taken the lead in the matter has been endeavoring to crystallize ideas upon a constructive program and has been inviting and inspiring discussions during the last six months.

If the plan can be carried through on the lines that have been in mind, it will result in a novelty in legislation of this sort; that is, the introduction of a bill based upon free and open discussion and representing the wishes of the majority, rather than the drawing of one by a few persons, which the public at large has no opportunity to criticize until after it has been introduced, and is thrown open for discussion only in brief hearings before a Congressional committee in Washington that but few are able to attend.

When the Mining Engineer Cannot Collect His Pay

The mining engineer occupies an anomalous position in many respects. He is both a professional man and he is not. In the eyes of the law he has no such standing as the medical and legal men, but in his dealings with the world all are on the same footing. To speak of one important thing, all collect their fees if they can, but often have a lot of trouble in doing it. If the engineer, like the lawyer, is sufficiently independent to demand and receive a retainer before beginning on a job, well and good. He makes himself sure of something. The men of less established reputation, however, who are eager for commissions, generally think it is risky to insist upon a retainer, fearing that the prospective client may be so offended that he will go elsewhere. But it is always feasible and wise for anybody to insist upon an advance against his expenses, unless he is absolutely sure of his client. We have known of engineers, moreover, who have delivered their reports through their bankers, c.o.d.

A recent decision by the United States District Court for Massachusetts deals another blow to the mining engineer. In this case a mining engineer was regularly employed by a mining firm at an annual salary of $4,000. The firm became bankrupt. By the Federal Bankruptcy Act the claims of "workmen, clerks and servants" have priority in the distribution of a bankrupt's assets. The mining engineer claimed the benefits of that provision. The court held, however, that the earnings of a professional man are not properly described as "wages" and the man himself is not a "workman, clerk or servant" within that provision of the law. Some fine points are involved herein, but anyway, they seem to be unlucky for the unfortunate mining engineer.

Consumption of Explosives in Mining

With the metal mines of the United States producing an estimated 141,500,000 tons of various ores in 1916, a probable increase of 30,000,000 tons over 1914, the indicated increase in their consumption of high explosives is great. Upon the basis of the figures given by the United States Bureau of Mines of about 84,264,577 lb. of dynamite consumed in 1914, it is estimated that during 1916 the consumption will reach the total of at least 103,144,500 lb., an increase of 23%.

From confidential correspondence with a number of the larger mining companies it is apparent that 40% dynamite is favored by the majority. According to the figures of the du Pont powder company, the price of 40% nitroglycerin dynamite and gelatin advanced from $11.25 to $19.75 per 100 lb. from 1914 to July 1, 1916. This is an increase of 8.5c. per lb., or 75.5%.

It is of course impossible to segregate the entire quantity of explosives consumed into classes of 30, 40, 50 and 60% and state. from the meager data obtainable so far, their exact value. If we assume that the entire amount of 103,144,500 lb. of dynamite estimated as consumed was 40% costing $19.75 per 100 lb., we shall not be far wrong in assuming that the value of the explosives used in metal mining in the mines of the United States in 1916 will reach at least $20,371,000. On the basis of the 1914 price of $11.25 per 100 lb., the total cost would be only $11,604,000. In other words, the difference between these two extremes, or $8,767,000, is the sum saddled upon the mining industry since the war began, as a sort of war tax.

The firing of the previously indicated quantity of explosives would require about 202,000,000 ft. of fuse. At the current price of $6.50 per 1,000 ft., the value is $1,313,000. Detonation of the estimated quantity of dynamite would require about 25,952,000 caps, which at present prices of No. 6 caps—$17 per thousand—would cost about $441,184. The cost of fuse has increased 39.7% and of caps an even 100% since the war began.

In their confidential reports to the *Journal*, the several mining companies indicate a shifting from 40% nitroglycerin and gelatin to 30, 35 and 40% ammonia powders. The du Pont company especially has for some months been advocating the use of ammonia powder in place of the nitroglycerin mixtures.

The pinch of increased powder costs is being felt most by those metal-mining districts not radically affected by war-boosted prices of their product. Practically all the gold and silver mining districts are thus affected. It is probable that the market for ammonia powders costing about 5c. per lb. less than nitro powders is now about one-third of the total, or 30,000,000 lb. This one-third is used advisedly, since reports from many companies indicate that the change is well under way.

*

The Question of Pulp Elevation

To the interested onlooker it is a matter of some surprise that engineers responsible for mill design have not been able to agree upon the most economical method for elevating wet pulps. The controversy between centrifugal pumps, on the one hand, and belt-and-bucket elevators, on the other, is still alive, while advocates of air lifts and piston pumps are still pointing out the merits of these devices. In general, it may be said that those engineers brought up under the South African influence mostly favor the centrifugal pump, while those under the American influence incline toward the elevator. The air lift, as a pulp elevator, does very well in some instances, but it has limitations that exclude it from a consideration of the problem in general. The limited ability of the air-lift mechanism, combined with its submergence requirement and its rather high power consumption, confines its use to those instances where the head is not great. Some years ago there was a great deal of talk in favor of the triplex power pump for elevating pulps, but one does not hear so much of it at the present time. Apparently the wear caused by fine ore particles was such that the power pump was unable to meet the requirements so far as endurance is concerned.

As between the centrifugal pump and the bucket elevator, to which the controversy is practically limited now, something may be said for each type. The centrifugal pump is cleaner and easier to operate, whereas the belt elevator is probably cheaper to install. It comes down to a question of final cost, however, which is the critical point of disagreement. Theoretically, it would appear that the belt-and-bucket elevator is more economical. Its power requirement must be less than that of the centrifugal pump, since only sufficient power is required actually to lift the weight of the pulp to be elevated, plus, of course, the small amount lost in transmission. The belt elevator is practically a balanced device, the weight of the belt and bucket used in lifting pulp at any moment being counterbalanced by the empty buckets and belt on the down side of the elevator. In addition, it is not difficult so to design an elevator that its bearings may be out of reach of pulp, and they may be of a type such as to reduce friction loss to a minimum.

With centrifugal pumps, on the other hand, in addition to the weight of the column of pulp lifted, there is the high friction loss of heavy pulp in pipe and the loss of efficiency due to imparting motion to the pulp under conditions where clearance is required. Again, the centrifugal pump is essentially a high-speed machine and therefore not economical of power. Its bearings may be protected from attrition by pulp particles, but this result is neither easy nor sure. Moreover, there is high wear on the pump shell, or its lining, due to the attrition of rapidly moving ore particles. Theoretically, at any rate, the balance of argument seems in favor of the elevator, although as usually built it is a messy and uninteresting piece of machinery. It is to be hoped that engineers will, before long, take up this question and settle, once for all, the doubt as to which is the most efficient appliance for elevating pulps.

*

The milk business is far from our own field of interest, but the recent events in it are of economic concern to everybody. The farmers producing the main milk supply of New York City combined to suspend supply unless the distributing companies paid the price they demanded. The companies resisted until the cutting-off of supply verged upon the murder of babies, and then they gave in. Sooner or later the people will pay. Query: Why may not the producers of copper, gasoline, etc., combine to exact the prices they would like to get? The Sherman law as amended by the Clayton law apparently permits some groups to do what others may not. It is much as if the Sullivan law of New York should be fixed up to read that nobody may carry a gun except Italians.

*

We are rather appalled by the impudence of the mining companies of the United States that have property interests in Mexico in appealing to the international committee for a hearing of the wrongs. Do not they know that the Washington Administration has repeatedly told them that they had no business to be interested in Mexico and that their opinions are not wanted? Do not they know, moreover, that the purpose of the commission is mainly political, with probably the idea in the back of the heads of the Mexicans that maybe they can pave the way for a loan?

*

The appointment of General Goethals to the head of the commission to investigate the working of the railroad eight-hour law is ideal. That cannot be said of the other members. Commissioner Clark is an esteemed member of the Interstate Commerce Commission, but as an ex-labor leader he has no more right to be on the eight-hour commission than an ex-railway president.

*

The latest development in the iron industry is a heavy demand for pig iron for export. Heretofore the foreign orders have been chiefly for finished steel and for shell billets; but apparently the European steel works are now in better condition to supply material than the blast furnaces. The export call is chiefly for basic iron and large orders have been already placed.

BY THE WAY

On the occasion of the recent trip of the A. I. M. E. it was remarked, in looking over the mine managers and engineers assembled at the various meetings in Arizona, that it is verily the day of the young man in handling big mining operations in the Southwest. But they are all prematurely gray.

⁂

Scores of men who got the public's money in the old days of speculation in mining shares may be seen in all the resorts of lower New and Broad streets, says the New York *Sun*. From outward appearances they are prosperous beyond previous experience. The stocks they offer, the public was never more eager to buy. Their offices are crowded with customers. The mails and wires bring in orders constantly. Automobiles carry them up town. In fact, they are so prosperous that they are beginning to fall out.

⁂

Frank A. Vanderlip in a recent public address expressed himself boldly as follows:

> It is my belief that war itself is scarcely more dangerous to a nation or more deadly to industrial progress than are some of the influences at work within our own boundaries. There is a prevailing idea that the wages-earning class is interested in restricting production. They hold to that view because they believe the employer is a natural enemy or, more often, that there is not enough work to go around to all laboring men and that it should be made to go as far and last as long as possible.
>
> Such a fallacy, generally held, is actually worse than war, for when war runs its course, recuperation can follow, but when the idea of restriction of production as a means to obtain individual prosperity becomes fixed in men's minds, it has the same effect upon production that a perpetual drought would have upon grain fields.
>
> Whatever controversies there may be about wages or other divisions of the product, there ought to be an agreement upon honest, sincere effort to increase all production for the common good. Not to coöperate to this end is to be disloyal to the community. The betterment of industrial conditions will come in the future, as it has come in the past, by increasing the individual output, never by policies restricting output.

This is sound economics.

⁂

The joint commission which has been meeting at New London to talk over the differences between the Washington Administration and Venustiano Carranza is shortly to adjourn to Atlantic City, where there are many delightful diversions, more, perhaps, than the Connecticut city can offer to them, says the New York *Sun*. Later in the season they should not fail to visit Lakewood, another agreeable fall resort. Were it not for the uncertainty of General Carranza's temper, sojourns at White Sulphur Springs and Palm Beach might be planned conveniently. So far as Mr. Wilson is concerned, the commissioners could easily arrange their recreation as far ahead as Mar. 4, 1917. The business of the commission has proceeded much faster than could have been anticipated. Already the representatives of Carranza have demanded enactment of stricter neutrality laws by the United States and have presented a list of atrocities for which we are to blame. Little is left for our commissioners except to make the necessary promises of laws to prevent Mexicans from fighting each other. The amount of the indemnity we shall pay Carranza can be settled along with the size of the loan we are to arrange for him. These are mere details of the Wilson policy of huckle, truckle and knuckle in Mexico.

September Mining Dividends

Dividends disbursed in September, 1916, by mining companies reached a very high total, as has been the case every month during the year. Payments by 40 United States mining companies making public reports amounted to $26,799,712, as compared with $10,708,720 in the corresponding month last year. This is the largest amount paid out in any month during 1916, with the exception of June, when $27,917,090 was disbursed. The large prophyry companies making quarterly payments are represented in both of these months. The reason for the difference in favor of the earlier month is probably that Butte & Superior paid an extra dividend of $10, as compared with $6 in September, and the New Jersey Zinc Co. paid an extra dividend amounting to $1.750,0000 in June, for which no corresponding dividend was declared for September. The Centennial and Cerro Gordo payments were the first made on those shares.

United States Mining Companies	Situation	Per Share	Total
Argonaut Cons., g	Calif.	$0 10	$20,000
Bunker Hill & Sullivan, l.s.	Ida.	50	163,500
Bunker Hill Con., g	Calif.	02½	5,000
Butte & Superior, z	Mont.	6 25	1,812,931
Caledonia	Ida.	63	78,150
Calumet & Ariz., c	Ariz.	2 00	1,283,204
Calumet & Hecla, c*	Mich.	20 00	2,000,000
Cardiff, l.z	Utah	25	125,000
Centennial, c	Mich.	1 00	90,000
Cerro Gordo, z.s	Calif.	02½	25,000
Champion, c	Mich.	6 40	640.000
Chino, c	N. M.	2 25	1,957,455
Cons. Interstate-Callahan.	Ida.	1.50	697,485
Copper Range, c	Mich.	2 50	985,003
Cresson Cons., g	Colo.	10	122,000
Eureka Hill	Utah	1 00	10,000
Federal Min. & Sm., pfd.	U. S.	1 00	120,000
Golden Cycle, g	Colo.	02	30,000
Grand Gulch, c	Ariz.	03	7,195
Hecla	Ida.	15	150,000
Hercules	Ida.	.20	200,000
Homestake, g	S. D.	65	163,254
Kennecott, c		1 50	4,170,874
Magma, c	Ariz.	50	120,000
Nevada Con., c.	Nev.	1 00	1,999,457
North Star, g	Calif.	20	50,000
Old Dominion, c.	Ariz.	3 00	486,000
Oroville Dredging Co		12	82,385
Prince Cons., g.s	Nev.	05	50,000
Quincy, c	Mich.	4 00	440,000
Ray Con., c	Ariz.	75	1,182,884
St. Joseph Lead	U. S.	75	1,057,050
Socorro, g	N M.	05	18,865
United Globe, c	Ariz.	18 00	414,000
United Verde, c	Ariz.	1 50	450,000
Utah Apex, c.	Utah	25	132,050
Utah Con., c	Utah	.75	225,000
Utah Copper	Utah	3 00	4,873,470
Yellow Pine, l.z.s	Nev.	10	100,000
Yukon Gold, g		07½	262,500

Iron, Metallurgical and Holding Companies	Situation	Per Share	Total
Am. Sm. and Ref., com.	U. S.	$1 50	$751,620
Am. Sm. and Ref., pfd	U. S.	1 75	875,000
Crucible Steel, pfd	U S.	3 00	1,487,352
General Dev	U. S.	1.50	180,000
Inland Steel Co	U. S.	2 00	198,194
Internat. Nickel	U S.	1,50	2,510,076
Lackawanna Steel	U S.	1 50	521,250
Nat. Lead, com	U S.	1 00	206,554
Nat. Lead, pfd	U. S.	1 75	426,433
Old Dominion of Me. (holding)		3 00	880,059
Phelps, Dodge & Co	U. S.	8 00	3,600,000
St. Mary's Min. Land	Mich.	2 00	320,000
U. S Steel Corpn	U. S.	2 25	11,436,806
Yukon-Alaska Trust		1 00	203,433

Canadian Companies	Situation	Per Share	Total
Dome Mines, s	Ont	$0 50	$200,000
Hedley, g	B. C.	50	60,000
Hollinger, g	Ont.	05	120,000
Kerr Lake, s	Ont	25	150,000
Min Corpn. of Can	Ont	15	311,250
Right of Way, s	Ont.	005	8,428
Standard Silver Lead	B. C	02½	50,000

* In addition to its cash dividend, Calumet & Hecla distributed in September its holdings of Tamarack shares, amounting to about 20,000, on the basis of 1 to 5.

Iron, metallurgical and holding companies paid $23,596,777, as compared with $6,900,586 a year ago.

Canadian companies paid $899,678, as compared with $720,000 in 1915.

The totals for the first nine months of the year are as follows: Mining companies, $134,996,315, as against $51,399,883 in 1915; iron, metallurgical and holding companies, $89,994,144, as against $61,726,344 in 1915; Canadian, Central American and Mexican mines, $15,438,210 as against $6,082,120 in 1915.

Personals

J. Parke Channing is at Miami, Ariz.

C. M. Weld returned to New York Oct. 9 from Cuba.

G. A. Morrison, lately at Gillham, Ark., is now in Chicago.

R. W. Bissell has gone to Greensburg, Penn., from New York.

W. J. Kee, lately at Blue Ridge, Ga., is now at Perth Amboy, N. J.

Hiram W. Hixon, lately at Worthington, Ont., is now in Philadelphia.

H. L. Klinck, recently at Charlotte, N. C., is now at Birmingham, Ala.

E. D. Morton has gone from Los Angeles, Calif., to the Mammoth mine at Shultz, Ariz.

F. E. Marcy has opened offices in the Atlas Building, Salt Lake City, Utah, as consulting engineer.

H. G. S. Anderson is now with the Chino Copper Co. at Hurley, N. M. He was recently at Muskogee, Okla.

Mr. and Mrs. Bradley Stoughton left the A. I. M. E. excursion party at La Junta, Colo., to spend two weeks camping in Estes Park.

S. B. Patterson, for 12 years past superintendent of the Robesonia Iron Co., Robesonia, Penn., has resigned. He will retire from active business after more than 50 years' service.

Henry Bruere, of New York, has been chosen a director of the Granby Consolidated Mining, Smelting and Power Co. in place of Jay P. Graves, of Spokane, Wash., retired

A. P. Anderson, S. J. Jennings and **F. D. Weeks**, all officers of the United States Smelting, Refining and Mining Co., have been in Arizona visiting mines of the company near Courtland.

J. W. Gocher has been appointed superintendent of the furnace and mines of the Robesonia Iron Co. at Robesonia, Penn. He was at one time with the Cambria Steel Co. at Johnstown.

H. H. Howry, formerly with the United States Gold Corporation, Boulder Cañon, Colo., is engaged in experimental metallurgical work for the Chile Exploration Co. in New York.

H. J. Stander, flotation engineer for the Yaryan Resin and Turpentine Co., of Brunswick, Ga., and Gulfport, Miss., has been visiting mines in Utah on his return from Alaska and British Columbia.

H. P. Henderson, of New York, after spending a few weeks on professional business in Arizona will leave there about Oct. 15 for Cuba and the end of the month will find him back in New York.

William G. O'Malley, master mechanic, Pittsburgh Crucible Steel Co., Pittsburgh, was appointed works manager of that concern Oct. 1, and now has charge of all operating and construction work at Midland.

Myron A. Folsom, for 17 years attorney for the Bunker Hill & Sullivan Mining Co., with office at Spokane, Wash., has gone to San Francisco, where he will take charge of all business of the company not handled by the executive officers.

Jay P. Graves, who was one of the organizers of the Granby Consolidated Mining, Smelting and Power Co., and till two years ago vice-president and managing director, retired as a director also at the annual meeting, Oct. 4, in New York.

Dr. L. D. Ricketts, C. E. Mills, Norman Carmichael, John C. Greenway and several others of the Arizona contingent left the A. I. M. E. excursion at Grand Cañon to return by way of Jerome in order to visit the United Verde Extension property.

Dr. C. Offerhaus has resigned his position with the Humboldt Engineering Co., Coln-Kalk, Germany, and has taken a position with Beer, Sondheimer & Co., Frankfurt am Main. He will, however, continue to act for the Humboldt Co. as consulting engineer.

Jesse Scobey, assistant to the president of La Luz & Los Angeles Mining Co., has removed his office with that of the company from Pittsburgh, Penn., to 511 Fifth Ave., New York. Mr. Scobey leaves New York this week for Bluefields, Nicaragua, on his way to make an inspection of the mines.

Louis L. Chapman, mining engineer, formerly with Oliver Iron Mining Co., and with Arthur Iron Mining Co., has severed his connection with the latter company and has associated himself with the Indiana Laboratories Co., of Hammond, Ind., as consulting mining engineer.

E. P. Mathewson, who for a number of years has been manager of the Washoe Reduction Works of the Anaconda Copper Mining Co., has resigned to become general manager of the British-Canadian Nickel Co., which owns the Murray and other nickel mines in the Sudbury district of Ontario.

V. E. Lednicky has been appointed chief geologist of the Philippine Bureau of Science to fill the position recently vacated by resignation. Mr. Lednicky is a graduate of the University of Kansas, and during the past two years has been connected with the Bureau of Science as mining engineer. The present appointment comes as a reward for the excellent work which he has done.

Burt B. Brewster, for the past two years with the Sullivan Machinery Co. as manager in Alaska, with headquarters at Juneau, has been transferred to Salt Lake City, to become manager at the company's branch office at that point, succeeding H. E. Moon, resigned. Walter F. O'Brien, for some time past associated with Mr. Brewster at Juneau, will take his place as local manager for Alaska.

Obituary

Adolph J. Zang, vice-president of the German-American Trust Co., and president of the Vindicator Gold Mining Co., of Cripple Creek, died Sept. 28 in Denver.

John Sanford Taylor, mining engineer, who followed his profession in the Porcupine district in Ontario before enlisting for service overseas in April, 1915, is reported killed in action. He was a graduate of Toronto University and leaves a mother and sisters resident in North Tonawanda, N. Y.

A. C. Hall died in Chile, Oct. 2, of typhoid fever. He left the United States in June last to take charge of the smelting plant at Caldera, in that country, which the American Smelting and Refining Co. had then recently furnished. He was well known in this country and in Mexico, where he was for some years superintendent of the smeltery at Aguascalientes. He had been with the American Smelting and Refining Co. for 15 years and was a very popular man.

Bedford McNeill, widely known as a mining engineer and a compiler of cable codes, died in London, Sept. 19. He was one of the founders and a prominent member of the Institution of Mining and Metallurgy, and was its president in 1913-14. Shortly after his graduation from the Royal School of Mines, Mr. McNeill was in 1880 appointed assistant to the late Mr. John Darlington. He had a wide experience in mining in Europe and America. His cable codes, the first edition of which was published in 1893, are in use all over the world.

Societies

The American Mining Congress, which opens its nineteenth annual convention at Hotel La Salle, Chicago, Nov. 13, plans to devote considerable attention to the oil industry. The general meetings are to be held in the mornings, and the sections devoted to oil, coal, lead and zinc, copper, and precious metals, are to meet every afternoon in their own assembly rooms at the hotel. One of the special questions in the oil section will be that relating to the rights of the Western oil claimants upon lands withdrawn from entry and upon which large development has been made.

Trade Catalogs

Matteson Mine Cars. Joshua Hendy Iron Works, San Francisco, Calif. Bulletin No. 125. Pp. 16; 7x10 in. Illustrated.

Pumping Engines. Allis-Chalmers Mfg. Co., Milwaukee, Wis. Bulletin No 1637. Pp. 74; 8x10½ in. Illustrated

Pulverized Coal Equipment. Lehigh Car Wheel and Axle Works, Catasauqua, Penn Catalog No. 71. Pp. 28; 8x10½ in. Illustrated.

All-Steel Jaw Crusher. Allis-Chalmers Mfg Co. (Mining Machinery Dept.), Milwaukee, Wis. Bulletin No. 1,810. Pp. 12; 8x10½ in. Illustrated.

Brass and Iron Valves, Fittings, Etc., for Steam, Gas, Water, Air and Oil. The Kelly & Jones Co., Greensburg, Penn. Catalog O. Pp. 470; 5x7½ in. Illustrated

Oxy-Acetylene Welding and Cutting Apparatus. The Alexander Milburn Co., 1418-28 W Baltimore St., Baltimore, Md. Catalog No. 21. Pp 32; 8x10½ in. Illustrated

Extracts from the Technical Press is the title of a 32-page booklet issued by the Hardinge Conical Mill Co., 120 Broadway, New York, which contains reprints of articles from the "Engineering and Mining Journal" and other papers relating to the Hardinge mill.

Industrial News

General Naval Stores Co., New York has issued a booklet on flotation oils that gives some useful information about oils, in general, for flotation and about G. N. S. oils in particular. It will be sent to all applicants upon request

A. Leschen & Sons Rope Co. has recently sold to the Queen of the West Mines Co., Cornucopia, Ore., a two-bucket gravity aërial tramway, 3,200 ft. long, with a capacity of 6 tons per hr The company has also supplied a two-bucket tramway, 800 ft. long, to the Cottonwood Coal Co., of Lehigh, Mont.

New Patents

United States patent specifications listed below may be obtained from "The Engineering and Mining Journal" at 25c each. British patents are supplied at 40c each.

ABRASIVES—Process of Treating Certain Aluminous Abrasives. Thomas B Allen, Niagara Falls, N. Y., assignor to General Abrasive Co., Niagara Falls, N Y (U S No. 1,199,011; Sept 26, 1916.)

ALLOY of Copper (95.5%), Iron, Tin, Etc Joseph Monville, Hubbell, Mich, assignor of one-half to Joseph J. Ethier and one-fourth to William Kline, Hubbell, Mich (U. S. No 1,199,200, Sept 26, 1916.)

CRUSHERS—Improvements in Rock Crushers E. H. Moyle, Los Angeles, Calif (Brit. No 3,705 of 1915.

DRILLS—Improvements in Rock Drills and Like Machines. G. Constantinesco, London, and W & W. & W Haddon, London, E. C, England (Brit No. 4,350 of 1915.)

ELECTRIC FURNACES—Improvements in or Relating to Electric Furnaces for Metallurgical or Other Purposes. Hans Nathusius, Upper Silesia, Germany, and Westdeutsche Thomasphosphat-Werke G m. b. h, Berlin, Germany (Brit No. 13,951 of 1914.)

MANGANESE ALLOYS—Improvements in the Production of Manganese Alloys. Th. Goldschmidt, Essen Ruhr, Germany. (Brit. No. 4,455 of 1915.)

MELTING FURNACES—Improvements in Metal-Melting Furnaces. I Hall, Birmingham, Eng. (Brit. No. 3,874 of 1915.)

NITROGEN—Process for Fixing Nitrogen by Means of Ferro-Aluminum or Other Ferro-Alloys. Ottokar Serpek, Paris, France, assignor to Société Generale des Nitrures, Paris, France. (U S. No. 1,198,965; Sept. 19, 1916.)

NITROGEN—Process for the Fixation of Nitrogen by Means of Ferro Aluminum Paul Bunet, Paris, France, assignor to Société Generale des Nitrures, Paris, France. (U. S. No. 1,196,657; Aug. 29, 1916.)

OIL AND GAS—Method of Recovering. Frederick Squires, Marietta, Ohio, assignor to Walter Squires, Zanesville, Ohio. (U. S. No. 1,198,078; Sept. 12, 1916.)

REFRACTORIES—Manufacture of Refractory Articles. Thomas B. Allen, Niagara Falls, N Y, assignor to The Carborundum Co., Niagara Falls, N. Y. (U. S. No. 1,197,327; Sept. 5, 1916)

REFRACTORY—Corrosion-Resisting Refractory. Paul Ralph Hershman, Chicago, Ill (U. S. No. 1,198,033; Sept 12, 1916.)

REFRACTORY—Production of Refractory Materials. Paul R. Hershman, Chicago, Ill, assignor to The Mineral Products Co., New York, N. Y. (U. S. No. 1,197,626; Sept. 12, 1916.)

Assessments

Company	Delinq	Sale	Amt
Alpha, Nev.	Oct 25	Nov. 15	$0 03
Aodes, Nev	Oct 11	Nov. 1	0 02
Beaver Mines, Utah	Sept 30	Oct. 21	0 0025
Blue Bell, Ida	Oct 9	Nov. 9	0 002
Blue Bull, Nev	Oct 16	Nov. 20	0 01
Blue Star, Ida	Sept 25	Oct 21	0 02
Bull Valley, Utah	Oct 10	Oct 31	0 004
Cash Boy, Nev	Sept 1	Oct 15	0 01
Chief Cons. Ext., Utah	Oct 10	Nov 1	0 002
Consolidated Imperial, Nev	Oct 25	Nov 15	0 01
Con Virginia, Nev	Sept 29	Oct 20	0 05
Demijohn, Utah	Oct 21	Nov. 10	0 005
Diam. Blk., Butte, Nev	Oct 12	Nov. 18	0 01
Eagle Mountain, Ida	Oct 2	Nov. 4	0 001
Four Timbers, Ida	Oct 1	Nov. 1	0 002
Giant, Ida	Oct 5	Nov. 9	0 003
Gold Bond, Utah	Sept 29	Oct 24	0 001
Goldstrike Bon., Utah	Sept 25	Oct 16	0 0025
Great Western, Nev	Sept 26	Oct 18	0 01
Independent, Ida	Oct 7	Nov. 7	0 005
Leonora, Utah	Sept 27	Oct 16	0 005
Manhattan Cons., Nev	Oct 9	Nov 8	0 01
Military, Ida	Oct 25	Nov 25	0 0005
Monarch-Pgh., Nev	Oct 23	Nov. 27	0 01
Murray Copper, Utah	Oct 9	Nov. 8	0 001
Naildriver, Utah	Nov. 4	Dec. 4	0 01
New Baltic, Mich	Oct 14	..	1 00
North Tintic, Utah	Oct 10	Nov 1	0 002
Ophir, Nev.	Oct 25	Nov. 15	0 05
Rio Grande Grubstake, Nev	Sept 22	Oct. 31	0 002
Royal Copper, Ida	Sept 22	Oct 2[illegible]	0 00[illegible]
Seg. Belcher, Nev	Oct 30	Nov 24	0 [illegible]
Sierra Nevada, Nev	Oct 12	Nov [illegible]	[illegible]
Silver Pick, Nev	Sept 25	Oct 30	[illegible] 01
Smuggler, Utah	Sept 2[illegible]	[illegible] 18	[illegible]
Spearhead, Nev	Oct 2	Nov. [illegible]	[illegible]
Tarbox, Mont	Sept 28	[illegible]	[illegible]
Tonopah-Bonanza, Nev	Sept 19	[illegible]	[illegible]
Tobar, Utah	Nov. 2	[illegible]	[illegible]
Umatilla, Nev	Sept. [illegible]	[illegible]	[illegible]
Uvada, Nev.	Oct 9	[illegible]	[illegible]
Diamondfield Bl'k B'tte, Nev.	Oct. 1	[illegible]	[illegible] 01

Editorial Correspondence

JACKSON, CALIF.—Oct. 10

(By Telegraph)

Union Posted Warning on Monday for all men, except superintendents, book-keepers and foremen, to keep away from the mines during the strike. Two agitators have been arrested. The South Eureka mine attempted work today but 250 strikers prevented reopening. District Attorney Snyder warned the men that they were breaking the law. There is great excitement in camp and fears are entertained of a general outbreak.

SAN FRANCISCO—Oct. 4

Keeler Is Dry since the recent cleanup and now it is commonly asked what excuse the town has for continuing to encumber the earth. It needs no excuse for being the supply point or the shipping point for a territory reaching back into the hills and including Darwin, Ophir, Cerro Gordo, Saline Valley and numerous small mining and prospecting camps. Through Keeler were shipped approximately 460 carloads of mineral products in September. These carloads, averaging 10 tons to the narrow-gage car, were made up of 161 cars of ore, 144 of slag, 6 of talc, 56 of rock, 90 of soda ash. That makes a total of 457 in 29 days of September. While the Cerro Gordo is the largest shipper through Keeler, it is by no means the only shipping mine in the Owens Lake region. The Estelle mine opened by the Troeger tunnel and numerous small mines in the neighborhood, and the Santa Rosa have joined the narrow-gage-car procession. The Lucky Jim has not quit altogether, since the installation of a flotation plant at the mine, and all the supplies for this and other mines and the camp of Darwin are obtained at or shipped through Keeler. The Saline Valley Salt Co. is moving 200 tons of salt a day over the 13-mi. aërial tramway and shipping as fast as cars can be obtained from the Swansea switch. The soda ash going out is part of the soda-products recovery from Owens Lake by the Inyo Development Co. and the Natural Soda Products Co. The reason shippers fail to do better is that the car supply is short. This hasty assembling of a few facts reveals why Keeler remains on the map. The shipments go chiefly eastward to Salt Lake, though San Francisco gets a portion, and should get more. At present the San Francisco shipments are chiefly by way of Hazen or Reno, Nev. The building of a connecting railroad from Keeler along the east shore of Owens Lake to Olancha, a distance of 20 mi. would turn the tide of shipments from Owens Lake region via Mojave to San Francisco and Los Angeles, and the large amount of supplies coming in from those points would be doubled, and be an advantage to the entire region.

Production of Crude Oil in California fields in August totaled 8,079,023 bbl., a daily average of 185 bbl. less than in July. Shipments in August reached a new high mark, totaling 9,548,075 bbl. or an excess over production of 1,469,052 bbl. Daily average shipments in the first half of 1916 were 267,235. Stocks on hand at Sept. 1 totaled 49,311,395 bbl. as against 50,780,447 on Aug. 1. Field reports show 51 wells completed, 62 new rigs, 284 wells drilling, 6,696 wells producing, 8 wells abandoned. This shows a decrease of nine completed wells and an increase in all other items, the producing wells increasing 71 over July.

BUTTE—Oct. 5

September Payroll of the five largest mining companies operating in Butte district distributed $2,189,000 in wages for September. Anaconda's roll for September was $1,560,000—$70,000 less than for August. The Butte & Superior September roll was $256,000 while that of the Clark properties, including the Elm Orlu mine and Timber Butte mill, was $70,000 and that of East Butte $137,000. Miners received the maximum scale in September, $4.50 per day, because of the high price of copper.

The Du Pont Powder Company's Plant situated between Butte and Anaconda, about 10 mi. west of Butte, is rapidly nearing completion. A large crew of men has for months been on the ground, engaged in constructing the various buildings required in the manufacture of explosives, as well as in the construction of roads, fences, railroad tracks and other facilities for handling the finished product. The welfare of the employees of the plant has not been lost sight of, and a dozen or more substantial cottages, equipped with every modern convenience are in process of construction. The settlement and the station on the Butte Anaconda & Pacific Ry. will be known as Ramsey, named after Colonel Ramsey who died recently after a long career with the du Pont company.

Butte Main Range First Shipment of high-grade copper ore was made recently when 40 tons taken out in the development work on the 500-ft. level was loaded and sent to the Washoe smeltery. This ore came from the Sinbad vein and is merely the ore taken out there in the cleaning-up work. Paul A. Gow, general manager of the company, said "The Tropic, of the Anaconda company which adjoins this property, has been producing splendid ore from the levels between the 500 and 700, and we feel confident that we will develop commercial ore that we can begin shipping from the same levels within a short time."

Butte & Superior Mine and Mill output for the month of September was approximately 50,000 tons of ore from which were produced about 4,000 lb. of concentrates. From this about 15,000,000 lb. of zinc in concentrates was secured. The percentage of recoveries ran from 93½ to 94%. About 290,000 oz. silver in concentrates was secured. Butte & Superior improvements are progressing and by the first of the year it is expected that the new shafts will both be completed, equipped and put into operation. The headframe at the new main shaft is completed and is the highest headframe in the Butte district. Its height is 152 ft. over all and from the collar of the shaft to the center of the sheave wheel is 135 ft. The belt conveyor from the coarse-crushing plant at the ore bins to the mill, has been completed and is now in operation. The foundations for the hoist and the new hoist buildings are all in and the steel work is going up. The new change house with accommodations for 1,800 men is nearly finished and will be put into service within three weeks. It is one of the best equipped in the district. In the new main shaft most of the stations and skip pockets down to the 1,500-ft. level are complete and connections have been made with the new No. 2 timber shaft. Most of the stations of this shaft are also completed.

DENVER—Oct. 4

The Denver & Rio Grande R.R. was an important factor in the upbuilding of numerous mining camps in Colorado. Its original lines were all of narrow gage. By a gradual process, the main line and several important branches have been made standard gage. For a long time, the main lines were three-rail tracks but it has been the desire of the company to entirely do away with traffic in both narrow- and standard-gage rolling stock over the same lines and, as a consequence, the third rail was taken up between Denver and Salida and between Pueblo and Alamosa. It is impossible to send narrow-gage carloads of ore to the big smelteries in Denver and Pueblo, and this is an item of significance to such districts as Ouray, Telluride, Lake City, Silverton, Gunnison, Rico and Pitkin. Some time ago (since the establishment of the state public utilities commission) the railroad company applied to the state authorities for permission to take up the third rail between Salida and Leadville; but there was such a protest awakened among ore shippers in Leadville and Breckenridge as well as throughout the San Juan country that the commission refused the request. By retaining the third rail in this stretch of main line, narrow-gage cars can be shipped to the smeltery of the Ohio & Colorado Company at Salida from portions of western Colorado that are provided only with the narrow lines.

General Mining Revival in Colorado is evidenced by the number of new companies incorporated since the first of present year, a total of 350. It is estimated that the 1916 output of all metal mines will exceed that of 1915 by 25%. Another indication of mining prosperity is the great increase in bank deposits in some of the mining counties, Boulder, Lake, Teller and San Juan being the most notable in this respect. Boulder County has furnished the only real sensational boom, this due to the high price of tungsten in the fore part of the year. Leadville district, it is estimated, will make a greater total production than Cripple Creek for the first time in years, and this will not be due to any falling off in Cripple Creek's production. Many old properties in San Juan County have been reopened and at least one important tungsten mine developed. In Summit County the Breckenridge district has taken on new life. Dredges are producing more than ever and new ground is being constantly drilled. New companies have been organized, old mines reopened and new mills built and in the case of the Wellington, additional property acquired, and capacity of milling plant increased. Robinson, formerly a dead camp in Summit County, now has several mines operating. Park County is also taking on more life with new milling plants operating at old mines and some hydraulic work In San Miguel County, the milling of Black Bear ore at the Smuggler-Union plants is adding largely to the production. In several other counties notably Gunnison, Hinsdale and Saguache, new and old properties are being opened.

SALT LAKE CITY—Oct. 6

Utah Copper's Production for the third quarter will be more than 60,000,000 lb., and earnings in the neighborhood of $11,000,000—not including interest in the Nevada Consolidated. The present rate of production is in the neighborhood of 20,000,000 lb. copper per month. With the interest in the Nevada Consolidated included, earnings for the quarter will be in the neighborhood of $1,000,000 a week.

Hearing in the Smoke Suits brought by farmers against the American Smelting and Refining Co. and the United States Smelting Co. was resumed Oct. 4 in the United States court before Judge Tillman D. Johnson. The cases have been on trial since last spring, but recess was taken during the summer. The plaintiffs have presented their side, and evidence is being offered by the smelting companies to show actual conditions. Both smelting companies have experimental farms in the neighborhood of the smelteries, where extensive data has been gathered. In this connection it may be mentioned that the United States company has received an unusual number of awards at the Utah state fair, now in progress, on stock, vegetables, grain, etc., raised on its farm.

Tintic Standard and Emma Copper are two Utah mines at present attracting attention, the former of east Tintic, and the latter of Alta. A recent strike at the Tintic Standard promises another regular producer. The company has been operating for a number of years and has made shipments from time to time. The orebody recently opened—lead-silver ore of shipping grade—is on the 1,600 level and up to the present has been developed 75 ft. by 60 ft. by 7 ft., with sides, roof and floor still in ore. In all about 10 cars of ore have been shipped from the strike, the ore having brought from $1,500 to $2,100 a car. The Emma Copper, which has been prospecting by diamond drilling in conjunction with the old Emma Leasing Co., has reported through its managing director, C. S. Herzig, that three drill holes have cut ore. Some of the cores show galena and some argentite. The drills were in ore 14 ft. and more in thickness. This prospecting was undertaken in hopes of finding the continuation of the old Emma orebody, which was cut off by a fault. The strike is of interest, although it may be some time before its full importance is determined. To reach this ore an inclined winze, or an old vertical working shaft from the Bay City tunnel will be unwatered, after which about 200 ft. of drifting or crosscutting will be done to reach the ore. Whether this is a continuation of the faulted Emma orebody, productive in early days, or some other orebody, remains to be seen. The position of the ore does not exclude the former possibility, and if this should prove the case, the displacement will be proved to be between 350 and 400 ft.

DULUTH, MINN.—Oct. 5

Royalties of $9,000 Per Day are being received by the State of Minnesota at present from state-leased mines. Fifteen state mines are being operated and the weekly output is in excess of 215,000 tons.

Soo Line Ry. Officials announce that the Soo ore dock at Superior, Wis., will have an extension of 600 ft. added, giving 50 additional pockets. This dock handles Cuyuna Range ore exclusively, as the Soo Line hauls no Mesabi Range ore.

Chisholm District Has 570,000 Tons yet to be shipped. The Oliver has 200,000 tons, while the Great Northern has 200,000 and the Shenango 170,000. The manager of the Great Northern properties has received orders to keep shipping "until the boats freeze in the lakes." The Shenango will stop shipping on Nov. 7 and begin stockpiling. About 1,000 men are employed underground at the present time. Labor is plentiful in the Chisholm district at present. The force will be increased to 1,500 men during the winter months.

Iron Ore Shipments from Lake Superior district for September reached 9,600,786 tons, making a total of 48,816,650 tons to Oct. 1, an increase of 14,147,084 tons over same period of 1915. The October movement should reach 8,500,000 tons and some ore will be moved in November and December. The total for the season should be near the 62,000,000-ton mark. The shipments by ports in September follow: Escanaba, 922,517; Marquette, 557,140; Ashland, 1,255,328; Superior, 1,945,171; Duluth, 3,455,611; Two Harbors, 1,456 019.

JOPLIN, MO.—Oct. 7

Extension of the Zinc Fields to the North is the hope of a new company just organized to drill near Columbus, Kan. Thirty-five business men of Columbus constitute the company and have pledged themselves to put in $20 a month, each for one year, to pay for prospecting. It is purely a civic movement—something new for this part of the country.

Three Thousand Tons of Surplus Ore in the Oklahoma field is the estimate of the editor of the "Commerce News," who made a trip over that district last week. This is likely too low, but is interesting as some have guessed the surplus in the Oklahoma section of the district to be as high as 17,000 tons. Probably 5,000 or 6,000 tons would be nearer correct.

Sheet Ground Mines of West Joplin are starting up despite the fact that there have been no rains. The A. W. C. Co., which has four mills in this section that have been idle since early in July, has obtained water from its drifts to fill its ponds and the management believes the decreased evaporation since the passing of extremely hot weather will make it possible to keep going. The La Nora B mine also has started up again, but the Ramage is still down and likely to remain so for some time.

EL PASO, TEX.—Oct. 6

Mine Titleholders in Mexico must work their mines or forfeit their titles, according to a decree signed by Carranza on Sept. 14. which became a law on date of publication. The Department of Fomento will declare the forfeiture of any mine that is idle for two consecutive months, or is idle at various times for a total of three months in one year, and will notify the Department of Finance, which will decide whether the mine shall again be denounced or worked by the government. The Department of Fomento will also fix the minimum number of laborers to be employed in developing new mining claims, but will allow the producing mines to resume operations with not less than the number of men working at the time work was suspended. If it is impossible to work a mine, however, the manager must present evidence of the fact to the department, which may permit the suspension of operations for three months. Mine titleholders must also, under penalty of forfeiture without recourse, keep all taxes paid up quarterly, notwithstanding the fact that it may have been impossible for the owner to keep in physical possession of the mine or operate it. A mine-tax law of June 6, 1892, was cited.

TORONTO—Oct. 7

The Ontario Nickel Commission, which recently visited Sudbury and other mining districts in northern Ontario, is now finishing its work here. Dr. Willet G. Miller, who recently returned from a lengthened examination of the nickel field of New Caledonia states that he found the nickel deposits there to be of considerably greater extent than is generally supposed. Large ore-bearing areas have not yet been developed. Some highly valuable deposits are owned by the International Nickel Co. and held as a reserve. The commissioners are reticent as to the findings of their forthcoming report, but the general impression in political circles is that it will strongly urge the refining of nickel in Canada under some form of strict government control.

The Report of the Royal Commission, appointed Aug. 28 to investigate the nature and causes of unrest in the mining industry of Cobalt, has been issued. During the sittings of the commission, a total of 79 witnesses were examined on behalf of the miners, and eight on behalf of the operators. There were only two demands, one being for increased wages and the other that the employers recognize and confer with a committee of the men. The commission reported that as far as all the other conditions of working the mines are concerned, the employees were unanimous in expressing their satisfaction. The report deals separately with the two points at issue. The question of increased wages was urged strongly by the men and was based on the increased cost of living. This increase was stated by various witnesses to range all the way from 20 to 40%. The employers admitted the increased cost of living but claimed from figures gathered by them from the reports of the labor department, that the increase in the last two or three years averaged only about 10%. On May 1 the managers granted an increase of 25c. a day to practically all employees, and believing that silver was destined for some time to come to sell over 70c. an ounce, granted a bonus to underground workers of 25c a day when silver averaged 70c. or over for the preceding month. This bonus, due to the drop in the price of silver, was paid for only two months. The managers claimed that the 25c. increase was sufficient to offset the increased cost of living and further that the conditions under which the mines were being operated at present did not justify them in granting any further increase. The increased cost of living was acknowledged by all parties, only the percentage of increase being in dispute, and the commission in view of the conflicting evidence found it difficult to determine exactly what the percentage of increase might be. The commissioners concluded, after reviewing all the evidence that they were not prepared at present to recommend an increase in the rate of wages, but they confirmed what the managers had already done including the bonus, but stated that in their opinion the bonus should be based on silver at 65c. an oz. instead of at 70c. The other grievance related to the refusal of the mine managers to meet the committee, composed of union men, appointed for the purpose of interviewing them in regard to wages. The employers in giving evidence stated that while they had no objection to meeting their own men, and believed in the miners having an organization, they considered the committee as representatives of the Western Federation of Miners, and they refused to have anything to do with that organization. The commissioners reported that as the committee was composed of local men, that there was evidently some misunderstanding as to the nature and scope of this committee, and that it would have been better for the managers to have conferred with the committee. This report is signed by two of the commissioners, while a minority report, was as perhaps might have been expected, presented by the third commissioner, who was the labor delegate. The minority report states definitely that on account of the increased cost of living all employees should have received a straight increase of 50c. a day. There is no obligation on the managers to follow the recommendations of the report, and it is not known whether there is any possibility of the men getting further concessions. In view of the fact however, that wages in Cobalt are on a par with the highest paid in any camp in the province it is doubtful if any material changes in the present scale will be made.

The Mining News

ALASKA

ALASKA MEXICAN (Treadwell)—Returns for August show running time of mill 20 days, 7 hr.; tons of ore crushed, 13,160 tons; concentrates saved, 346.53; estimated value of free gold, $15,959; of concentrates, $14,579; estimated realizable value, $30,232. With operating expenses of $16,461, and construction expenses $4,606, the estimated net profit was $9,165; other income, $3,730. Yield per ton of ore milled was $2.32; stock of broken ore decreased by 9,842 tons.

ALASKA UNITED (Treadwell)—Returns for August: Mill ran 30 days 13 hr.; tons of ore crushed, 49,889; estimated value of free gold, $51,527; of concentrates, $52,373; estimated realizable value, $102,861. Estimated profit on Ready Bullion mill, $19,940; loss on 700 Claim mill, $5,322. With construction expenses on the Ready Bullion of $7,925, and on the 700 Claim of $6,559, the estimated total loss on the latter of $11,882 nearly balanced the profit on the former of $12,015.

ALASKA TREADWELL (Treadwell) August report gives subsidence of hanging wall, due to drawing of reserves, reason for shutting down 240 mill and one-half of 300 mill on Aug. 1. Time run by 240 mill only 10 hr., and by 300 mill, 30 days, 16 hr. Tons of ore crushed, 24,696; tons concentrates saved, 781; estimated gross value of free gold, $11,825; of concentrate, $63,582; of base bullion, $2,787; of total production, $78,195; of realizable value, $77,413. Operating expenses were $44,416, giving estimated operating profit of $32,997. With construction expenses at $17,585, estimated net profit was $15,411. Yield per ton was $3.16; stock of broken ore decreased by 5,411 tons.

ARIZONA

Cochise County

SHATTUCK-ARIZONA (Bisbee)—September production: Copper, 1,566,446 lb.; lead, 233,800 lb.; silver, 26,928 oz.; gold, 119 oz. Nine months' copper production, 13,543,030 lb.

Gila County

INSPIRATION NEEDLES (Miami)—Planning to sink 300-ft. winze from tunnel on Standard No. 5 claim to open up 100-ft. mineralized dike traversing property.

INSPIRATION CONSOLIDATED COPPER (Miami)—September production, 11,850,000 lb.; August, 11,450,000 lb. Reported that plans are being prepared for leaching plant

MIAMI COPPER (Miami) Injunction obtained at Wilmington, Del., by Minerals Separation, Ltd., stayed pending hearing in Circuit Court of Appeals, provided monthly statement of flotation operations be filed. Total September copper production about 4,381,000 lb.

Greenlee County

ARIZONA COPPER (Morenci)—A 10-in. pipe line for air being installed on 2nd level; recent fire in Clay mine extinguished.

SHANNON COPPER (Clifton)—September production, 774,000 lb.; treated low-grade ore; also 5 days required for furnace repairs. August output, 860,000 lb. Company resumed dividends posting 25c. quarterly and 25c. extra, payable Nov. 15.

DETROIT COPPER (Morenci)—Tunnel connecting West Yankee shaft with orebodies explored by churn drills in Coronado Hill struck orebody now being tested by churn drills.

Maricopa County

GOLD BAR MINES CO. (Wickenburg) New company, backed by Pittsburgh capital, to reopen old O'Brien mine, near Wickenburg. Now equipped with good buildings and 12-stamp Nissen mill. Mill will not be started until new shaft is sunk to 600-ft. level. Active development has begun. T H Jenks, manager.

Mohave County

OATMAN SYNDICATE (Oatman) Development resumed by prospecting along vein.

CUSTOM MILL at Chloride may be constructed under management of Frank Steffee Process will include flotation.

TOM REED (Oatman) Red Cloud shaft crosscut penetrated 9 ft. of vein, 115 ft from shaft, and footwall not yet reached

GOLD DUST (Oatman)—On second level, 800 ft. northwest of shaft, a 30-ft winze penetrated 14-ft. orebody. Engineer estimates 50,000 tons ore blocked out in property.

OATMAN UNITED (Oatman)—Property financed and shaft sinking being pushed to reach 600-ft. level. A 60-hp. compressor en route from Kingman will soon allow use of air drills.

Yavapai County

NEW STATE (Prescott) Struck 18 in. vein, assaying high in gold.

EWING & HOOKER (Jerome) Has opened gold ore in 260-ft tunnel

HARRY HAUSEN GROUP (Jerome)—F. M. Winter, of Phoenix, has taken over and will develop.

PITTSBURG-JEROME (Jerome)—Southwest crosscut penetrated 12 ft. copper ore. S. S Ballard, manager.

VERDE MONSTER (Jerome)—New promotion of Charles P. Myers, of Los Angeles, to develop Black Warrior group, 8 mi. north of Jerome.

ALVARADO GROUP (Congress)—Has been taken over by New York men; extensive development planned, including new reduction plant.

UNITED VERDE EXTENSION (Jerome)—Reported to have recently secured smeltery site Shipping 8,000 to 8,500 tons high-grade ore monthly

JEROME DAISY COPPER (Jerome)—New organization of Phoenix, Bisbee and Prescott men to take over 10 claims situated north of the Arkansas and Arizona.

ARKANSAS & ARIZONA (Jerome)—At recent meeting, John Boyle elected president; H. N Jasper, secretary-treasurer; H. P. Tear, vice president; W. D Tickner, director, all of New York Stock has been listed on Curb.

CALIFORNIA

Amador County

KENNEDY (Jackson) The mine's first-aid team, which won first prize the silver trophy cup at the recent meet at Sacramento received in addition $10 each from E. C Hutchinson, president of the Kennedy Mining and Milling Co. The team is composed of G Ireland, William Daugherty, H Stewart, A Rossi, C Glenfardoni, J. Hill, J Canonica. In addition t[illegible] these prizes the California Metal Producers Ass[illegible] ciation paid a cash prize of $30 to the team [illegible] a gold medal to each member. The A[illegible] team, which won first prize at the Panama [illegible] meet a year ago, was third this year, and [illegible] much disappointed, is drilling hard f[illegible] test.

Inyo County

SODA ASH, recovered from Owe[illegible] on Southern Pacific in Septe[illegible] nearly 1,000 tons. Total mi[illegible] from Keeler in September [illegible] 160 carloads of 10 tons p[illegible]

LUCKY JIM (Darwin)—New flotation plant said to be in successful operation. Mine supplies are hauled in by motor truck from Keeler, distance 25 mi.

CERRO GORDO (Keeler)—Shipped in September about 1,000 tons of zinc ore and 250 tons lead ore; 144 carloads of slag added to the month's shipments made a total of 269 narrow-gage cars.

ESTELLE (Keeler)—Drifting on first of five veins cut by the 7,000-ft. Troeger tunnel; high-grade silver-lead ore recently opened Property south of old Union mine; ores contain silver, lead, copper, gold and zinc. Roy C. Troeger, superintendent.

TUNGSTEN MINES (Bishop)—Shaft completed in August on Little Sister, connecting surface with lower tunnel, now used as chute for ore from surface gloryhole. Large surface deposit will be quarried into shaft and trammed through tunnel and on surface track by electric motor to mill. New Deister table added to four concentrators of mill equipment, which will be increased to a total of 12 tables, including Deister, Isbell and Wilfley types. Concentrator house 30x100 ft. will be added to the mill building.

Tuolumne County

DRILLING CONTEST at Jamestown on Labor Day won by Payton and Burbank, of Amador drilling $30^{12}/_{16}$ in. in 15 min. Lumsden brothers, of Big Oak Flat, drilled $30^{11}/_{16}$ in. in the same time. In mucking contest, E. Costella shoveled one ton of rock in 3¾ min. Earl Barron shoveled one ton in 3 min.

BUCKEYE (Sonora)—Miners to whom wages were overdue have received 50% with promise of the remainder within 60 days. Reported property will be reopened by New York men.

STREET (Tuttletown)—Headframe, hoist building and compressor building recently destroyed by fire, which also burned timbers in shaft to depth of 60 ft. Reported that mine will be unwatered, equipment rebuilt and operation resumed. Richard Kinsman, of Oakland, owner.

COLORADO

Boulder County

KEYSTONE MINING AND REDUCTION (Boulder)—Building 50-ton mill.

LIVINGSTON (Sugarloaf)—Latest cleanup at milling plant brings present production for year up to $30,000.

NELSON MINE (Ward)—Operated by crew of three, made production of 6½ tons tungsten concentrates during month of September.

Clear Creek County

TEK MINING, MILLING AND LEASING (Idaho Springs)—Shoot of bold-silver-copper ore opened in main tunnel level while driving to cut cross vein. Tunnel will be advanced 500 ft. farther to cut second cross vein. Mine equipped with 10-stamp mill, modern mine plant and hydraulic power plant.

Lake County

WESTERN ZINC OXIDE (Leadville)—Construction of four furnaces completed recently.

LEADVILLE UNIT (Leadville)—U. S. S., R. & M. Exploration Co., will retimber the 525-ft. Jamie Lee shaft. Intend to sink 300 or 400 ft. into the white limestone, where approximately 2,000 ft. of exploratory work is contemplated. Will install double-drum electric hoist, with capacity of 5,000 lb. at rope speed of 400 ft. per min. H. S. Lee, manager.

La Plata County

VALLEY VIEW (La Plata)—Flotation process being installed in new milling plant. Several strikes of high-grade gold-silver ore reported made in district lately.

Ouray County

REVENUE (Sneffels)—Property acquired by St. John Mining Co.

JUMBO (Ironton)—Car gold-silver-lead ore shipped recently by lessees netted $60 per ton.

CAMP BIRD (Ouray)—New tunnel now in 2,085 ft. Will be driven total distance of 10,700 ft.

MOUNT HAYDEN (Ouray)—Milling-grade oreshoot 3 ft wide opened in development work.

GOVERNOR (Ouray)—Shoot of high-grade gold quartz several inches wide opened in this Sneffels mine. Talc streak beside quartz also high grade.

CROWN PRINCE MINING (Ouray)—Reorganized and money raised to complete milling plant. Property just below town of Ouray and mill on railroad.

ST. PAUL (Ironton)—New oreshoot 18 ft. in diameter opened in this Red Mountain property. Ore occurs in chimneys and chief value is in copper and silver contents. Last shipments netted $800 per car. Crew of 18 men employed.

MOUNTAIN TOP (Ouray)—Machinery for new mill received. Plant will be unique in milling practice as it will be built underground 900 ft. from tunnel portal. This will permit winter work without interference from deep snows and snow slides. Large tonnage milling-grade ore developed.

SUMMIT COPPER MINING AND MILLING (Ironton)—Development commenced in Koehler tunnel to open San Antonio property at Red Mountain. Force of 10 men repairing tunnel and placing underground equipment in condition. John F. Roper, manager.

Park County

BLACK CLOUD (Alma)—Four-foot vein assaying well in gold, silver and lead opened recently. Preparations for winter work under way. Property near London mine.

San Juan County

FRANK WALLER (Animas Forks)—Lessees Hayti & Boss have opened 3-ft. vein, assaying 0.5 oz. gold and 70 oz. silver a ton.

GREEN MOUNTAIN (Silverton)—A. W. Harrison and associates have obtained options on Pride of West and Green Mountain mines, and will treat ores in Green Mountain mill, which is being overhauled and repaired.

Summit County

BLUE FLAG (Breckenridge)—Stated company will resume operations on its Colorado properties at Breckenridge and Cripple Creek.

PIONEER CONSOLIDATED (Breckenridge)—New tunnel being driven and old workings repaired. Mill will be running to capacity soon.

EL DORADO (Breckenridge)—Crosscut tunnel being driven to cut vein at depth. Mine equipped with compressor, machine drills and milling plant.

COLORADO METALS (Silverton)—Car high-grade tungsten concentrates shipped recently to New York City. Ore produced from Dawn of Day mine and treated at Yukon mill. Louis Schafer, manager.

WILFLEY (Kokomo)—Carload of zinc sulphide ore shipped to new mill of Colorado Metals Separation Co., at Breckenridge. If tests are successful, large tonnage of similar ore will be shipped from this and other mines in Kokomo district.

NEW PLACER MINE in Breckenridge—portions of Washington and Pittsburgh ground—has been leased by Denver men and hydraulic equipment will be installed. Survey now under way for pipe line from Indiana Gulch, a distance of seven miles.

MUTUAL CORPORATION (Kokomo)—Vein 10 ft. wide with 1-ft. shoot, assaying 40 oz. silver, opened in this Jacque Hill property. Ore also assays well in gold and lead. Crosscut tunnel, now in 330 ft., being driven to cut Gold Queen vein at depth of 250 ft.

TONOPAH PLACERS CO. (Breckenridge)—Testing area south of Gold Pan placer. New dredge, larger than those now operating, may be built for this ground. No. 3 dredge recently cut through apex of large silver-lead vein; thought to be extension of vein on New York group.

PUZZLE LEASING CO. (Breckenridge)—New machinery to be installed at shaft and sinking to 500-ft. level started at once. In level from this shaft below tunnel level 1,000 ft. of new development work opened shoots of good-grade lead and zinc ore assaying well in gold and silver. After an examination by Forbes Rickard, it is stated, Bulkley Wells, manager of Smuggler-Union Mining Co., Telluride, Colo., has become intersted and has assumed management.

Teller County

PORTLAND (Cripple Crek)—Oreshoot 500 ft. long, 10 to 40 ft. wide, with fair gold content, reported opened on lowest or 1,950-ft. level recently.

GRANITE (Cripple Creek)—Rich oreshoot opened on 1,400-ft. level. Another shoot discovered on 1,500-ft. level of Bobtail vein, which extends into Portland territory.

DELAWARE

WORTH BROS., who sold their Coatesville, Penn., plate mills to Midvale Steel and Ordnance Co. about a year ago, will build $10,000,000 plant on Delaware River, 6 mi. below Marcus Book and 8 mi. above Wilmington.

IDAHO

Shoshone County

EMPIRE COPPER (Enaville)—Mill capacity to be increased from 150 to 300 tons daily. Machinery already ordered. Now shipping three cars concentrates weekly to Trail smeltery, which averages 18.5% copper. Company employs about 60 men.

RAY-JEFFERSON (Wallace)—Will be greatly benefitted by new branch of O. W. R. & N R. R. started building up Beaver Creek. Test runs made with new 400-ton mill reported satisfactory. Pending railway completion shipments will be made by motor trucks.

BUNKER HILL & SULLIVAN (Kellogg)—Grading for smeltery buildings completed and concrete foundations in place. O. W R & N. R.R. is installing sidings from main line at Sweeny. Active building construction begins soon with delivery of materials from storage at Kellogg.

HECLA (Burke)—Milling 450 tons daily at Gem mill and 300 tons at Federal mill. When 200-ton addition to its own mill is completed, Federal plant will probably be retained. Gross income for six months ended June 30, 1916, was $1,082,587, on which net profit was $766,887, or $205,135 more than for entire year of 1915.

MICHIGAN

Copper

1916 COPPER PRODUCTION for Lake Superior district, according to local estimates, will reach 280,000,000 lb., scarcity of labor preventing greater production.

ALLOUEZ (Allouez)—Shipping more than 2,000 tons daily.

ISLE ROYALE (Houghton)—Average grade of rock now better than 14 lb.

AHMEEK (Ahmeek)—Developing second fissure vein which miners claim will prove as good as first developed by No. 2 shaft.

CALUMET & HECLA (Calumet)—Considerable 50-lb. copper rock recently sent to stamps from lateral extensions into territory previously regarded of doubtful value. Flotation process plans under consideration.

Iron

ON MARQUETTE RANGE annual report of Inspector of Mines for year ended Sept. 30, shows 13 men killed—the best showing of any year for some time past. There are 116 mines, of which only 33 are in operation. Men employed underground, 3,332; on surface, 1,578. Number of fatal accidents per 1,000 men employed was 2.58.

CASTLE (Wakefield)—Shaft sunk to 19th level. Pump station now being cut. Two 500-gal. electric pumps to be installed.

TRADERS (Iron Mountain)—Stripping about completed. Contract let first for removal of 50,000 cu.yd., later increased to 100,000 cu.yd. Ore will be shipped until close of navigation.

SECTION 16 (Ishpeming)—New engine house about completed. Hoist already installed. Four 4-ton electric locomotives to be put underground on two main levels and two 2-ton locomotives on surface trestles. New steam engine and a 100-kw. generator installed. All electric wiring completed

MISSOURI

Joplin District

HURRY UP (Webb City)—Enlarged its Portia plant at Galena and restarted operations after three weeks' shutdown.

J. B. S. (Joplin)—Getting good "chunk lead" in shallow ground, 56 ft., on Aylor land, 4 mi. east of Joplin. New field.

TWO-FORTY (Picher, Okla.)—Started drilling on 240-acre tract directly east and adjoining Picher Lead Co. developments.

F. R. COOK (Springfield)—Paid $60,000 for lease on 1,115 acres of mineral land 4 mi. north of Commerce, Okla., and will develop.

TULSA (Joplin)—Building mill on Haggerty tract in South Joplin. Working good run at 95 ft. but main body lies at 165 ft.

McDONALD (Webb City)—Have sunk shaft through 35 ft. of rich, soft ground ore and will be drifting soon. Property is close to former big soft-ground producers.

OSAGE (Carthage)—Encountered ore in new shaft at 184 ft. Company headed by Dr. Charles Powers, pastor, First Methodist Episcopal Church, South, at Springfield.

LUCKY STAR (Joplin)—Opened up rich run of blende in mine, in which Ohio capitalists sunk considerable money in 1909. Former company was working just over ore.

BALTIC (Duenweg)—Former rich producer, virtually worked out, leased to miners for pillar pulling. Was sold for $125,000 in July, 1915, and company made big profits over cost.

FIFTH STREET (Joplin)—Opening up good mine on Starr land. Plan joining with C. M. & H. Co. in erection of mill, latter company to work Glendale shaft on Continental land.

EVANS-HALL-SOY (Duenweg)—In driving air drift opened face of rich ore 8 ft. high, 45 ft. wide, in sheet ground at 215-ft. level. May be extension of O. F. & L. run, short distance southeast.

BARNETT-GROUNDS (Duenweg)—Constructing 200-ton calamine mill on Burch land. Mill will cost $25,000 and $14,000 already spent in development. Will be most pretentious calamine property in district, Granby excluded

FREEMAN-BARNETT (Duenweg)—Good shallow lead ground opened, making output of 100 tons in week. In another shaft on lease the company now sinking in sheet-ground blende ore, which will be worked after lead is exhausted

W. M. SHERIDAN (Picher, Okla.)—Has let contract for 300-ton mill, to be erected on developed tract west of Picher. Company had long fight with water, but now has two shafts in good ore. Mill to be completed in 90 days.

COAHUILA LEAD AND ZINC (Webb City, Mo.)—Overhauling mill No. 1 at Porto Rico and installing new jigs, bringing capacity up to 900 tons per day by Nov. 1. Tramway from field shaft to Carthage mill is completed; about 500 tons per day will be handled.

MONTANA

Beaverhead County

BEAVERHEAD-ALBERTA CO. (Dillon)—Drilling for oil 9 mi. south near mouth of Smallhorn Cañon. Now down 500 ft.

Carbon County

MONTANA COAL AND IRON CO. (Washoe)—Coal mine in Bear Creek district compelled to suspend for several weeks; fire destroyed tipple, Sept. 24.

Granite County

GRANITE BI-METALLIC (Philipsburg)—J. P. Meyer, of St. Louis, elected president of company to succeed L. M. Rumsey, Jr., who retired from management on account of illness. Company's mines near Philipsburg, large producers of rich silver ore in past, are still in the list of regular producers. Extensive new development being carried out at mines to open up new ore reserves.

Mineral County

INTERMOUNTAIN COPPER (Superior)—The 100-ton mill is in operation. Reported more than three years' ore supply developed in old Amador mine. Edward Evans and Oscar Nordquist were recently elected president and general manager respectively.

Silver Bow County

EAST BUTTE (Butte)—Plans to explore properties down to 2,200 level. So far in 1916 company has produced 12,043,860 lb. of copper.

BUTTE-DULUTH (Butte)—Plant expected ready by Oct. 15 for operation, and leasing company plans mining 500 tons per day by end of year.

BUTTE & SUPERIOR (Butte)—Owing to necessary repairs to old shaft during August, output of zinc in concentrates fell from normal 16,000,000 to 10,000,000 lb. Conditions again normal. With new shafts completed in a few months shutdowns due to shaft troubles will cease.

BUTTE & GREAT FALLS (Butte)—Exploration work by diamond drills on Rio Tinto and Snowdrift claims recently acquired. Will drill to depth of 1,000 to 2,000 ft. Veins intercepted in crosscut on 500 level show zinc and lead. Water encountered in Dewey vein on that level now being handled without difficulty.

ANACONDA (Butte)—Lexington mine, for some time developed by Anaconda for zinc ores, will be sold at auction in Butte on Nov. 1. Sale a formal step in final disposition of assets and cash distribution to stockholders of Atlantic Mines Co., former owner. Anaconda offered price for property, which will return to stockholders $250,000 cash originally in treasury.

TUOLUMNE (Butte)—Development work in eastern section district making rapid progress. Within 30 days regular shipments of ore will probably be made from properties, including Butte-Main Range and Colusa-Leonard Extension. At latter mine, new hoist being installed after which unwatering will begin. At Main Range, crosscut on 700 level will be carried 1,200 ft. to south side line, where Anaconda company's adjoining Tropic mine is producing ore from stopes betwen 500 and 700 levels.

NEVADA

Esmeralda County

CRACKER JACK (Goldfield)—Shaft being retimbered to 320-ft. level where laterals will be driven to pick up extension of oreshoot encountered on 120-ft. level.

SILVER PICK (Goldfield)—Shaft down about 940 ft.; will be continued to shale-alaskite contact. At this point a west crosscut will be driven to develop veins disclosed by recent core drilling west of shaft.

GOLDFIELD CONSOLIDATED (Goldfield)—Final report for August shows net realization of $18,211.10 from treatment of 17,300 tons. Decreased tonnage result of delays incidental to conversion of plant to flotation treatment. Total operating costs $7.01 per ton; 1,664 ft. of development done at $8.39 per ft.

GREAT BEND (Goldfield)—East drift on 300-ft. level, incline, penetrated 50 ft. in second oreshoot, yielding assays from a few ounces to 20 oz. gold across a width from 1 to 3 ft. Recent carload shipment assayed about $40 per ton. East drift out 150 ft., showing 2½ ft. shipping ore. West drift penetrated fault. Jack Campbell, superintendent.

Humboldt County

PACKARD NORTH EXTENSION (Lovelock)—Development by company discontinued; lease given to Kromer & Hogerton.

ROCHESTER MINES (Rochester)—Plans to erect aerial tram from mine to mill having capacity of 25 tons per hour and length of 12,017 ft. Survey completed.

SEVEN TROUGHS COALITION (Seven Troughs)—Damage repaired in recently flooded workings and regular operations resumed at mine and mill.

NEVADA PACKARD (Lovelock)—During first 18 days of September, mill treated 1,900 tons averaging about $10 per ton. Bullion valued at $8,400 recently shipped.

Nye County

TONOPAH ORE PRODUCTION for week ended Sept. 30 was 9,398 tons, valued at $195,011, compared with 9,568 tons for week previous. Producers were: Tonopah Belmont, 3,053 tons; Tonopah Extension, 2,200; Tonopah Mining, 1,700; Jim Butler, 1,200; West End, 656; Halifax, 212; Rescue-Eula, 212; Midway, 28; miscellaneous leases, 137 tons.

JIM BUTLER (Tonopah)—August profit $21,296 from treatment of 1,532 tons of ore shipped to the Belmont plant at Millers.

MIZPAH EXTENSION (Tonopah)—Crosscutting to north on 1,140-ft. level and to east on 1,300-ft. level. Property being developed by Tonopah Mining Co. under working option.

TONOPAH EXTENSION (Tonopah)—August profit was $64,506 from treatment of 9,247 dry tons of ore. Bullion production was 1,618.85 oz. gold and 168,878 oz. silver. Sinking Victor shaft continues; now down about 1,650 ft.

TONOPAH BELMONT (Tonopah)—August profit, $92,636.07 from treatment of 12,364 tons. Bullion production 2,232.37 oz. gold and 199,145 oz. silver. Company started core drilling on East End company's ground as preliminary to further exploration. Additional drill will be in operation soon.

NEW JERSEY

AT BAYONNE employees of Tidewater Oil Co. are on strike. Riots occurred Oct. 11 and union leaders that evening voted to call strikes in plants of International Nickel, General Chemical, Pacific Coast Borax, and Edible Products companies. Bergenport Chemical Co. and some other Standard Oil subsidiaries, posted notices announcing plants would be "closed, until further notice." Total of about 11,000 men affected.

NEW MEXICO

Grant County

BONNEY (Lordsburg)—Unwatered and ready to break ore on 4th level.

BANNOVER-BESSEMER (Fierro)—Erection of new 400-ton elctrostatic mill progressing satisfactorily.

Sierra County

LADY FRANKLIN (Kingston)—Percy Fern driving two tunnels.

EMPIRE ZINC (Kingston)—Making topographical survey of Kentucky Mountain; William McDonald driving Greer tunnel on 800-ft. level.

TEXAS

FREEPORT SULPHUR (Freeport)—Fourth pumping plant about completed; total daily capacity expected to be about 1,200 tons.

UTAH

Juab County

TINTIC SHIPMENTS for September 750 cars, or about 37,500 tons, by 34 shippers, compared to 720 cars in August. Dragon Consolidated, Chief Consolidated, Iron Blossom and Centennial-Eureka, largest shippers.

MAY DAY (Eureka)—Ore discovered below tunnel level; thought to be continuation of ore mined above.

TINTIC STANDARD (Eureka)—Extra shift to be put on to develop large orebody recently opened. Fan for ventilation to be installed shortly.

DRAGON CONSOLIDATED (Silver City)—New development to be undertaken on 1,000 level. September shipments were four cars daily. Large amount of iron ore being shipped.

IRON BLOSSOM (Silver City)—What appears important body copper ore—crosscut and drifted on for approximately 100 ft. in two directions—opened on 1,200 level. Winze sunk in ore of shipping grade down almost to 1,300 level. Drifting on 1,700 to prospect for downward extension of body. Increase from 25 to 100 tons of siliceous ore daily allowed by smelters.

Piute County

ARROWHEAD (Sevier Station)—General Connor mine, near Annie Laurie, recently acquired. Two quartz veins 5 to 14 ft. wide, carrying gold. Tunnel to be driven to connect vein and workings. Bonds amounting to $1[illegible] sold to finance development. H. D. Ch[illegible], president.

Utah County

BAY STATE (American Fork)—Tunnel in 308 ft.; and drifting being done from near face. George Tyler, manager.

MINERAL FLAT (American Fork)—Tunnel—in 2,100 ft.—being put in shape for further driving. Objective point intersection of fissure with ore-bearing limestone. Tunnel to be driven 300 to 500 ft., and crosscuts extended east and west. J. C. Jensen, manager.

WISCONSIN

M. & A. (Platteville)—New mill placed in operation at Rewey.

BELL (Platteville)—Company will commence milling within the next 10 days.

UTT-THORNE (Platteville)—Has taken over Big Eight mine on the Kalbeck land near Meeker's Grove and is installing surface equipment.

BLOCKHOUSE (Platteville)—Producing 40 to 50 tons per 10-hr. shift of 40% zinc concentrates; the first 10 cars of roasted ore sold have assayed over 62% zinc. Kistler & Stephens are the sole owners.

CANADA

British Columbia

STANDARD SILVER LEAD (Silverton)—Struck orebody of 3-ft. solid galena on two levels 10 ft. apart.

IVANHOE (Sandon)—One hundred ton mill replacing one burned last year about ready to start milling Surprise ores.

Ontario

ROSS (Porcupine)—Being diamond drilled.

McINTYRE (Porcupine)—Plant capacity being increased to 600 tons daily.

PETERSON LAKE (Cobalt)—Has found some good ore in old Nova Scotia property.

LITTLE NIPISSING (Cobalt)—High-grade 3-in. vein encountered on 100-ft. level.

SCHUMACHER (Schumacher)—Vein of sulphides showing free gold struck at 200 ft. level.

APEX (Porcupine)—Secured funds for development by issue of 500,000 shares; will resume operation.

THOMAS-HANNAH (Porcupine)—Contract let for several thousand feet of diamond drilling on this claim.

BURTON (Munro)—Contract let 4,000 ft. of diamond drilling. New vein carrying free gold found on surface.

DAVIDSON (Porcupine)—Cut new vein about 2 ft. wide, carrying much free gold. Contract let to sink shaft 100 ft.

NOVA SCOTIA (Cobalt)—Three high grade veins uncovered on surface, from one of which a ton of ore has been bagged.

HURD CLAIMS (Kirkland Lake)—La Rose Consolidated has taken option on these claims, 1½ mi. south of the Tough Oakes.

BELLELLEN (South Lorrain)—An 8-in. vein of 2,000-oz. ore found at depth of 270 ft. in a winze and also in drift on 300 ft. level.

ADANAC (Cobalt)—Having realized $50,000 from sale of stock, will push development and sink shaft from 330 to 450 ft. to reach contact.

TOUGH OAKES (Kirkland Lake)—Production during August and September was approximately $175,000, being an average of $23 per ton milled.

HOLLINGER (Timmins)—For 28-day period ended Sept. 8, mill treated 50,177 tons, averaging $8.59; profit of $221,543; about $19,000 short of dividend requirements. Average running time was 90.4% and total operating costs were $[illegible].628.

PITTSBURG LORRAIN (Silver Center)—This mine, also known as the Curry, has two good oreshoots and several small orebodies resulting from four years' steady devlopment; approaching milling stage.

DOME (South Porcupine)—September production $179,500 from 38,300 tons, or average recovery of $4.68 a ton, a somewhat lower production than for preceding month. Costs were $2.5[illegible] as follows: Mining, 76c.; development charge, 60c.; crushing and conveying, 10c.; milling, 82c.; general, 31c.

MEXICO

SANTA GERTRUDIS (Pachuca, Hidalgo)—Treated in August, 2[illegible],421 tons; estimated profit $33,500.

EL ORO MINING AND RY. (El Oro)—Operating staff ordered to return to mines, probably due to Carranza edict.

CHILE

BRADEN COPPER (Rancagua)—September output, 2,970,000 lb.; August, 2,616,000 lb. Plant extensions proceeding.

CHILE EXPLORATION (Chuquicamata)—Reported to have purchased [illegible] properties of Cia. Minera de Calama for $1,250,000, besides Rosario del Llano, Buena Vista, [illegible], [illegible], Poderosa and Carolina claims. September production 4,038,000 lb. copper; August, [illegible].

CHOSEN

ORIENTAL CONSOLIDATED ([illegible])—Cable report gives September cleanup as $1[illegible]. Details of August cleanup follow: Bonanza Tabowie mill, $29,2[illegible]; from Taracol mill, $2[illegible]; from Maibong mill, $2[illegible]; from [illegible] cyanide plant, $52,110; from Maibong tube-mill plant, $[illegible]; total, $1[illegible]. Tons treated during August, 26,895 tons. Water [illegible] low and without rain soon will have to [illegible] more power than usual during coming winter.

The Market Report

Metal Markets

NEW YORK—Oct. 11

All of the metal markets were strong last week, copper scoring a substantial advance. Lead was very firm, but at unchanged prices. Spelter advanced sharply on speculative buying, but weakened upon the failure of consumers' buying to materialize so much as expected.

Copper, Tin, Lead and Zinc

Copper—There was somewhat larger business than in the previous week, our reports amounting to 23,250,000 lb., compared with about 20,000,000 lb. in the previous week. The bulk of the business was taken by a few agencies, others failing to participate broadly in the business, for one reason or another. Right from the beginning of the week prices exhibited an advancing tendency, this being apparently a belated reflection of the extraordinarily strong statistical position On Oct. 7 important business was done at 27½c., r. t. for January-March delivery. Having made sales at that figure, certain of the largest agencies advanced their asking price.

The shock received by all markets from the submarine exploits off Nantucket, which the newspapers reported on Oct. 9, killed business. Practically all of the business done during the last week was concentrated in the three days, Oct. 5-7. During that time there were a few sales for export, but the great bulk of the business was for domestic account. Wire drawers were large buyers. By far the major part of the business was for delivery in the first quarter of 1917 and was done at prices ranging from 26¾c., net cash, New York, at the beginning, to 27¼c at the end There was a certain volume of business done with belated consumers for prompt delivery at 29c., r. t, and there was some for December delivery at 28c., r. t. The average realized on all business reported was 27@27⅛c., net cash, New York.

The steamship "Strathdene" sunk by German submarine "U-53," carried down a large quantity of both copper and spelter, which it is figured must be replaced immediately in this market.

Copper Sheets, base price, nominally 37½c. for hot rolled and 38½c. for cold rolled for delivery at mill convenience. Earlier deliveries mainly on toll basis.

Copper Exports from Atlantic ports in September are estimated at 29,803 gross tons.

Visible Stocks of Copper in Europe Sept. 30 are reported as follows: Great Britain, 3,162; France, 2,634; afloat from Chile, 1,575; afloat from Australia, 3,000; total, 10,371 gross tons, or 23,231,040 lb. This is a decrease of 1,297 tons from the Sept. 15 report.

Tin—This market advanced sharply, especially in the spot position, owing to the fear of interruption of imports. Up to Monday tin for future delivery was about unchanged in price, but on Oct. 10 there was a sharp advance, following a big rise in the East. A large business in tin was done in this market right through the week. Tin for future delivery opened at 39¾c., rose to 40¾c., on Oct. 10, and closed at 40⅝c., on Oct. 11.

Visible Stocks of Tin Sept. 30 were, including tin afloat: London, 7,320; Banka, 1,263; United States excluding Pacific ports, 7,609; total, 16,192 gross tons, which is 1,850 tons less than on Aug. 31, but 1,001 tons more than on Sept. 30 last year.

Lead—This market was active, there being a better demand and an increased volume of business as compared with the previous week. Canada, South America and Holland were buyers, and there were inquiries from Russia, with prospects that some further business would soon be consummated in that quarter. Prices were unchanged, but were very firm. The statistical position becomes stronger and stronger in favor of the producers. There is prospect that lead for November delivery will presently become quite as scarce as October delivery is now. A contributory factor is the falling down in output of at least three important refineries, which occurred in the early part of this month. The explanation of this is increasing inefficiency of labor.

Spelter—The improvement that began last week continued through Oct. 5 and 6, when a sharp advance in price occurred. This was due to speculative buying. On Oct. 5 the market for prompt spelter momentarily touched 10c. The advance in prices did not have the expected effect of bringing consumers into the market in a broad way, discovering which some producers took what consuming business there was, including some from galvanizers, at a little lower prices. On Monday the news of the exploits of the "U-53" produced a shock that killed all prospects of business and the market became distinctly stale.

Brass special spelter is quoted at 10¼c., intermediate at 14@15c., and high grade at 15@16 cents.

Zinc Sheets are in steady demand. Base price is unchanged at $15 per 100 lb., f.o.b. Peru, Ill., less 8% discount.

Other Metals

NEW YORK—Oct. 11

Aluminum—Stocks for early delivery are still very scarce. Quotations are 65@67c. per lb. for No. 1 ingots.

Antimony—This market became distinctly stronger through the development of a demand which resulted in large business, upward of 1,000 tons being reported done. We quote 11½@12½c. per lb., New York.

Quicksilver—This market advanced further, on good demand and small supply. We quote $80 per flask. San Francisco reports, by telegraph, $74@75, market firm.

Nickel—Demand and prices steady at 45@50c. per lb. for ordinary forms, with 5c. premium for electrolytic.

Minor Metals—Current quotations for **Bismuth** are $3.15@3.30 per lb., New York—**Cadmium** is quoted at $1.30@1.50 per lb.—**Cerium**, electrolytic, is sold at $8@9 per lb.—**Cobalt Metal** is quoted at $1.25 per lb.—**Magnesium** is steady, with sales at $3.50@3.75 per lb. for 99% pure—**Selenium** is from $3 up to $5 per lb., according to size of order.

Gold, Silver and Platinum

NEW YORK—Oct. 11

Gold in the United States Oct. 1 is estimated by the Treasury Department as follows: Held against gold certificates outstanding, $1,704,948,269; in Treasury current balances, $275,579,465; in banks and circulation, $655,481,834; total, $2,636,009,568. This is an increase of $494,227,309 over Oct. 1 last year.

Silver—The market is steady with present demand chiefly for coinage. Recent silver shipments from China to India have tended to firm up the exchanges of the former country. Supplies from this side have shown some increase, judging from from last week's shipments to London.

Mexican dollars in New York were quoted Oct. 5 at 53@56c.; Oct. 6 at 53@56c.; Oct. 7 at 52½@55½c.; Oct. 9 at 52½@55½c.; Oct. 10 at 52@55c.; Oct. 11 at 52⅛@55⅛c. Demand and supply have both been light.

Coined Silver in the United States Oct. 1 is estimated by the Treasury Department as follows: Standard dollars, $568,270,319; subsidiary coins, face value, $189,869,616; total, $758,139,935. Of the standard dollars $485,162,915 are held in Treasury against silver certificates outstanding.

Platinum—This market was quiet, the demand having become rather light. However, the price holds firmly. We quote $89@90 per oz. Iridoplatinum (hard metal) with 10% iridium, is quoted at $96.

Palladium—Quoted at $75 per oz. Some business.

Zinc and Lead Ore Markets

Platteville, Wis., Oct. 7—Quotations of the district are according to the following figures: Base price per 2,000-lb. ton for material assaying 60% zinc is $60 for premium ore down to $50 for medium-grade. For material assaying 80% lead the base price per 2,000-lb. ton is $74. Shipments for the week were 2,654 tons of zinc ore, 153 tons of lead ore, and 721 tons of sulphur ore. For the year to date the figures are 96,590 tons of zinc ore, 3,428 tons of lead ore, and 23,723 tons of sulphur ore. Shipped during week to separating plants, 2,621 tons of zinc ore.

Joplin, Mo., Oct. 7—Price quotations per 2,000 lb.: Blende, high, $68.75; 60% zinc, premium ore, $67.50; medium grades, $68@60; low, $60; calamine, per ton 40% zinc, $45@35; average selling price, all grades of zinc, $60.99 per ton. Lead, base price, $75@80 per ton 80% metal content; high price, $78.80; average selling price, all grades of lead, $74.10 per ton.

Shipments of the week, blende, 8,500 tons; calamine, 425 tons; lead, 950 tons. Value, all ores, $611,740, the week; $28,817,810 the year to date

Other Ores

Manganese Ore—The Steel Corporation, it is reported, has closed a contract for 200,000 tons Brazilian manganese ore for delivery through 1917. The ore will average 48% manganese. The price is 48c. per unit at Rio Janeiro. At current freight rates this will be 70@75c. per unit at Baltimore.

Tungsten Ore—We quote this market at $17 per unit, considerable business done.

Antimony Ore—There was some demand for small quantities, $1.10@1.25 per unit being paid, according to grade of ore.

SILVER AND STERLING EXCHANGE

Oct.	Sterling Exchange	Silver New York, Cents	Silver London, Pence	Oct.	Sterling, Exchange	Silver New York, Cents	Silver London, Pence
5	4.7569	67½	32⅛	9	4.7569	67⅛	32⅛
6	4.7569	68¼	32½	10	4.7569	67½	32 5/16
7	4.7569	68¼	32½	11	4.7569	67⅝	32⅜

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine.

DAILY PRICES OF METALS IN NEW YORK

Oct	Copper Electrolytic	Tin Spot.	Lead N. Y.	Lead St. L.	Zinc St. L.
5	26⅝@27	39⅞	7.00	6.82½@6.92½	9.37½@10.00
6	26¾@27¼	40	7.00	6.82½@6.92½	9.40@9.80
7	27@27½	40	7.00	6.82½@6.92½	9.50@9.75
9	27@27½	43¼	7.00	6.82½@6.92½	9.50@9.62½
10	27@27½	43	7.00	6.82½@6.92½	9.50@9.62½
11	27@27½	42½	7.00	6.82½@6.92½	9.50@9.92½

The quotations herein are our appraisal of the average markets for copper, lead, spelter and tin based on wholesale contracts for the ordinary deliveries of the trade as made by producers and agencies; and represent, to the best of our judgment, the prevailing values of the metals, reduced to basis of New York, cash, except where St. Louis is basing point.

The quotations for electrolytic copper are for cakes, ingots and wirebars. Electrolytic copper is commonly sold at prices including delivery to the consumers and is subject to discounts, etc. The price quoted for copper on "regular terms" (r.t.) is the gross price including freight to the buyer's works and is subject to a discount for cash. The difference between the price delivered and the New York cash equivalent is at present about 0.25c. on domestic business. The price of electrolytic cathodes is 0.05 to 0.10c. below that of electrolytic. Quotations for lead represent wholesale transactions in the open market for good ordinary brands. Quotations for spelter are for ordinary Prime Western brands. Only St. Louis price is given, St. Louis being basing market. We quote New York price at 17c. per 100 lb. above St. Louis.

Some current freight rates on metals per 100 lb. are: St. Louis-New York 17c.; St. Louis-Chicago, 6.3c.; St. Louis-Pittsburgh, 13.1 cents.

LONDON

Oct.	Copper Standard Spot	Copper Standard 3 Mos.	Copper Electrolytic	Tin Spot	Tin 3 Mos.	Lead Spot	Zinc Spot
5	120	116½	141	177½	178	31	54
6	120½	117	142	177¼	177½	30¾	54½
7							
9	121	117½	142	178	178½	30¾	57
10	123	119	142	181	181½	30¾	56
11	123½	119½	142	180	180½	30½	56

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2,240 lb. Copper quotations for electrolytic are subject to 3% discount. For convenience in comparison of London prices, in pounds sterling per 2,240 lb., with American prices in cents per pound the following approximate ratios are given, reckoning exchange at 4.80. £15 = 3.21c.; £20 = 4.29c.; £30 = 6.43c.; £40 = 8.57c.; £60 = 12.85c. Variations, £1 = 0.21⅜ cents.

Iron Trade Review

NEW YORK—Oct. 11

The chief development at present is the strengthening of the pig-iron market. A heavy demand for export has stimulated domestic buying and made prices firmer. Special demand is for basic pig, but foundry is also in request.

Pig Iron Production, estimated for September at 3,238,400 gross tons; nine months to Sept. 30 at 29,360,100 tons. Oct. 1 there were 328 coke and anthracite furnaces in blast, with total daily make of 106,600 tons.

United States Steel Corporation reports unfilled orders Sept. 30 at 9,552,581 tons, a decrease of 137,773 tons during September.

PITTSBURGH—Oct. 10

The September decrease of 137,718 tons in the Steel Corporation's unfilled obligations does not represent any weakness in the trade, as it would have been possible to put much more business on the books. The mills were very reserved about booking business and in some of the products were already practically filled for the delivery period they were willing to consider. In the past four months the net decrease in the corporation's obligations represents no more than nine days' production, and the present obligations represent a tonnage equal to seven months of production. Fully 60% of the obligations, or as large a proportion as at any time, is in the form of actual specifications.

The Phillips Sheet and Tin Plate Co., the largest independent tinplate maker, has announced a price of $6 per base box for tinplate for the first half of 1917 and most of the independents have opened their books. The leading interest will open its books for both sheets and tinplates within a couple of days. The tinplate price is the highest on record. Last season's price was $3.60.

Steel production is increasing, the weather being now very favorable, and this month's output will probably be the largest yet, but there is as great pressure as formerly for deliveries. Steel prices are advancing.

For several months railroad buying has amounted to practically nothing, and a resumption was hardly expected until prices were lower, but there has been a definite resumption.

Pig Iron—We quote: Bessemer, $23; basic, malleable and foundry, $20; forge, $19.50, f.o.b. Valley furnaces, 95c. higher delivered Pittsburgh.

Ferroalloys

Production of spiegeleisen and ferromanganese in the United States nine months ended Sept. 30 is estimated at 305,576 gross tons, an increase of 148,489 tons over last year.

Ferrosilicon is unchanged, high grade, $86@89, low grade, $31@41 at furnace.

Spiegeleisen is steady, 20% quoted at $35@45 per ton at furnace.

Ferromanganese—Since the recent open competition the market has been steady, contract being quoted at $164 for imported and $165 for domestic. Spot lots stand at about the same level. August imports were 8,525 tons, making the total for eight months 48,687 tons.

IRON ORE

Shipments of Lake Superior iron ore in September were 9,600,786 gross tons. For the season to Oct. 1 the total shipments were, in gross tons:

Port	1915	1916	Changes
Escanaba	4,011,682	5,630,994	I. 1,619,312
Marquette	2,313,532	3,026,845	I. 713,313
Ashland	3,829,582	6,051,712	I. 2,222,130
Superior	5,997,023	9,760,966	I. 3,763,943
Duluth	11,807,219	16,174,159	I. 4,366,940
Two Harbors	6,710,528	8,171,974	I. 1,461,446
Total	34,669,566	48,816,650	I14,147,084

Some round tonnages of New Jersey nonbessemer magnetite ores analyzing 58 to 60% iron for delivery over the first half of 1917, have been sold to eastern Pennsylvania furnaces on the basis of 9c. per unit, delivered. A higher price is now asked.

Coke

Coke production in the Connellsville region week ended Sept. 30 is reported by the "Courier" at 412,364 net tons; shipments, 421,196 tons. Upper Connellsville and Greensburg shipments, 41,529 tons.

Chemicals

NEW YORK—Oct. 11

The general market is steady with a good undertone.

Arsenic—Quiet and a little easier. Sales, $5.75@6 per 100 lb. according to quantity.

Copper Sulphate—Steady. Sales at $10@10.25 per 100 lb. according to order.

Nitrate of Soda—Unchanged at $2.90@2.95 per 100 lb. for spot and futures.

STOCK QUOTATIONS

N. Y. EXCH.†	Oct. 10
Alaska Gold M.	12½
Alaska Juneau	6¾
Am. Sm. & Ref., com.	108½
Am. Sm. & Ref., pf.	116
Am. Sm. Sec., pf. A	96½
Am. Sm. Sec., pf. B.	88
Am. Zinc	47
Am. Zinc, pf.	77½
Anaconda	93¾
Batopilas Min	1¾
Bethlehem Steel	535
Bethlehem Steel, pf	130
Butte & Superior	64
Chile Cop	21
Chino	53½
Colo. Fuel & Iron	54½
Crucible Steel	85¾
Dome Mines	24½
Federal M. & S.	16
Federal M. & S., pf.	39
Great Nor., ore ctf.	41½
Greene Cananea	50½
Homestake	133½
Inspiration Con	65
International Nickel	51½
Kennecott	52½
Lackawanna Steel	85
Miami Copper	37¼
Nat'l Lead, com	69
National Lead, pf	114
Nev. Consol	21¾
Ontario Min	6½
Quicksilver	‡2½
Quicksilver, pf.	‡4
Ray Con	24¾
Republic I. & S., com.	74½
Republic I. & S., pf.	112½
Sloss-Sheffield	59½
Tennessee Copper	22
Utah Copper	94½
U. S. Steel, com	111¾
U. S. Steel, pf	120¾
Va. Iron C. & C.	45½

N. Y. CURB†	Oct. 10
Beaver Con	41½
Buffalo Mines	1½
Butte & N. Y.	1½
Butte C. & Z.	7½
Caledonia	.59
Can. Cop. Corpn.	1½
Cashboy	.05
Cerro de Pasco	39
Con. Ariz. Sm	1⅛
Con. Coppermines	2½
Con. Nev.-Utah	¾
Crystal Cop	1¼
First Nat. Cop	4½
Florence	.72
Goldfield Con	.61
Goldfield Merger	.08
Granite	.40
Hecla Min	5½
Howe Sound	5½
Jerome Verde	2
Joplin Ore & Spel	.50
Kerr Lake	4½
Magma	17½
Majestic	.60
McKinley-Dar-Sa	60
Mother Lode	.34
Nevada Hills	20
N. Y. & Hond	15½
Nipissing Mines	8½
Oro	04
Ray Hercules	3½
Rochester Mines	.58
St. Joseph Lead	18½
Standard S. L.	1 1/16
Stewart	.22
Success	41
Tonopah	5½
Tonopah Ex.	5½
Tribullion	1
United Zinc	5
White Knob, pf.	1½
White Oaks	4½
Yukon Gold	2½

SAN FRAN.*	Oct. 10
Alta	.05
Andes	.11
Best & Belcher	.05
Bullion	.01
Caledonia	30
Challenge Con	‡.08
Confidence	.20
Cons. Imperial	‡ 01
Con. Virginia	12
Gould & Curry	03
Hale & Norcross	.05
Jacket-Cr. Pt	.05
Mexican	.15
Occidental	.70
Ophir	18
Overman	‡ 06
Savage	11
Seg Belcher	02
Sierra Nevada	28
Union Con	56
Utah Con	02
Belmont	4 50
Jim Butler	.90
MacNamara	.07
Midway	26
Mont.-Tonopah	22
North Star	.15
Rescue Eula	23
West End Con	.73
Atlanta	09
Blue Bell	‡ 01
Booth	.11
C.O.D. Con	.03
Comb. Frac	.06
D'field B B	.04
D'field Daisy	.05
Jumbo Extension	.38
Round Mountain	.38
Sandstorm Kendall	.04
Silver Pick	19
Central Eureka	05
Argo	.11
Ariz. Central	.10
Big Jim	1.31½
Lazy Boy	.10
Oatman No. Star	‡ 14
Tom Reed	2 15
United Eastern	3 62½
United Western	.08

BOSTON EXCH.*	Oct. 10
Adventure	3½
Ahmeek	102
Algomah	1¼
Allouez	68
Ariz. Com., ctfs	12½
Bonanza	40
Butte-Ballaklava	1½
Calumet & Ariz	74½
Calumet & Hecla	570
Centennial	20½
Copper Range	66½
Daly West	2½
East Butte	15
Franklin	8
Granby	90
Hancock	13½
Helvetia	30
Indiana	3
Island Cr'k, com	44
Island Cr'k, pfd	90
Isle Royale	31½
Keweenaw	5
Lake	13
La Salle	4½
Mason Valley	5½
Mass	15
Mayflower	2
Michigan	3
Mohawk	90
New Arcadian	6½
New Idria	14
North Butte	20½
North Lake	1½
Ojibway	1
Old Colony	2
Old Dominion	69½
Osceola	88
Quincy	88
St. Mary's M. L.	86
Santa Fe	1½
Shannon	9½
Shattuck-Ariz	28
So. Lake	5½
So. Utah	25
Superior	15
Superior & Bost	4
Tamarack	41
Trinity	7½
Tuolumne	67
U. S. Smelting	72
U. S. Smelt'g, pf	51½
Utah Apex	3½
Utah Con	14½
Utah Metal	7½
Victoria	4
Winona	5
Wolverine	46½
Wyandot	1½

BOSTON CURB*	Oct. 10
Bingham Mines	10½
Boston Ely	80
Boston & Mont	88
Butte & Lon'n Dev	68
Calaveras	5½
Calumet-Corbin	02
Chief Con	2
Cortez	30
Crown Reserve	52
Davis-Daly	2½
Eagle & Blue Bell	1½
Houghton Copper	1½
Iron Cap Cop., pf	5½
Mexican Metals	.33
Mines of America	2½
Mojave Tungsten	3½
Nat. Zinc & Lead	57
Nevada-Douglas	1½
New Baltic	1½
New Cornelia	16½
Ohio Copper	15
Oneco	80
Raven Copper	‡ 07
Rex Cons	29
Rilla	10
United Verde Ext.	39½

SALT LAKE*	Oct. 10
Big Four	96
Black Jack	11
Cardiff	7 50
Colorado Mining	19
Crown Point	07
Daly-Judge	7 95
Emma Cop	2½
Gold Chain	20
Grand Central	74
Iron Blossom	1 55
Lower Mammoth	05
May Day	13
Opohongo	‡ 01½
Prince Con	1 35
Seven Troughs	‡ 03
Silver-King Coal'n	2 97½
Silver King Con	3 67
Sioux Con	16
So. Hecla	2 15
Uncle Sam	04
Wilbert	08
Yankee	21

TORONTO*	Oct. 10
Adanac	‡ 25
Bailey	07½
Chambers Ferland	17
Coniagas	4 90
La Rose	57
Peterson Lake	22
Right of Way	05
Seneca Superior	10
T. & Hudson Bay	70 00
Temiskaming	62
Wettlaufer-Lor	11
Dome Exten	34
Dome Lake	59
Foley O'Brien	70
Hollinger	6 75
Jupiter	26
McIntyre	1 44
Newray	70
Porcu. Crown	70
Vipond	37
West Dome	34

STOCK QUOTATIONS—Continued

COLO. SPRINGS	Oct. 10
Doctor Jack Pot	09½
Elkton Con	16
El Paso	40
Findlay	‡ 03
Gold Sovereign	06½
Golden Cycle	2 29
Granite	71
Isabella	22½
Jack Pot	05
Mary McKinney	.31
Portland	1 92
Vindicator	1 97

LONDON	Sept. 26
Alaska Mexican	£0 1 6d
Alaska Tre'dwell	1 5 0
Burma Corp	4 3 0
Cam & Motor	0 11 3
Camp Bird	0 7 6
El Oro	0 9 6
Esperanza	0 11 6
Mexico Mines	3 17 6
Nechi, pfd	0 13 0
Oroville	0 16 9
Santa Gert'dis	0 12 0
Tomboy	1 1 6

* Bid prices † Closing prices ‡ Last Quotation

MONTHLY AVERAGE PRICES OF METALS

Silver	New York			London		
	1914	1915	1916	1914	1915	1916
January	57.572	48.855	56.775	26.553	22.731	26.960
February	57.506	48.477	56.755	26.573	22.753	26.975
March	58.067	50.241	57.935	26.788	23.708	27.597
April	58.519	50.250	64.415	26.958	23.709	30.662
May	58.175	49.915	74.269	26.704	23.570	35.477
June	56.471	49.034	65.024	25.948	23.267	31.060
July	54.678	47.519	62.940	25.219	22.597	30.000
August	54.344	47.163	66.083	25.979	22.780	31.498
September	53.290	48.680	68.515	24.260	23.591	32.584
October	50.654	49.385		23.199	23.925	
November	49.082	51.714		22.703	25.094	
Dec	49.375	54.971		22.900	26.373	
Year	54.811	49.684		25.314	23.675	

New York quotations cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

Copper	New York Electrolytic		London Standard		London Electrolytic	
	1915	1916	1915	1916	1915	1916
Jan	13.641	24.008	60.756	88.083	65.719	116.167
Feb	14.394	26.440	63.494	102.667	*	133.167
Mar	14.787	26.310	66.152	107.714	*	136.000
April	16.811	27.895	75.096	124.319	*	137.389
May	18.506	28.625	77.000	135.457	*	152.522
June	19.477	26.601	82.574	112.432	95.333	137.455
July	18.796	23.865	76.011	95.119	91.409	125.500
Aug	16.941	26.120	68.673	110.283	82.333	126.304
Sept	17.502	26.855	68.915	113.905	85.250	134.071
Oct	17.686		72.601		88.000	
Nov	18.627		77.744		93.273	
Dec	20.133		80.773		100.430	
Year	17.275		72.532			

Tin	New York		London	
	1915	1916	1915	1916
January	34.260	41.825	156.550	175.548
February	37.415	42.717	176.925	181.107
March	48.426	50.741	180.141	193.609
April	47.884	51.230	166.225	199.736
May	38.790	49.125	162.675	196.511
June	40.288	42.231	167.636	179.466
July	37.423	38.510	167.080	168.357
August	34.389	38.565	151.440	169.870
September	33.125	38.830	152.625	171.345
October	33.080		151.554	
November	39.224		167.670	
December	38.779		167.000	
Av. year	38.590		163.960	

Lead	New York		St. Louis		London	
	1915	1916	1915	1916	1915	1916
January	3.729	5.921	3.548	5.826	18.606	31.167
February	3.827	6.246	3.718	6.164	19.122	31.988
March	4.053	7.136	3.997	7.375	21.883	34.440
April	4.221	7.630	4.142	7.655	21.094	34.368
May	4.274	7.463	4.182	7.332	20.347	32.967
June	5.932	6.936	5.836	6.749	25.170	31.011
July	5.659	6.352	5.531	6.185	21.611	28.137
August	4.656	6.244	4.520	6.088	21.946	29.734
September	4.610	6.810	4.490	6.699	23.151	30.786
October	4.600		4.499		23.994	
November	5.155		5.078		26.278	
December	5.355		5.266		28.807	
Year	4.673		4.567		22.917	

Spelter	New York		St. Louis		London	
	1915	1916	1915	1916	1915	1916
Jan	6.386	16.915	6.211	16.745	30.844	89.810
Feb	8.436	18.420	8.255	18.260	39.819	97.762
Mar	8.541	16.846	8.360	16.676	44.141	95.048
April	10.012	16.695	9.837	16.525	49.888	99.056
May	14.781	14.276	14.610	14.106	68.100	94.217
June	21.208	11.752	21.038	11.582	100.614	68.591
July	19.026	8.925	18.856	8.755	97.250	50.750
Aug	12.781	8.730	12.611	8.560	67.786	51.587
Sept	13.440	8.990	13.270	8.820	67.841	52.000
Oct	12.800		12.596		66.536	
Nov	15.962		15.792		88.409	
Dec	15.391		15.221		89.400	
Year	13.230		13.054		67.553	

New York and St. Louis quotations, cents per pound. London, pounds sterling per long ton. * Not reported.

Pig Iron, Pitts.	Bessemer‡		Basic‡		No. 2 Foundry	
	1915	1916	1915	1916	1915	1916
January	$14.59	$21.60	$13.15	$18.78	$13.90	$19.7[illegible]
February	14.55	21.16	13.45	18.93	13.90	19[illegible]
March	14.55	21.81	13.45	19.20	13.[illegible]	19.4[illegible]
April	14.55	21.65	13.45	18.95	[illegible]	19.1[illegible]
May	14.61	21.78	13.60	19.11	13.8[illegible]	19.[illegible]
June	14.70	21.95	13.67	18.95	13.7[illegible]	19.[illegible]
July	14.94	21.95	13.9[illegible]	18.95	13.[illegible]	[illegible]9.20
August	16.01	21.95	15.3[illegible]	18.9[illegible]	14.7[illegible]	19.2[illegible]
September	16.86	22.88	15.95	19.[illegible]	[illegible]	[illegible]
October	16.95		15.96		[illegible]	
November	17.57		16.47		17.[illegible]	
December	19.97		18.44		[illegible]	
Year	$15.821		$14.76		$14.[illegible]	

‡ As reported by W. P. Snyder & Co.

Mining Companies—United States

Name of Company and Situation		Shares		Dividends		
		Issued	Par	Total	Latest	Amt.
Acacia, g	Colo.	1,438,989	$1	$122,004	Jan '11	$0.01
Ahmeek, c	Mich.	200,000	25	4,950,000	July '16	3.00
Alaska Mexican, g.	Alas.	180,000	5	3,507,381	Nov. '15	0.10
Alaska Treadwell, g.	Alas.	200,000	25	15,785,000	May '16	0 50
Alaska United, g.	Alas.	180,200	5	2,045,270	Feb. '16	0.30
Allouez, c.	Mich.	100,000	25	550,000	July '16	2.00
Am. Sm. & Ref., com	U. S.	501,080	100	31,337,653	Sept '16	1.50
Am. Sm. & Ref., pf.	U. S.	500,000	100	57,431,386	Sept. '16	1.75
Am. Smelters, pf. A.	U. S.	166,498	100	11,433,788	July '16	1.50
Am. Smelters, pf. B.	U. S.	300,000	100	16,635,000	July '16	1.25
Am. Zinc, Lead & Sm.	U. S.	228,120	25	1,108,820	Apr. '13	0.50
Anaconda, c.	Mont.	2,331,250	50	111,229,375	Aug. '16	2.00
Argonaut, g.	Calif.	200,000	5	1,760,000	Sept. '16	0.10
Arizona Copper, com.	Ariz.	1,519,896	1 20	18,470,646	July '16	0.36
Arizona Copper "A," pf.	Ariz.	160,000	1.20	247,795	Apr. '16	
Arizona Copper, pf.	Ariz.	1,266,120	1.20	1,940,880	May '16	
Baltic, c.	Mich.	100,000	25	7,950,000	Dec. '13	2 00
Barnes-King, c.	Mont	400,000	5	60,000	June '16	0.075
Bingham N. H., c.	Utah	228,689	5	960,493	Dec. '15	0.05
Bonanza Dev., g.	Colo	300,000	1	1,425,000	Oct '11	0.20
Brunswick, g	Calif.	395,287	1	203,315	Sept. '15	0.06
Bunker Hill Con., g.	Calif.	200,000	1	866,000	Sept. '16	0.02½
Bunker Hill & Sul., l.s.	Ida	327,000	10	18,081,000	Sept. '16	0.50
Butte-Alex Scott, c.	Mont.	79,311	10	1,054,119	Apr. '16	10.50
Butte-Ballaklava, c.	Mont.	250,000	10	125,000	Aug. '10	0.50
Butte & Superior, z.	Mont.	290,069	10	13,195,955	Sept. '16	6 25
Caledonia, l.s.c.	Ida.	2,605,000	1	1,560,031	Sept. '16	0 03
Calumet & Arizona, c.	Ariz.	641,602	10	26,949,457	Sept. '16	2.00
Calumet & Hecla, c.	Mich.	100,000	25	134,250,000	Sept. '16	20.00
Camp Bird, g.s.	Colo	1,100,051	5	10,917,116	July '16	0.17
Centen'l-Eur., l.s.g.c.	Utah	100,000	5	4,150,000	Apr. '16	1.00
Center Creek, l.z.	Mo.	100,000	10	595,000	July '16	0.15
Champion, c.	Mich.	100,000	25	16,040,000	Sept. '16	6.40
Chief Consolidated, s.g.l.	Utah	880,676	1	483,367	Aug. '16	0 05
Chino, c.	New Mex.	869,980	5	11,700,380	Sept. '16	2.25
Cliff, g	Utah	300,000	1	90,000	Jan. '13	0.10
Cliff, g	Alas.	100,000	1	210,000	Oct. '13	0.01
Colo. Gold Dredging	Colo.	100,000	10	775,000	Feb. '16	1 00
Colorado, l.s.g.	Utah	1,000,000	0.20	2,570,000	Dec. '12	0.03
Commercial Gold	Ore.	1,666,000	1	230,490	May '16	0.00½
Cons. Inter. Callahan l.z.	Ida.	464,990	10	4,649,900	Sept. '16	1.50
Continental, z.l.	Mo.	22,000	25	583,000	July '16	1.00
Copper Range, c.	Mich.	394,001	25	17,729,756	Sept. '16	2.50
Cresson Con	Colo.	1,220,000	1	3,672,162	Sept. '16	0.10
Daly West, s.l.	Utah.	180,000	20	6,606,000	Jan. '13	0.15
Doctor Jackpot, g.	Colo	3,000,000	0.10	84,814	Mar. '10	0 00½
Doe Run, l.	Mo.	65,749	100	3,550,969	Dec. '13	0 76
Eagle & Blue Bell, g.s.l.	Utah.	893,146	1	491,230	July '16	0 05
Elkton Con., g.	Colo.	2,500,000	1	3,579,460	May '15	0.02
El Paso, g	Colo.	490,000	5	1,707,545	Feb '14	0.10
Ernestine, g.s.	N M.	300,000	5	150,000	July '15	0.10
Fed. M. & S., com.	Idaho	60,000	100	2,708,750	Jan. '09	1.50
Fed. M. & S., pf.	Idaho	120,000	100	12,936,795	Sept. '16	1.00
Florence, g.	Nev.	1,050,000	1	840,000	Apr. '11	0.10
Free Coinage, g.	Colo	10,000	100	180,000	Dec. '09	1.00
Fremont Con., g.	Calif.	200,000	2.50	258,000	Oct. '14	0.02
Frontier, z.	Wis.	1,250	100	146,202	Nov. '13	2.00
Gemini-Key'ne, l.g.s.	Utah.	5,000	100	2,330,000	June '16	5 00
General Dev.	U. S.	120,000	25	3,503,917	Sept. '16	1.50
Gold Chain, g.	Utah.	1,000,000	1	130,000	May '13	0.03
Gold Dollar Con.	Colo.	2,500,000	0 10	100,000	Dec. '12	0.00½
Gold King Con., g.	Colo.	1,000,000	1	1,417,319	Nov. '15	0.01
Golden Cycle, g	Colo	1,500,000	1	7,578,300	Sept. '16	0.02
Golden Star, g.	Ariz.	400,000	5	140,000	Mar. '10	0.05
Goldfield Con., g.	Nev.	3,559,148	10	28,999,832	Oct. '15	0.10
Good Springs Anchor, s.	Nev.	550,000	1	108,785	May '16	0.01
Grand Central, g	Utah.	500,000	1	1,633,250	Dec. '15	0.02½
Granite, g.	Colo	1,650,000	1	286,500	Dec. '12	0.01
Hazel, g.	Cal	900,000	1	971,000	Dec. '13	0.01
Hecla, l.s.	Idaho	1,000,000	0.25	4,855,000	Sept. '16	0.15
Hercules, l.s.	Idaho	1,000,000	1	12,600,500	Sept. '16	0.30
Homestake, g.	S. D.	251,160	100	40,361,194	Sept. '16	0.65
Horn Silver, l.s.z.	Utah.	400,000	25	5,682,000	June '16	0 05
Inspiration, c.	Ariz.	1,159,471	20	3,768,281	July '16	2.00
Inter'l Nickel, com.	U. S.	1,673,384	25	33,451,414	Sept. '16	1.50
Inter'l Nickel, pfd.	U. S.	89,126	100	5,748,513	Aug. '16	1.50
Iowa, g.s.l.	Colo	1,666,667	1	270,167	Dec. '15	0.00½
Iowa-Tiger, g.s.	Colo	3,000	1	25,179	Dec. '15	1.00
Iron Blossom, s.l.g.	Utah.	1,000,000	0 10	2,750,000	July '16	0 10
Iron Silver, s.l.g.	Colo.	500,000	20	4,950,000	Dec. '14	0 10
Jamison, g.	Cal.	390,000	10	386,100	Dec. '15	0.01
Jerry Johnson, g.	Colo.	2,500,000	0.10	187,500	Nov. '14	0.01
Jim Butler-Tonopah, g.	Nev.	1,718,021	1	515,406	Aug. '16	0.10
Judge M. & S., s.l.	Utah.	480,000	1	1,350,000	July '16	0.25
Jumbo Extension, g	Nev.	1,550,000	1	685,000	June '16	0.05
Kendall, g.	Mont	500,000	5	1,555,000	Apr '16	0.10
Kennecott Cop., c.	Alas.	2,780,583	...	11,121,848	Sept. '16	1.50
Kennedy, g.	Cal	100,000	100	1,831,001	Apr. '10	0.03
Klar Piquette, z.l.	Wis.	20,000	1	259,000	Apr. '13	0 50
Knob Hill, g.	Wash.	1,000,000	1	70,000	Oct. '13	0 00½
Liberty Bell, g.	Colo	133,551	5	1,752,795	Sept. '15	0.20
Little Bell, l.s.	Utah.	300,000	1	90,000	Apr. '16	0.05
Magma, c	Ariz.	240,000	5	600,000	Sept. '16	0.50
Mammoth, g.s.c.	Utah.	400,000	2.50	2,360,000	June '16	0.05
Mary McKinney, g.	Colo	1,309,252	1	1,169,306	July '14	0 02
May Day, g.s.l.	Utah.	800,000	0 25	284,000	May '16	0.02
Mexican, g.s.	Nev.	201,600	2.50	161,910	June '14	0.75
Miami, c	Ariz.	747,114	5	8,575,112	Aug. '16	1.50
Modoc, g.s.	Colo.	500,000	1	275,000	Dec. '11	0.01
Mohawk, c.	Mich.	100,000	25	5,575,000	Aug. '16	10.00
Monarch-Mad'a, g.s.l.	Colo	1,000,000	1	40,000	May '11	0.01
Montana-Tonop., s.g.	Nev.	921,865	1	488,588	Dec. '12	0.10
Mountain, c	Cal	250,000	25	4,216,250	May '08	0.44
National, g	Nev.	750,000	1	570,000	May '11	0.10
National Lead, com.	N. Y.	206,554	100	9,655,216	Sept. '16	1.00
National Lead, pf.	N. Y.	243,676	100	32,632,551	Sept. '16	1.75
Nevada Con., c.	Nev.	1,999,457	5	24,474,937	Sept. '16	1.00
New Idria, q.	Cal	100,000	5	2,030,000	June '16	1.00
North Butte, c.	Mont.	430,000	15	13.244,500	July '16	0.75
North Star, g.	Cal	250,000	10	4,962,040	Sept. '16	0 20
Old Dominion, (holding)	Ariz.	293,353	25	9,813,978	Sept. '16	3 00
Old Domin'n, M. & Sm.	Ariz.	162,000	25	7,857,000	Sept '16	3 00

Corrected to October 1, 1916.

Mining Companies—United States—(*Continued*)

Name of Company and Situation		Shares		Dividends		
		Issued	Par	Total	Latest	Amt
Ophir, s.g.	Nev.	201,600	$3	$ 2,068,360	Jan. '12	$0.10
Opohongo, g.s.l.	Utah.	898,978	0.25	80,907	Jan. '13	0.02
Oroville Dredging	Cal	686,538	5	2,107,215	Sept. '16	0.12
Osceola, c.	Mich.	96,150	25	14,006,525	July '16	4.00
Pacific Mines Corpo., g.	Calif.	642,000	1	256,800	Aug. '16	0.02
Parrot, c.	Mont.	229,850	10	7,871,839	July '15	1.63
Pearl Con., g.	Wash.	1,909,711	0.05	181,422	Dec. '10	0.02
Pharmacist, g.	Colo	1,500,000	1	87,500	Feb. '10	0.00½
Phelps, Dodge & Co.	U. S.	450,000	100	54,659,304	Sept. '16	8.00
Pioneer, g.	Alas.	5,000,000	1	2,041,526	Oct. '11	0.03
Pittsburgh-Idaho, l.	Ida	809,407	1	217,083	Apr. '13	0.04
Pittsburg Silver Peak, g.	Nev.	2,790,000	1	771,200	July '14	0 02
Portland, g.	Colo.	3,000,000	1	10,447,080	July '16	0.03
Prince Con	Nev.	1,000,000	2	300,000	Sept. '16	0.05
Quilp	Wash.	1,500,000	1	67,500	Feb. '12	0.01
Quincy, c.	Mich.	110,000	25	22,987,500	Sept. '16	4.00
Ray, c.	Ariz	1,577,179	10	7,353,921	Sept. '16	0.75
Reorg. Booth, g.	Nev.	1,000,000	1	500,000	July '16	0.10
Republic, g	Wash.	1,000,000	1	170,000	Nov. '12	0.01½
Rochester, l.z.	Mo.	4,900	100	190,846	July '12	0.50
Round Mountain, g.	Nev.	1,266,591	1	363,365	Aug. '13	0.04
Seven Troughs Coal., g.	Nev.	1,443,077	1	246,419	Apr. '16	0.02½
St. Joseph, l.	Mo.	1,409,466	10	12,029,681	Sept. '16	0.75
Shannon, c.	Ariz.	300,000	10	750,000	Jan. '13	0.50
Shattuck Arizona, c.	Ariz.	350,000	10	4,200,000	July '16	1.25
Silver King Coalition, l.s	Utah.	1,250,000	5	14,148,385	July '16	0.15
Silver King Con., l.s.	Utah.	637,582	1	942,573	July '16	0.10
Sioux Con., s.l.g.	Utah.	745,389	1	872,097	July '11	0.04
Skidoo, g.	Cal	1,000,000	5	365,000	Oct. '14	0.01
Snowstorm, c.g.	Ida	1,500,000	1	1,192,103	Oct. '13	0.02
Socorro, g.	N. M.	377,342	5	233,802	Sept. '16	0.05
South Eureka, g.	Calif.	299,981	1	722,870	May '16	0.07
Standard Con., g.s.	Cal	178,394	10	5,274,407	Nov. '13	0.25
Stewart, s.l.	Ida.	1,238,362	1	2,012,314	Dec. '15	0 05
Stratton's Ind., g.	Colo.	1,000,000	0.60	618,625	Jan. '16	0.04
Success, z.	Ida	1,500,000	1	1,125,000	July '16	0.03
Superior & Pitts., c.	Ariz.	1,499,792	10	10,318,569	Dec. '15	0.38
Tennessee, c.	Tenn.	200,000	25	5,206,250	Apr. '16	0.75
Tomboy, g.s.	Colo.	310,000	4 85	3,862,485	June '16	0.24
Tom Reed, g.	Ariz.	909,555	1	2,528,648	Oct. '15	0.01
Tonopah Belm't, s.g.	Nev.	1,500,000	1	8,205,531	July '15	0.12½
Tonopah Ext., g.s.	Nev.	1,272,801	1	1,400,827	July '16	0.15
Tonopah of Nev., s.g.	Nev.	1,000,000	1	13,450,000	July '16	0.15
Trimountain, c.	Mich.	100,000	25	1,450,000	Dec. '13	2.00
Tuolumne, c	Mont.	2,500,000	1	520,000	May '13	0.10
Uncle Sam, g.s.l.	Utah.	500,000	1	495,000	Sept. '11	0.05
United Cop. Min., c.	Wash.	1,000,000	1	40,000	Nov. '12	0.01
United Globe, c.	Ariz.	23,000	100	3,749,000	Sept. '16	18.00
U. S. Steel Corp., com.	U. S.	5,083,025	100	246,504,807	Sept. '16	2.25
U. S. Steel Corp., pf.	U. S.	3,602,811	100	414,427,771	Aug. '16	1.75
U. S. S., R. & M., com.	U.S.-Mex.	351,115	50	7,327,909	July '16	1.00
U. S. S., R. & M., pf.	U.S.-Mex.	486,350	50	18,072,360	July '16	0.87½
United Verde, c.	Ariz.	300,000	100	39,322,000	Sept. '16	1.50
Utah, s.l.	Utah.	100,000	10	281,860	Dec. '10	0.02
Utah, c.	Utah.	1,624,490	10	46,530,062	Sept. '16	3.00
Utah Con., c.	Utah.	300,000	5	9,825,000	Sept. '16	0.75
Valley View, g.	Colo.	1,000,000	1	210,000	Dec. '10	0 04
Victoria, g.s.l.	Utah.	250,000	1	207,500	Mar. '10	0 04
Vindicator Con., g.	Colo.	1,500,000	1	3,442,500	July '16	0.06
Wasp No. 2, g.	S. D.	500,000	1	649,466	May '16	0.02½
Wellington Mines, g.	Colo	10,000,000	1	1,050,000	July '16	0.02
Wolverine, c.	Mich	60,000	25	8,760,000	Apr. '16	6.00
Yak, s.l.	Colo.	1,000,000	1	2,127,685	June '16	0.07
Yankee Con., g.s.	Utah.	1,000,000	1	167,500	Jan. '13	0.01
Yellow Aster, g.	Cal.	100,000	10	1,185,789	June '16	0.12
Yellow Pine, l.z.s.	Nev.	1,000,000	1	1,593,008	Sept. '16	0.10
Yukon Gold, g	Alas.	3,500,000	5	8,370,610	Sept. '16	0.07½

Canadian, Mexican and Central American Companies

Name of Company and Situation		Issued	Par	Total	Latest	Amt
Ajuchitlan, g.s.	Mex.	50,000	$ 5	$ 212,500	Oct. '12	$0.25
Amparo, g.s.	Mex.	2,000,000	1	1,960,883	Aug. '16	0.05
B. C. Copper	B. C.	591,709	5	615,399	Jan. '13	0.15
Beaver Con., a.	Ont.	2,000,000	1	649,912	Apr. '16	0.03
Buffalo, s.	Ont.	1,000,000	1	2,787,000	July '14	0.05
Canadian Goldfields, g.	B. C.	600,000	0.10	290,000	July '14	0.001¼
Chontalpan, g.s.l.z.	Mex.	7,000	25	61,250	May '14	0.75
Cobalt Townsite, a.	Ont.	45,000	1	1,042,259	May '14	0.10
Coniagas, s.	Ont.	800,000	5	8,240,000	Aug. '16	0.25
Con. M. & S. Co. of Can	B. C.	337,100	25	2,739,796	July '16	2.50
Crown Reserve, s.	Ont.	1,999,957	1	6,102,408	July '15	0.02
Dome Mines, s.	Ont.	400,000	10	1,000,000	Sept. '16	0 50
Dos Estrellas, g.s.	Mex.	300,000	0 50	10,335,000	Dec. '13	1 50
El Oro, g.s.	Mex.	1,147,500	4.85	8,947,260	July '13	0.24
Esperanza, s.g.	Mex.	455,000	4.85	12,013,882	July '15	0.24
Granby, s.l.c.	B.C.	149,985	100	6,575,289	Aug. '16	2.00
Greene Cananea	Mex.	488,414	100	6,816,028	Aug. '16	2.00
Greene Con., c.	Mex.	1,000,000	10	12,044,400	May '16	1.00
Guanajuato D., pf., s.	Mex.	10,000	1000	214,356	Jan. '10	3.00
Hedley Gold	B. C.	120,000	10	2,003,520	Sept. '16	0.50
Hollinger, g.	Ont.	600,000	5	5,250,000	Sept. '16	0.05
Kerr Lake, s.	Ont.	600,000	5	6,570,000	Sept. '16	0 25
La Rose Con., s.	Ont.	1,498,627	5	5,611,914	July '16	0 05
Le Roi No. 2, g.	B. C.	120,000	24.30	1,566,450	Mar. '16	0.30
Lucky Tiger Com., g.	Mex.	715,337	10	3,470,839	June '16	0.08
McK.-Dar. Sav. s.	Ont.	2,247,692	1	4,742,625	July '16	0.03
Mines Co. of Am. (new)	Mex.	862,658	10	4,958,600	July '13	0.12½
N. Y. & Hond. Ros., g.	C. A.	200,000	10	4,090,000	July '16	0.50
Nipissing, s.	Ont.	1,200,000	5	14,340,000	July '16	0.25
Peñoles, s.l.g.	Mex.	80,000	25	6,361,688	June '13	1.25
Pinguico, pf., s.	Mex.	20,000	100	840,000	Oct. '13	3.00
Right of Way Mns, s.	Ont.	1,685,500	1	569,042	Sept. '16	0.00½
Rio Plata, s.	Mex.	374,518	5	345,745	Feb. '13	0 05
San Rafael, g.s.	Mex.	2,400	25	1,442,380	Jan. '14	0.50
San Toy, g.s.	Mex.	5,750,000	1	530,000	July '13	0 01
Seneca-Superior	Ont	478,884	1	1,460,096	Aug. '16	0.30
Sorpresa, g.s.	Mex.	19,200	20	3,979,240	Jan. '11	34.00
Stand'd Silver-Lead	B. C.	2,000,000	1	2,250,000	Sept. '16	0.02½
Temiskaming, s.	Ont.	2,500,000	1	1,609,156	July '16	0.03
Tem. & Hud. Bay, s.	Ont.	7,761	1	1,940,250	Nov. '14	3.00
Trethewey, s.	Ont.	1,000,000	1	1,061,998	July '14	0.05
Wettlaufer-Lorrain, s.	Ont	1,416,590	1	637,465	Oct. '13	0 05

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The Southwest Virginia Lead-Zinc Deposits

By Sydney H. Ball* and Lester S. Thompson†

SYNOPSIS—Recent investigation leads the authors to believe that the lead-zinc deposits of Pulaski and Wythe Counties, Virginia, have been deposited by water of magmatic origin, rather than of meteoric origin as was heretofore thought.

A minor, although one of the oldest, American lead and zinc regions is that of southwest Virginia. The oxidized orebodies have been described many times, but the development of the sulphide orebodies, having been of comparatively recently date, the literature descriptive of them is not extensive. Dr. T. L. Watson[1] has, however, published an excellent bulletin upon the region, and his theory as to the ore genesis has generally been accepted. Doctor Watson holds[2] that the ore materials were originally finely disseminated components of the Shenandoah limestone; that they were taken in solution, transported and redeposited by circulating underground waters, which apparently, at the time the orebodies were formed, were ascending. He states that evidences of secondary sulphide enrichment are lacking. Certain observations of the writers in recent visits to the region appear to be perhaps incompatible with these views, although development to date is scarcely sufficient to permit of a final statement.

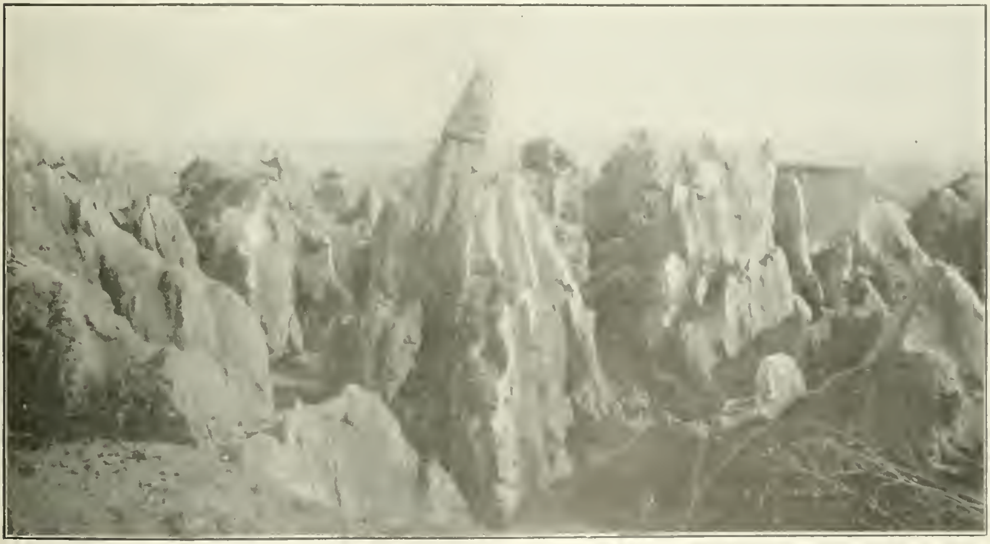

FIG. 1. PINNACLES TYPICAL OF A ZINC-CARBONATE OPENCUT

The southwest Virginia lead and zinc region lies in the great valley to the west of the Blue Ridge, and extends for 150 mi. in an east-northeast to west-southwest direction from Roanoke, to a point west of Lebanon. The more important orebodies are in Pulaski and Wythe Counties, and with these the writers are particularly familiar. They are situated in what is practically a single topographic feature, the New River-Cripple Creek valley, and that of one of the headwaters of Holston River, the two valleys being separated by an unusually [illegible]

The country rock is the Cambro-Silurian Shenandoah limestone, which is at least 4,000 ft. thick [illegible] tically is a heavy-bedded dark-colored dolomite. This formation and the overlying and underlying rocks in Wythe and Pulaski Counties are greatly disturbed. Close folding and parallel overthrust faulting along east-northeast-west-southwest axes are well developed. There are at least seven major overthrust faults in the region in question. Locally normal faults are prominent.

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*Mining geologist, 71 Broadway, New York.

†Geologist, 71 Broadway, New York.

[1] Thomas L. Watson, Geol. Sur. of Va., Bull. 1, 1905.

[2] Op. cited, pp. 127-33.

ORE MORE COMMON IN LOWER LIMESTONES

The orebodies are not confined to any particular horizon of the Shenandoah limestone, although perhaps more common in its lower rather than in its upper half. They are generally associated with unusually disturbed strata. The orebodies are tabular in form, with their greatest dimensions parallel to the bedding of the limestone, and replace beds of limestone crushed during folding or faulting. Several orebodies may occur in different portions of a single limestone bed, and in a single locality from three to six limestone beds may be mineralized. In instances, however, the orebodies occur along strike-faults which cut the bedding-planes at various angles. The immediate country-rock is more or less completely replaced by rather coarse white calcite, and calcitization usually extends beyond the limits of sulphide mineralization. The sulphides, while predominantly replacing the limestone, fill such breccia and other cavities as were available during ore deposition. The limits of the orebodies are usually gradational, although the ore frequently stops abruptly laterally upon encountering a fault or joint plane. In addition to such faults and joints which antedated the mineralization, there are others which are younger and fault the orebodies. In instances the ore consists of practically solid sulphides, but as a rule the sulphides of either fine or coarse grains are scattered through the limestone itself with or without the associated gangue minerals.

The principal primary sulphide is sphalerite with which is associated pyrite and some galena and marcasite, and rarely chalcopyrite. Contemporaneous gangue minerals named in the order of their abundance are dolomite, calcite, fluorspar, barite and quartz. Fluorspar at several of the prospects is the most prominent gangue. Sulphides of known secondary origin are sphalerite, galena, chalcocite and greenockite. Most of the primary sphalerite is of a honey-yellow color, although some is steel gray and evidently ferruginous. All the known secondary blende is of a honey-yellow color. Other secondary minerals include smithsonite, calamine and limonite in considerable quantities, some cerussite, calcite and hematite, and a little gypsum, malachite, native sulphur and manganese oxide. As Doctor Watson states, the ore-depositing waters were undoubtedly ascending, as is indicated by conditions at the Chamberlain mine, near Rye Valley. Here two small parallel veins of galena occur in limestone beds immediately beneath bands of comparatively impervious shaly limestone. Small spurs extend up into the shaly limestone. Of similar significance is the fact that at Austinville the hanging walls of the orebodies are well-defined planes parallel to the bedding, and the foot walls are ill-defined and irregular, the passage from ore to rock being gradual. The location of many of the orebodies near or upon the crests of anticlines is of similar import.

Several observations, however, suggest strongly that the orebodies were deposited by waters of magmatic origin and not by meteoric waters. Perhaps the strongest indication is the situation of the orebodies themselves. North of the ancient rocks of Carroll County, Virginia, there are in Wythe and Pulaski Counties and in the two counties still farther north (Bland and Giles) certainly five, and possibly six successive bands of Shenandoah limestone, which extends N 70° E to S 70° W. Faults parallel to the strike of the limestone are apparently equally abundant and equally important in each of these bands. Notwithstanding such conditions, all the important ore occurrences are confined to the most southerly limestone band. There are a few minor deposits in the next band to the north, but blende and galena in the three or four more northerly bands are, as far as known, mineralogic curiosities. In southwest Wisconsin and in Washington County, Missouri, where the lead and zinc ores were quite certainly derived from overlying sedimentary rocks and deposited by descending meteoric waters, the orebodies are dotted irregularly over the respective districts without orderly alignment. Were the southwest Virginia deposits of such an origin, it would appear that they should occur not in one but in all of the Shenandoah limestone bands, as all appear equally favorable to ore deposition. The distribution at least suggests the influence of an underlying igneous rock beneath the most southerly Shenandoah limestone band. Outcrops of igneous rocks younger than the Shenandoah limestone are unknown, however, in the lead and zinc region, although not absent in neighboring portions of the state.

To the south of the lead and zinc region at a distance of from 7½ to 12 mi., is the "great gossan lead" and its less important parallel veins. This, as is well known, is an exceedingly strong pyrrhotite-pyrite vein of magmatic origin. The course of this vein and the strike of the lead and zinc orebodies coincide. It is not believed that there is any direct relation between the two types of orebodies, and it is not even known that they are contemporaneous, but the two types of orebodies at no great distance from one another occupy parallel and possibly contemporaneous planes of structural weakness.

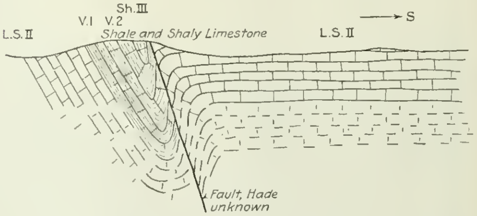

FIG. 2. SECTION AT THE CHAMBERLAIN MINE, SUGAR GROVE, VIRGINIA

Fluorite is a common gangue in the region and is locally abundant at the Simmerman property near Ivanhoe and at the Keesling property at Cedar Springs. In some regions it is probably transported and deposited by meteoric waters, but its abundance at these two deposits is strongly suggestive of magmatic waters.

The texture of the sulphide ore at certain of the prospects, particularly those near Allisonia, is also indicative of magmatic rather than meteoric deposition. The very considerable depth at which drill holes are reported to have cut ore at one property is certainly not against the former origin.

A trace and even weighable quantities of antimony are reported from the ore, and in instances traces of gold have been found. Where lead is present with the sphalerite, small but appreciable quantities of silver are usually present. The silver content usually increases with an increase in the amount of galena present, the sphalerite being probably nonargentiferous. In the following assay results from a single property, the percentage of lead is given, together with the corresponding silver content in ounces: Pb, 0.01, Ag (nil); 0.1 (nil); 0.1 (0.01); 0.3 (nil); 0.3 (trace); 1 (nil); 2.1 (0.03); 2.8 (0.1); 3.1 (0.2); 5 (0.08); 10 (0.7); 52.1 (concentrate) (1.6); 78 (picked sample) (5). These figures indicate an average silver content of a little over 5 oz. per ton of lead. This small silver content is nevertheless considerably greater than the average of the Joplin, Mo., or southwest Wisconsin lead and zinc districts, which were without much doubt deposited by meteoric waters, and is more than double that of the southeast Missouri disseminated lead ores, which by most authorities at least are considered to have been deposited by meteoric waters.

The calamine and smithsonite derived from the sulphide deposits have been frequently and excellently described. Oxidized ores were formed to some extent by the oxidation of these sulphides in place, but these secondary ores were to a larger extent reprecipitated around and particularly at the base of the limestone pinnacles so characteristic an accompaniment of the oxidized ores. In part the oxidized ores replace the limestone along fractures as both crystalline and globular bodies, the softer and more "sandy" (decomposed) limestone being more readily replaced than the hard unaltered limestone. Many of the zinc carbonate opencuts were originally iron-ore pits, and recently some of the oxidized zinc deposits have been mined for limonite iron ore. As a rule where iron ore predominates in the clay, the pinnacles are well rounded and loaf-shaped and composed of solid rock; where much zinc ore is present, however, the pinnacles are remarkably uneven and jagged in form and the limestone decomposed to a sand-like mass. Brecciation of the limestone composing the pinnacles in zinc deposits is also much more common than in those producing predominantly iron ore.

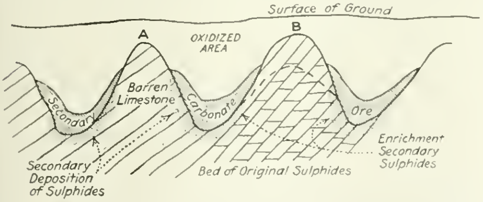
Surface of Ground
A
B
OXIDIZED AREA
Barren Limestone
Secondary
Carbonate
Ore
Enrichment Secondary Sulphides
Secondary Deposition of Sulphides
Bed of Original Sulphides

FIG. 3. SHOWING RELATION OF SECONDARY SULPHIDES AND CARBONATES

Secondary sulphide enrichment is common, although commercially of no great importance, and in deposits in which original sulphides are not minable, the secondary enriched sulphides will probably in no instance be of economic interest. Indeed, the relatively small development of secondary enrichment is surprising, considering the quantity of sulphides that must have been inclosed in the rocks eroded from certain of the deposits.

It is in the limestone pinnacles that the secondary origin of some of the sphalerite and galena is most obvious. Lead and zinc sulphides are not rarely disseminated in the exterior portion of these pinnacles, and when an inch or at most 8 in. of the outside rock has been knocked off, barren limestone is encountered. Several tunnels driven through such pinnacles passed through a crust of limestone mineralized with secondary sulphide, then into barren limestone and then, as they holed through, into a thin crust of mineralized limestone. Such secondary sulphides are particularly common on the lower and middle reaches of the pinnacles.

Other secondary sulphides are not absent. For example, the ore lying in the bed of New River, one-half mile northwest of Allisonia, shows curly crustified masses of black blende, pyrite and calcite, and a little galena. Locally the pyrite has been leached out, and in the cavities well-developed crystals of rosin jack, and rarely a crystal of galena, were deposited. At the Austinville mines radiated bands of cerussite have been deposited upon iron sulphide. Protruding from and extending into the cerussite are well-crystallized cubes of galena, which are evidently of a later generation than the cerussite itself. This secondary galena, which is reported to come from a "clay" stope approximately 150 ft. deep, has itself been slightly pitted by solution. At a number of places knife-edges of rosin-jack cut calcite and rosin blende of earlier age. Of course, in this instance both generations of zinc sulphide may be primary. Sometimes such younger (although not necessarily secondary) sulphide veinlets are well developed. On the Lobdell Carwheel Co.'s property near Ivanhoe, one such vertical veinlet, cutting a sphalerite-mineralized limestone bed, consists of two discontinuous borders of sphalerite grains with barite center. A stringer of galena 1 in. wide on the Ivanhoe Furnace property, which cuts a mineralized limestone bed, is bordered for half an inch by many galena cubes.

In résumé, while it is recognized that the data presented do not prove that the southwest Virginia lead and zinc orebodies were deposited by magmatic waters, it is believed that the predominant evidence is in that direction.

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New Gold-Mining Areas To Be Opened in South Africa

The Government of the Union of South Africa has called for tenders for the leasing of two large gold-mining areas, comprising some 2,460 claims, on the Far East Rand, Transvaal, for exclusive rights to mine precious metals. Applications must received by the Government Mining Engineer, New Law Courts, Johannesburg, not later than noon on Oct. 31, 1916.

For the development and proper equipment of mines in the two areas, a total of about $10,000,000 will be required. Blueprint maps of the claims, copies of the lease and other literature may be examined at the district office of the Bareau of Foreign and Domestic Commerce, 109 Custom House, New York. Refer to file No. 80.51

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Safety for Mexican Miners in Arizona is one of the aims of the Arizona State Bureau of Mines at Tucson, Ariz., and beginning Nov. 1 the monthly bulletin entitled "State Safety News" will also be published in Spanish. The proportion of Spanish-speaking laborers is large in the mines of Arizona and it is felt that they require education along "safety-first" lines more than do the straight American miners. The bulletins are distributed free.

The Labor and Capital Problem

SYNOPSIS—A simple analysis of the problem of distribution of wealth and income. Increased profits mean more capital seeking investment, with more opportunities for wage-earners and an improved standard of living for all classes. In the last 15 years the amount of capital employed in manufacturing, per person employed, has increased 60%. Increase of wages is dependent upon increased production rather than mere demands. Condition of the Chinese masses largely due to primitive production methods.

The monthly circular of the National City Bank for September, 1916, contains the following simple and lucid exposition of the greatest problem in economics, which is well worth reading by everybody:

Every industrial dispute like the one between the railway companies and brotherhoods is related, of course, to the larger problem of the general distribution of wealth and income, and stimulates discussion of the whole subject. Unfortunately the discussion is usually extremely superficial. A great many people regard each dispute as simply one phase of a continuous struggle which is necessary in order that labor may win from capital a fair share of the results of their joint efforts. There is slight recognition of any general economic law governing the distribution of wealth, or of its silent but inevitable accomplishments. In the railway controversy the wage-earners are set over against the managers or shareholders, as though there was a fixed amount for them to divide and nobody else was concerned. And so there is a common assumption in industrial disputes that the only obstacle to higher wages and shorter hours is the stubborn unwillingness of employers to grant them.

All Employers Are Not Prosperous

There is, however, an abundance of evidence to show that the lot of the average employer is far from an easy one. The Federal Trade Commission has reported, as the result of an official inquiry, that a majority of the manufacturing establishments of this country are not making even a fair profit. This is the usual situation. The leaders are always making money and raising the efficiency of industry to higher levels, while the tail-enders are always losing and in process of being eliminated. These differences in management and efficiency always exist. Industry is undergoing constant evolution, but no sudden revolution is possible. Few will deny that organization among wage-earners and legislation for the regulation of working conditions have corrected abuses and accomplished good, but the great advance that has taken place in the condition of the masses has been mainly due to the improvements in methods of production which have been worked out in the competitive struggle. The efficient organization of industry and transportation, the multiplied use of machinery, the growth of capital, the development of banking and of credit facilities, these have enormously increased the production of goods and the demand for labor. These agencies have made possible and inevitable the shorter work day and higher wage.

Organization is not a new thing among wage-earners. The strike and boycott have been known in China for centuries, and no people are more expert in their use, but the lot of the Chinese laborer has not been raised to the level of the laborers in the United States, for the reason that capital has not been applied to industry in China as it has in this country. The wheelbarrow is still the principal means of transport in China, and factory organization and factory machinery are almost unknown there. The elevation of the Chinese masses waits on these things, and when they are supplied, the lot of the workingman in China will change, as it has changed here.

Distribution of Wealth Measured by Consumption Rather Than Ownership

The fundamental thing about the relationship of wealth to the general welfare is the fact that the final distribution is in goods and services for personal use. The fact that a man makes money enough with one factory to build another is of less significance than the fact that the output of goods is doubled. The ownership of the railways is of less significance than their service to the public. People are impressed by statements showing a large proportion of the wealth of the country in few hands, but this wealth is in productive property, to wit, farms, factories, machinery, railways, etc.; in short, in the means of providing goods and service to the public. It would be desirable, no doubt, to have the ownership of these things more widely and equally distributed than it is at present, but after all, the value of these things is not in themselves but in the products that flow out from them. All the benefits come out in the flow; the real distribution of serviceable wealth is there.

The chief interest in the ownership of productive property is in having it efficiently handled, so that the product will be as large as possible, and it may be more efficiently handled in few hands than in many. But when it comes to the distribution of products, we see that this cannot be confined to a few. Nobody wants to confine it; everybody is struggling for the largest possible distribution. The goods must go to the people. The public must buy and consume them, or the whole business of production comes to a standstill. If the owners of productive property control the market so as to increase their profits, they cannot use the profits in business except to increase production, either in their own line or some other, and there is no outlet for this increasing supply except by distribution to the public.

Production and Consumption Must Be Equal

Production and consumption are bound to be in equilibrium. The owners of capital may combine and contrive in their efforts to make money, but the more they make and put into business the more goods there will be on the market, and unless these goods are distributed and consumed, the stream will be dammed up, production will be choked off, and further accumulations of capital will be impossible, and if possible, they would be useless. It is the growing purchasing power of the public that gives employment to new capital.

People fret and protest, and legislative bodies investigate and resolve, when oil, or paper, or wheat, or some other commodity goes up in price and the producers are known to be making unusual profits, but these profits create a fund for the correction of the shortage, and the correction of the shortage is the vital thing. The surest remedy for high-priced capital is more capital.

In short, increasing profits, meaning as they do more capital seeking investment, are bound to result in an enlargement of the industries, the installation of more machinery, the more rapid substitution of new processes for old and a general advance in the position of the entire community, with widely distributed benefits.

Each line of industry is expanded and developed largely by means of the profits made in it, and its rate of progress corresponds to them. The money that has been made in cotton mills in the Southern States has gone back into new cotton mills and better ones, and the profits of the cotton industry in New England have gone in the same direction.

Transfer of Capital to New Fields

Frequently, capital accumulated in one business finds other fields in which to do development work. A citizen of Atlanta, Ga., Asa G. Candler, having made a fortune in the manufacture of a popular drink known as "Coca-Cola," has invested a million dollars within the last year in perhaps the best cotton-storage warehouse in the world. It is built of concrete and equipped with a sprinkler system, and has secured an insurance rate upon cotton of ⅕% per annum, against an average rate upon cotton in miscellaneous storage of about 3½%; it is equipped with a trolley system by means of which cotton can be loaded and unloaded at a cost of 1½c. per bale, against an average cost of handling by trucks of 16c. per bale; it is equipped with a high-density compress, which secures a saving of approximately $1 per bale on ocean freights and ¼% on marine insurance. Finally, receipts for cotton stored in this warehouse make a class of collateral upon which money can always be borrowed in any money market of this country at the lowest ruling rates. This warehouse is for the service of any cotton grower or dealer or consumer. A Georgia farmer can store his crop with perfect security until he is ready to sell; a cotton-goods manufacturer in Georgia or Massachusetts may buy and store against future needs, or a trader or investor may use the facilities. Millions more are being invested in similar warehouses at Memphis, New Orleans, Houston and other points in the South.

A great many manufacturing companies are making unusual profits this year, but these profits are being used, for the most part, for strengthening the position of the companies, enlarging their capacity and putting them in condition to produce more economically in the future. These expenditures will not inure to the benefit of the owners exclusively; the natural effect will be to provide more employment and steadier employment, and to increase the supplies of goods on the market.

The Lackawanna railroad company last year completed a costly piece of cutoff construction between New York and Buffalo, building 38 mi. of new road with a great viaduct at a cost of $12,000,000, to take the place of 41 mi. of track over heavy grades and with sharp curves. In the early years of the road's history such construction would not have paid, and probably was not thought of. But now, with greater traffic, heavier equipment and higher wages, there is economy in spending more upon the roadway. The savings in moving the traffic will pay the interest on the new capital that has been borrowed and amortize the principal. There is a gain of wealth to the community, an improvement in the service, and no member of the community is so remote or so humble that the benefits of such improvements do not reach him. They are improvements in the equipment of society, and it is impossible that the effect of such changes shall not be widely diffused. They make the difference between the condition of the workingman in China and the workingman in the United States.

The capital for the 38 mi. of new road may have come from people in widely different circumstances. Some of it may have been supplied by savings banks and represented the small savings of wage-earners; some of it may have come from misers whose penurious habits are not admired; some of it may have come from the surplus income of employers who ought in fairness to pay higher wages than they do; but wherever the money came from, it is now placed where it renders a widespread service to the public. And when the interest upon this investment is turned back into a similar improvement on another railroad or into some other constructive and productive work, and as we follow down and find all of the increment going into public works, it is pertinent to ask how the private owners derive any benefit from these investments. The answer, of course, is that they derive exclusive benefits only from what they eat and wear or otherwise withdraw from public use and devote to themselves or their dependents. All the rest of their income goes to public uses as effectively as though it was donated to the public treasury. What better could the treasury do with it?

The public grievance against great private incomes narrows down to undue and wasteful personal expenditures, which, although offensive in instances, are a very small factor in the total.

Census Figures

We have heretofore found occasion to call attention to the remarkable growth of capital as a factor in the industries of this country, but the figures are worth repeating at every opportunity. In the three five-year periods 1899-1904, 1904-09, 1909-14 the principal figures for our manufactures, as collected by the census, showed increases over those for the preceding period as follows:

	Percentage of Increase		
	1904 Over 1899	1909 Over 1904	1914 Over 1909
Capital employed	41 2	45.4	23.7
Primary horsepower	33.6	38.5	20.7
Wage earners, average number	16.0	21.0	6.4
Total wage payments	30.0	31.0	19.0
Value of products	29.7	39.7	17.3
Value added by manufacture	30.3	35.5	15.8

This table will repay careful study. All percentages of increase were noticeably less in the last period, showing a smaller expansion of industry, and indicating that profits were lower. The tendency, however, was the same throughout all periods. The number of wage-earners shows a lower percentage of increase than either amount of capital or amount of wage-payments or value added by manufacture. (The latter term is used by the Census Bureau to indicate value of product after deducting cost of constituent materials.) The value of product added in manufacture increases by a percentage lower than the increase of capital or wage-payments, but higher than the increase in number of wage-earners.

These figures support the judgment long pronounced by economists that labor, by the inevitable workings of natural law, gets a constantly increasing share of a constantly increasing product. The wage-earners not only gain in wages, but in having their manufacturing done for them at lower cost through the increasing use of capital. If their position does not improve absolutely, the explanation must be found in the prices of materials and other things outside of the field in which labor and capital are the chief factors. Labor has unmistakably gained where labor and capital divide the proceeds of their joint efforts, but has lost some of these gains to the producers of grain, meats and other natural products.

In 1899 the amount of capital employed in manufacturing was $1,770 to each person employed, in 1904 it was $2,117, in 1909 it was $2,488 and in 1914 it was $2,848.

If all the effects of the increase in capital were on the side of prices, a greater reduction would be shown, but in part the influence is upon wages. Every increase in the supply of capital makes an additional demand for labor, and with capital increasing faster than population, as it does, there is bound to be an upward tendency in wages. Moreover, the gains in production give better living conditions, better educational advantages, with the result that wage-earners are not only more efficient but more independent and capable in making their bargains. Unless there are gains in the purchasing power of the public, either through lower prices or higher wages, a growth of production greater than the growth of population cannot be absorbed.

THE LAW OF PROGRESS

It does not follow that an individual or group of wage-earners may not be interested, and justly interested, in increasing his or their wages at the expense of employers' profits. The effect may be to increase present consumption and curtail the accretions to the investment fund, or it may cause the contributions to the investment fund to reach it through other channels. The fundamental truth is that all surplus above current living expenses, whoever owns it, goes into the investment fund, the growth of which finances the progress of society. Obviously, the more there is saved from current consumption and put into productive equipment the more rapid the progress of society will be, and capital tends naturally to accumulate in the hands of people best able to use it in the creation of more capital. This is only repeating by the operation of economic law what millions of people do voluntarily when they deny themselves that their children may start life under more favorable circumstances. It is evident that if this view were accepted, much of the bitterness of industrial disputes, which arises largely from a feeling of class interest and class injustice, would disappear and with its disappearance would come more harmonious relationships, greater efficiency and more rapid progress.

THE VIEWS OF ECONOMISTS

The foregoing views are not new. They have been held in substance by the leading economic authorities, but they are taught so ineffectively in the schools that the truths embodied are practically without influence in everyday life. They come to the surface, however, in nearly every treatment of fundamental conditions. A comprehensive work upon the "Wealth and Income of the People of the United States," by Dr. Willford I. King, of the University of Wisconsin, has recently appeared in "The Citizens' Library of Economics, Politics and Sociology," edited by Dr. Richard T. Ely, head of the Department of Political Economy of the same university. We take the liberty of making a few extracts which are pertinent to this discussion:

> After all reasonable allowances have been made, the fact remains, practically, that, beginning with 1870, there has been an increase in the national dividend so enormous that it cannot logically be ascribed to anything but the tremendous advance in productive power due to the revolutionary improvements in industry which have characterized the last half-century. It seems improbable that any other great nation has ever experienced such sweeping gains in the average income of the inhabitants. It has, almost necessarily, been accompanied by a great rise in the standard of living. . .
>
> Of late we have had a period of "muck-raking" in which all things that exist have been pictured as very bad and growing worse. The misery of life, the difficulty of making both ends meet, has been over-emphasized. True, it is just as difficult to secure the articles required by our standard of living as it ever was. But our standard of living has grown more expensive. Increases in quality cost even more than increases in quantity. Our wants always have and probably always will increase with our ability to satisfy them, so that there is never any hope of winning the race with our standard of comfort. Such a race is just like chasing one's shadow. Nevertheless, to the present author, a larger per capita supply of economic goods appears to be a most distinct benefit to any nation, and the United States has been greatly favored in this line during the last 60 years. . . .
>
> The period 1850-1900 saw that come to pass in the United States which the English economists of the earlier Nineteenth Century deemed impossible—the improvement of the workingman's economic welfare to the extent that he was lifted out of the conditions formerly thought inseparable from a working life. He tasted the cup of learning; he experienced the joys of leisure and entertainment; and he so limited the size of his family as to enable his children to continue to secure these advantages. Larger income and more learning naturally brought more power and secured more respect. The army of labor became an ally to be courted or an enemy to be feared.

EFFECTS OF CONFISCATION

After a careful discussion of the division of the national income among all classes, Dr. King reached the conclusion that if all rent, interest and profits were added to wages, the sum of the latter would not be increased by more than one-fourth. He says:

> It would seem improbable that, with our present national productive power, any feasible system of distribution could increase the average wage earner's income in purchasing power by more than one-fourth, and this is an extreme rather than a moderate estimate. While such a change might or might not be desirable, it would at least work no startling revolution in the condition of the employees of the United States. The grim fact remains that the quantity of goods turned out absolutely limits the income of labor and that no reform will bring universal prosperity which is not based fundamentally upon increasing the national income. After all, the classical economists were right in emphasizing the side of production in contradistinction to that of distribution. Nature refuses to yield her bounty except in return for effort expended. Demands for higher wages have never yet unlocked her storehouses.

Dr. King might have added that, saying nothing about the disorganization of industry which would result from confiscating all rent, interest and profits, and assuming that production would continue to be as great after all the incentives to leadership were removed, there would certainly be a check upon capital accumulations, with the result that additions to the productive equipment would be correspondingly reduced. Society would use up more of its current earnings in current consumption and industrial progress would be retarded accordingly

The Roasting of Blendes*

By Maurice V. M. de Lummen†

SYNOPSIS—A study of three systems applicable to the roasting of Australian concentrates, the ones considered comprising the Hegeler, Spirlet and Delplace. Without reference to the labor required and its cost, the Delplace furnace is considered the best, as the blende is well roasted in it and the gas is rich in SO_2. *Highly skilled labor is required, however, and for this reason the Hegeler furnace, although making a poorer gas and more dust, is more popular in the United States, since it can be operated with ordinary labor. With the Spirlet furnace, reduction of the number of workmen is the principal feature. Data of operation and comparative costs are given.*

The question of the roasting of the Australian concentrates for the extraction of zinc being a timely one, it would be of interest to examine closely the special features of some furnaces employed for this purpose. We will content ourselves with the study of three systems: Hegeler, Spirlet, and Delplace. A description of these apparatus is unnecessary, as their arrangement is known. The Hegeler furnace is used in America by all the works roasting blende and making sulphuric acid. The great majority of the Belgian and German works use hand furnaces, the older ones the Rhenania (Hasenclever) furnace, the modern works the Delplace furnace, which has entirely supplanted the former. In late years the mechanical Spirlet furnace has been tried and put up in several works on the Continent, and its use seems likely to become general in many cases.

Features of the Delplace Furnace

Putting to one side the question of labor and only considering the desulphurization of the blende and the manufacture of sulphuric acid, from every point of view the Delplace furnace is absolutely matchless. The blende is roasted to the utmost possible limit, and the gases produced are rich in SO_2 ($6\frac{1}{2}\%$). The liberation of the gas, and consequently the feeding of the lead chambers, is absolutely regular, and the consumption of fuel is a minimum (10 to 13%). From the nature of the furnace, the quantity of dust produced is infinitesimal and may in practice be considered as negligible. This is important both from the economic point of view considering the value of the unit of zinc in the ores and from that of trouble in working. In fact, there are never any stoppages for repairs, and on leaving the works in the evening, one is certain of finding the furnace working as well on the next morning as it was the night before, which unfortunately is not always the case with mechanical furnaces. From the economic point of view the Delplace furnace, despite the high number of workmen it requires, would be able to compete successfully in Europe against the Hegeler. Its only drawback is that of labor. The difficulty not being simply the number of workmen needed, but the fact that a man requires two or three days' practice in order to work skillfully. Under these conditions, if at the time of changing shift there is any man missing, the working of the furnace is partly disorganized. Continental works, with a view to avoiding this inconvenience, make a practice of taking for the acid factory and for such accessory services as ore and fuel, transport workers with previous experience of the working of the furnaces. By this means there is always a supply of men in reserve. This method of procedure is obviously not possible where labor is very mobile, as in the United States.

Disadvantages of the Hegeler Furnace

If the characteristics of the Hegeler furnace are examined, it will be seen at once that there are a number of weak points. The number of workmen is high for a mechanical furnace, while the motive power required and the consumption of fuel are enormous. If the working of a furnace is followed for several weeks, it will be found that the SO_2 content of the gases is very low (4 to 5%), very irregular, which is not favorable to good operation of the acid plant. As a consequence of the very principle of the furnace, the ore is raked only at long intervals, nearly every two hours, and only during a few minutes each time, which is evidently unfavorable to good roasting. The quantity of dust produced is great, and the loss of zinc from this cause may reach 5 or 6%, wherefore the need for large dust chambers or special installations for the recovery of the zinc carried over. Stoppages of the furnace by reason of accidents to the machinery are frequent, and it is not rare to have a furnace shut down for 5 or 6 hr. It is needless to speak of the state of the acid plant when a single furnace roasting 10 tons begins working again after so long a stoppage. It is also unnecessary to mention the quantity of nitric acid required in order to get the chambers in good operation again.

In spite of all these disadvantages, the use of the Hegeler furnace is general throughout the United States, which is explicable if one considers the labor conditions of that country and the standpoint of the American zinc works. These cannot count on their workmen, who frequently move from works to works, and moreover, the dominant idea up to late years has been to desulphurize the blende sufficiently in order to be able to treat the roasted ore in distilling furnaces for the extraction of the metal. In these circumstances a mechanical furnace such as the Hegeler, with which any workman, without previous experience but under the control of a few experienced men, can insure a sufficient roasting of the blende is bound to succeed where the question of the cost of roasting is subordinated to that of its continuity.

The Spirlet Furnace on the Continent

The operation of the Spirlet furnace always requires a little more attention than the Hegeler, the former being much less primitive. The two plants cannot be compared; besides, the Spirlet has been developed for Continental conditions of working. The dominant idea is the reduction to a minimum of the number of workmen while securing a roasting of the blende as good as with the best hand furnace and a fuel consumption as low as possible. So far as the number of workmen is concerned, this is much lower than with the Hegeler. The motive power is not great, and the fuel consumption is lower than with any other type. This latter advantage results from the principle of the furnace, which tends to the great concentration of the heat. The height of the compartments of the furnace being nearly the same as that of the shelves of a Delplace, the Spirlet permits, like the latter, of the obtaining of gases rich in SO_2. The fall of the ore from one stage to another being low, the quantity of dust carried over is much less than with the Hegeler. The loss of zinc carried over with the dust varies from 1 to 2%. The low height of the compartments of the Spirlet is a consequence of the main feature of the apparatus; namely, the absence of metal parts in the interior of the furnace. This very considerable advantage from the point of view of cost of upkeep and regularity of working is not sensibly influenced by the inconvenience of having to stop a furnace when the number of broken teeth becomes too great for the blende to be properly raked. Evidently the success of the Spirlet is connected with the use of a refractory material of the highest quality.

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*From an article in "Chemical Trade Journal and Chemical Engineer," London, England.

†Metallurgical engineer, London, England.

Comparative Data of the Three Systems

The following is a comparison of the expense of a plant to treat 40 tons of Australian concentrates per 24 hr. with each of the three apparatus; the labor, fuel and power requirements are also compared:

Delplace—Three batteries of furnaces, each burning 14 tons per 24 hr.; cost, including buildings, accessories, and royalty, £9,000. Labor: For the working of the furnaces, transport of ore and fuel, and for heating, 50 men are needed, plus 2 foremen, or a total of 52 men; fuel consumption, 12%; power, none.

Hegeler—The cost of the furnace, properly so-called in the United States, varies from £12,000 to £15,000. Let us take the minimum figure of £12,000. The cost of the building and of all accessory apparatus is about £3,000. The total cost of the furnace ready for work is therefore £15,000. Labor: For the working of the furnace, transport of ore and fuel, heating, and upkeep, 20 men are required, plus 2 foremen, or a total of 22 men; fuel consumption, 30%; power, 35 hp.

Spirlet—With Australian concentrates it is preferable not to exceed 5 tons per furnace. A battery of 8 furnaces is needed, plus 1 in reserve, or a total of 9 furnaces. A furnace completely installed costs, including royalty, £1,280. The cost of the building with accessories is about £2,000, or a total cost for the installation of £13,520. Labor: For the operation of the furnaces, for transport of ore and fuel and for heating and upkeep, 16 men are necessary, plus 2 foremen, a total of 18 men; fuel consumption, 10%; power, 16 hp.

Taking wages at 5s., including foremen (since two are required in each case), 10s. per ton for fuel. 15% for depreciation and interest on capital, and 0.7d. per hp.-hr., the roasting costs are given in the accompanying table. The prices given for each installation—namely, £9,000, £15,000 and £13,250—are based on the prices ruling before the war.

In spite of the difference in cost between roasting with mechanical and with hand furnaces, the great majority of blendes treated by the Continental works are roasted in hand furnaces. This is due to various reasons, among which I would note the possibility of recruiting labor without too much difficulty, the qualities of the Delplace furnace, and also the fact that the Hegeler is looked upon as impossible under the conditions of Continental working. During the latter years preceding the war, the question of labor became much more acute in many Belgian and German industrial districts, so that the interest excited by the appearance of the Spirlet furnace was all the greater. At any rate the choice of the mode of roasting depends on different factors peculiar to each case, and above all on local conditions, as the question presents itself differently to the zinc works obliged to roast its own blende and to whom the acid is a byproduct, from the acid maker roasting blendes for the zinc works. In the latter case, the acid being the principal product, these works must employ a type of furnace which, while leaving the least sulphur possible in the roasted blende, permits of the most regular and economical working of the lead chambers.

COST OF ROASTING PER TON OF MATERIAL

	Delplace	Hegeler	Spirlet
Wages	£13	£5 10s. 0d.	£4 10s. 0d.
Per ton ore	6s. 6d.	2s. 9d.	2s. 3d.
Coal	4.8 tons	12 tons	4 tons
Per ton ore	1s. 2½d.	3s. 0d.	1s. 0d.
Power:			
Per ton ore	....	1s. 2½d.	7d.
Depreciation and interest	£1,350 p.a.	£2,250 p.a.	£1,987 p.a.
Per ton ore	1s. 10d.	3s. 1d.	2s. 8½d.
Repairs and maintenance:			
Per ton ore	2d.	1s. 3d.	1s. 0d.
General charges:			
Per ton ore	7d.	1s. 0d.	1s. 0d.
Total cost of roasting per ton	10s. 3½d.	12s. 3½d.	8s. 6½d.

"Lands Forlorn"

George M. Douglas has written a fascinating story (published by G. P. Putnam's Sons) of an expedition to Hearne's Coppermine River, which flows into the Arctic Ocean. He was accompanied by August Sandberg, geologist for Phelps, Dodge & Co., and by Lieut. L. D. Douglas, R. N. The book is beautifully printed and is illustrated by an uncommonly fine collection of photographs, which give a better idea of this barren northland than anything else we have ever seen. We fear they are flattering, for they do not show such an inhospitable country as we imagined. Moreover, Mr. Douglas and his companions appear to have had an agreeable time of it, although they had plenty of hardships. We fancy that in writing of them in after time, Mr. Douglas took a genial view of them. Anyway, his book is superior in human interest and in many other things to most books of travel. The following introduction by Dr. James Douglas will be of interest to everybody:

"My cousin, George Mellis Douglas, the leader of the expedition described in this narrative, is an engineer and has had wide experience of small craft. After years of work in the arid Southwest, he was naturally seized with an uncontrollable thirst for water, and one day told me of his longing to explore some one of the rivers flowing into the Arctic Sea. Half in jest I undertook to "grubstake" him if he would report on the copper-bearing rocks of Hearne's Coppermine River. He accepted the challenge. And this book is one of the results. It contains a narrative of travel in arctic Canada by three youths without native guides, who brought back scientific information of great interest and importance. Hearne's Coppermine River, flowing into the Arctic Ocean in Latitude 68° 49′ N, and Longitude 115° 32′ W, was chosen as offering an exceptionally interesting field for exploration, partly because the results might have a final commercial value.

"In his introductory chapter the author describes how rumors and proofs of great copper deposits among the mountains in the far north prompted the earlier explorations of that inhospitable land. The Indian tales of the remote copper mines were as far from accurate as is many a mining report in the prospectus of a modern promoter. Instead of a mountain of copper Hearne found one lump of metal, which he picked up "among a jumble of rocks." Copper may once have been more prodigally exposed, but for centuries the croppings had been searched for float metal by the Eskimos and by the Coppermine River Indians, who used it as an article of barter over the whole Northwest. It was carried by them eastward to the Hudson Bay and westward to the Pacific. The Eskimos are said still to prefer it for certain uses to iron.

"Dr. Sandberg examined and mapped only the section of the Copper Range immediately west of the Coppermine River, but the party followed the same traps to the Dismal Lake and found them strewn on the shores of Great Bear Lake 150 mi. west of the Coppermine River. Simpson, Hanbury and others picked up metallic copper on the beach of the islands in Bathurst Inlet. Thus these rocks, with a general northeast and southwest strike, have been traced for some 300 mi., and if the same rocks really appear in Victoria Land, where Stefansson describes the Eskimos as gathering copper, their cross-section must be vastly greater than the corresponding series on Lake Superior. The total area, therefore, within which copper ore may possibly be found, covers nearly 10,000 sq.mi.

"Whether profitable ore occurs anywhere in this district can be determined only by a thorough survey, followed, should favorable indications be found, by exploratory development on an extensive scale. Our three explorers confirmed Sir John Richardson's diagnosis of the identity of these copper-bearing rocks with the melaphyres and conglomerates of the Keweenaw series of Lake Superior. This was conclusively proved by Graton's petrological examination of the hundred samples of rocks brought out by our explorers. On analysis a large proportion of these rock samples contained traces of metallic copper—two of them were ores of profitable grade. What they did for the first time was to trace and map the succession of beds that compose this interesting—possibly commercially important—group of rocks. In this work they even preceded the Canadian Geological Survey.

"The region may become one of the great copper producers of the world. It is now still inaccessible; but the easternmost exposure of these rocks, so far as known, is not more than 500 mi. distant from navigable water in Hudson Bay, over a possible railroad route. And a railroad from the south is already projected to within 800 mi. of their most westerly exposure. As far back as 1845 Alexander Simpson anticipated that 'it is possible that ere this century has passed, an organized system of internal communication such as that which traverses northern Asia may place this valuable natural deposit within the reach of commerce.' He was too sanguine. The climate is severe. But so is that of Lake Superior; and for about 25 years after the native copper mines of Michigan were first opened, they were shut off from the east by ice, from steam communication, for almost half the year.

"As to fuel, lignite is plentiful within the Arctic circle, and our explorers brought samples from a large bed of it which crops out on the shores of the Great Bear Lake. If copper ores therefore exist in large quantities and are of a profitable grade, the unfavorable conditions are not sufficiently prohibitive to prevent their being exploited. And the race has happily not yet become so effeminate that men cannot be found willing to exchange the luxuries of civilization for the novelties and adventures of work in the wilderness, when the inducement is added of winning from Nature the treasures she has hidden away in such inhospitable regions."

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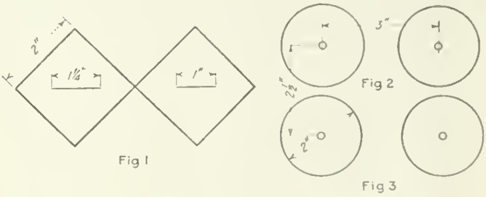
Cultivating Stereoscopic Sight

By Walter M. Brodie*

The study of crystallography is made easier and more interesting by having before one the actual crystals or, if these are not obtainable, representations or models of the various forms. To the expert crystallographist it may suffice to have a special facet described by a conventional sign, but the casual observer or amateur is far more impressed by actually seeing the occurrence, either on the crystal or on a model.

Crystals and models may be found in public or private collections, but as they cannot be carried around by students, it was suggested at one time that the various forms might be shown stereoscopically, and years ago, when stereoscopic views were in fashion a book was published giving such views of crystals. Other books may have been published later, but the use of an instrument was an objection, and I do not believe that the attempt received much attention from students, notwithstanding the clear manner in which it showed the subject. It was not generally known that a stereoscopic picture can be easily seen without any instrument.



FIGURES TO BE ENLARGED TO DIMENSIONS SHOWN

To do so easily and quickly it may be well to remember the following: When we look at an object with both eyes, we see a single and distinct image, but everything nearer and everything farther off we see double and therefore indistinctly. To see things distinctly at various distances, we have to change the focus of our sight, and this accommodation, or change of focus, produces on us, through habit, an impression of the distance. But this is not the only way in which we unconsciously estimate distance. Near by objects we see clearly and of a certain size; far-off objects we see hazily and smaller. In a clear atmosphere distant objects appear much [illegible] than on dark or moist days.

A stereoscopic picture is supposed to show the [illegible] it is seen with the right eye of the observer [illegible] view as it is seen with the left eye, and [illegible] the two pictures cover each other approximately, either by means of prismatic glasses or in any other way, the effect of perspective is procured by our own involuntary effort. The true perspective effect theoretically requires two pictures similar to those seen by each of our eyes, which, if seen together, would require a certain change of focus from foreground to background, the same as we are accustomed to use.

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*Mining engineer and metallurgist, 50 [illegible]

It is, however, not always necessary to give exactly what our sight is accustomed to. Most stereoscopic pictures are not made that carefully. If we can impose on our sight and give it a picture where it is not accustomed to see it, the impression on our brain is altered and we give more attention to the impressions that are not interfered with.

If we hold a pencil up vertically, say 15 in. from our face, and look beyond it at a distant object, we see the pencil double. If we hold up a stereoscopic picture, prepared for the stereoscope, and look at the far distance, we see each of the two pictures double, and by accommodating our sight we can make the two inner images cover each other. As soon as this happens we see the middle picture stereoscopically, the same as we would in the stereoscope.

THE ACQUISITION OF STEREOSCOPIC SIGHT THROUGH PRACTICE

Some people have great facility of accommodation of sight and others have not, but with a little practice such accommodation is easily acquired, as we all constantly use it unconsciously.

An easy way to acquire this facility quickly is to look at a piece of floor linoleum divided in squares of two different colors. A good size of the squares is 3 in. across diagonally. Have the linoleum before your feet, and as you sit in your chair, stare at it. You will see each square sharply and distinctly. Now try to look through the floor at a point beyond. Between the squares little squares will appear, which get larger as you look farther, until, when you look far enough, they get to be the size of the original squares. You now see the squares stereoscopically, the same as if seen in a stereoscope. Hold your vision there, and you will soon see the linoleum squares plainly at a certain distance below the floor and apparently larger. A white mark or spot on one of the black squares will be seen on two of the squares in the image, which, if you move your head sidewise, will also move, but in the opposite direction. You can do the same with Fig. 1, but the different colors and the number of squares on the linoleum make the process easier.[1]

Now observe this: Your eyes are only 2½ or 2⅝ in. apart. The squares are 3 in. apart from center to center. You therefore do not converge your sight on one point. You look with one eye at one square and with the other eye at the next square and the impression of distance is given by the unusual position of the eyes. Turn the linoleum around 45°, so as to get the black and the white squares parallel to your eyes. Look again far beyond the floor, and though the distance between centers of similar squares is more than 4 in., you will in a short time be able to get the two images to cover each other and you will see the linoleum squares still larger and still farther away than you did when their centers in the plane of your eyes were 3 in. apart.

While looking at a stereoscopic picture this way or through a stereoscope, we are unconsciously aware that the distance at which we see the picture is wrong and are therefore strongly impressed by the other things which produce the idea of distance, such as the sizes of objects in foreground and background, shadows, dimness of focus, etc. Therefore two exactly similar pictures placed side by side, looked at steroscopically, will give some impression of perspective, but to get good stereoscopic pictures of the forms in which crystals occur, it is necessary to have the two pictures properly drawn.

While sitting in your chair, looking at the linoleum in its first position, or at Fig. 1 on the floor, try the following: Hold your pencil about the height of your knees and you will see it double. Move it a little nearer or farther until the two images are as far apart as two similar squares are from center to center on the linoleum or on the figure you are looking at. Now look at your pencil. You will see the squares of the linoleum at the point where the lines of vision of your eyes cross as if painted on glass, and you will have no trouble in making the image stay there. The squares you see will appear much smaller than they really are. You again see stereoscopically, and if you look at a double picture prepared for this stereoscopic way of looking, you will get good perspective effect.

THE APPLICATION OF STEREOSCOPIC SIGHT TO CRYSTALLOGRAPHY

If, looking at the linoleum, you hold your pencil closer to your face, so as to make its double image cover the first and third similar squares instead of the first and second, you will, when you look at your pencil, be able to see a new image of the linoleum, smaller and nearer to you. Looking still nearer—that is, looking still more cross-eyed—you will see another and still smaller image. You can, if you stand far enough off, get a near-by image looking at wall paper or at anything where shapes or forms are reproduced in the same plane in which your eyes are situated.

Good stereoscopic pictures of crystals give satisfactory impressions, and if students were shown how to see such pictures properly without any instrument, the pictorial description of crystallography and of several other studies could be made much more interesting. Very little exercise is needed to make one an expert at seeing stereoscopically.

Look at Figs. 2 and 3, drawn according to the indicated dimensions, stereoscopially. First look at the far distance and see the dot in the upper circle nearer to you than the circle, the dot in the lower circle farther away. Change your view a few times from Fig. 2 to Fig. 3 and back again. Observe the effect. Now look for the near-by image and see the dot in the upper circle farther away and the dot in the lower circle nearer to you than the circle itself—the opposite of the first stereoscopic view. Now look again at Fig. 1 and notice the position of the line in the square when looking at the farsighted image and also its reversed position when looking at the nearsighted image.

If a reader has followed thus far, there is no doubt that he will ever after remain interested in the stereoscopic way of seeing things pictured or described.

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[1] In carrying out the experiments referred to, it will be necessary for the reader to reproduce the accompanying figures to full scale in order to have the objects appear in correct proportion.

Safety for Hoist Engineers

By Harry E. Scott*

In the last few years much has been done in the name of safety first. The Bureau of Mines has circulated many bulletins; mining and scientific journals have published articles covering almost every stage of the game; nearly all the mining companies have taken up the work, with wonderful results in lowering the percentage of accidents; but there is one that has been overlooked by almost all of them, and that is the hoist engineer. Many accidents are caused by the carelessness of the engineer that could have been avoided by taking the proper precautions. The men on the larger hoists have obtained their experience and been tried out on small hoists, and as a rule can be relied on to keep their heads in case of an emergency.

On the small hoist the engineer is often a young fellow who has taken a course in running a car on top, then a post-graduate course in dumping buckets. He learns the different levers and becomes the engineer. While he is not running the bucket or cage up and down the shaft for practice, he is rolling another "pill" or has a very interesting novel which he may be able to finish in that shift if he does not lose too much time. He is brought to his senses by the shooting signal. He knows everything is all right, so he answers it without looking at anything to see if he is ready to hoist when the time comes—still having his book in his hand.

The Novel-Reading Hoist Engineer

A case of the novel-reading engineer came to my notice about two years ago. The shaft was down nearly 300 ft. and drillmen had their round in and loaded. They gave the shooting signal, and it was answered by raising and lowering the buckets. The three men who were in the shaft spit their holes, 16 in number, got on the bucket and gave the signal to hoist. The bucket went up about 8 ft. and stopped; the men heard the engineer's voice at the collar of the shaft and knew that something had gone wrong; two made the timbers and got up far enough to be safe, but the other man dropped back to pull the fuses. He got five of them but the other eleven went off, and of course he was killed.

At the inquest the man who was running the engine (a 50-hp. gasoline) said that he was reading a novel when they gave the signal and that he answered it without speeding up the engine, taking a chance that it would speed when he was ready for it; when the bell came to hoist, he dropped the book, grabbed the levers and threw in the clutch. The engine stopped before it got the gas, with the men so far away from the timbers that one of them could not make it. It was not the fault of the engineer that there was no chain ladder in the shaft, but it was his fault that the engine failed to do its work.

Another instance occurred in the same camp about five months later, and although no one was injured, it was simply a case of fool luck that three men were not killed. This shows the most dangerous class of men on a hoist, from the miners' viewpoint, to be inexperienced men who can sit at the hoist and tell everything that is going on down the shaft when all they should know is what the bell tells them. In this shaft they are running two small drills with one man on each; the third man looked after the steel, powder, water, etc. The round had been drilled, the tools sent to the surface, the holes loaded and the men were ready to shoot the round. It was the custom for the third man to give the shooting signal. This day one of the drillmen asked him if he had given the bells, and he answered that he had, so the fuses were spit and they got on the bucket and gave the one-bell to hoist, which was proper. The bucket went up about a foot and down again. They gave another bell, and the same thing happened a second and a third time, so they took to the ladders and started for the top as fast as they could and succeeded in getting up far enough to be safe before any of the shots went off, and no one was injured.

On arriving at the top they found a very much excited man. When asked why he did not pull them out, he answered that he did not get any shooting signal, and as he knew they were ready to shoot he would not pull the bucket up on one bell when they were blasting. The man who said that he had given the signal admitted that he "guessed" he had not done so, but that did not excuse the engineer. One bell was the hoisting signal, and he should have hoisted, but he was one of the wise ones who know more about what is going on down in the shaft than the men who are there.

One of these hoistmen was a relative of the superintendent, the other a relative of one of the large stockholders. The management tried to keep them on the job, but the miners in the district decided that they should not run hoists any more, and they at last gave up the notion of being hoistmen and tried something else they could handle better.

It would be difficult to suggest a remedy for such cases as these, as long as the laws allow the use of this kind of men on hoists. Some of the states have statutes that are supposed to protect the miner against men of this character, but the law is not enforced if the applicant for a license has the *pull*. Even the *price* suffices with some of the officials. In the state where these accidents happened, an engineer had to have a license to run a hoist. The two men, who knew nothing about engines and had never had hold of a lever, were taken to the proper officials by the superintendent of the mine and got licenses without an examination, all that was required of them being to "dig up" a five-dollar bill.

Advantage of Universal Code of Signals

There is one thing that will help the engineer and also the miner; namely, a universal code of signals, so that when he learns it on one job he will not have to learn a new code on the next one. This could be assisted greatly if the mining men of the country and the mining journals would take it up. Nearly all the states have different codes and some have none—each camp having a different system.

The following are a few suggestions for the new engineer, provided he is not already too wise to take them on: Keep a cool head; always use judgment and play safe; do not move the cage too soon after receiving the signal; look over your engine the first thing you do when you go on shift and be sure that all nuts are tight and the brake is in good condition; remember that you know nothing about what is going on down the shaft, so do as the bell tells you, and then if a mistake is made it is the other fellow's fault.

Although it may be hard on the engineer, it is noticeable that companies that have the "No Admittance" sign over the door and enforce it have fewer accidents than those that allow visitors in the engine room.

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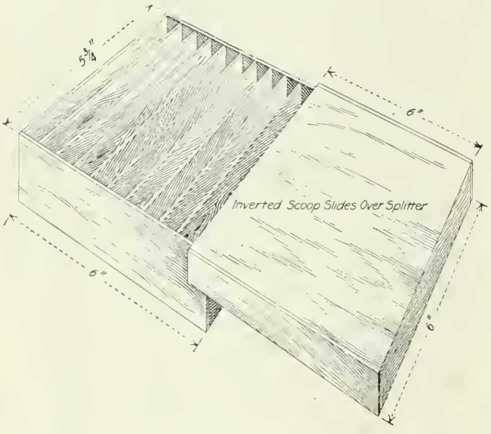
*Mining engineer, Johnson, Ariz.

Details of Practical Mining

A Compact Sample Splitter

In examining mines and prospects in out-of-the-way places many implements that would be of great convenience or are almost indispensable to the engineer are left behind because they take up too much room. Among these may be mentioned the sample splitter. This is a sampling tool that in its usual form of construction is awkward to pack and is therefore often not carried. If no splitter is found where the samples are cut and broken down, mixing on a canvas and quartering must be resorted to. The advantages in always having sampling riffles, both for convenience and accuracy in cutting down samples, are so great that the riffles shown in the accompanying illustration were designed. Only two changes were made over the ordinary form. The inside length of the riffles was cut down from 6 in. to 5¾ in. so that the outside length, when taking into consideration the wire reinforcement always around the edges, would be slightly less than the inside width of the scoop, permitting the latter to be slipped over the riffles. It is obviously necessary to shorten the length of the riffles to permit them and the scoop to be fitted together, as the width of the riffles and scoop must be the same. Thus, by leaving the handle off the scoop, an unnecessary adjunct anyway, we have a set of sampling riffles that take up less than one-half the space of those of the ordinary construction and hence are much more convenient to transport. The riffles shown are 6 in. wide, making an exceptionally compact set. They could be made any size on the same plan and be far more compact than those of the usual construction. Portable equipment is becoming more and more popular and many appliances are available in portable form which a short time ago were impossible to take along on account of the size or weight. It is hoped that in the future additional equipment will be developed in portable form.



A COMPACT AND PORTABLE SAMPLE SPLITTER

Bell and Buzzer Signal System

By Albert E. Hall* and George McFeely

Various kinds of signals are in use at mines, ranging from the old lever with its wire running to the power house to the modern electric system. The system here described is in use at the Creighton mine, Ontario, Canada, and has proved satisfactory. It may appear complicated, but when in operation works smoothly and causes no loss of time.

Each level is provided with a bell and pull for each hoisting compartment in the shaft, and there is a corresponding set of bells in the hoisthouse. When the signal is given, the bell rings not only in the hoisthouse, but also on every level in the mine, so that observers at any of the stations are informed as to the movements of the skip or cage. Thus the chances of a man's being hurt by sticking his head into the shaft or climbing on the track are reduced to a minimum. The hoistman also has a set of push-buttons placed conveniently on his working platform, and he repeats every signal given before he moves the skip or cage. This is a further safeguard against accident as it insures a thorough comprehension of the signal. On each level and also on the surface, but not in the hoisthouse, a buzzer with a pull is placed, and this is used as a call.

The wiring for the system is shown in the accompanying illustration. A large cable containing 12 wires extends down the shaft. Only the six wires connected with the bell signal system are shown in the diagram. Other wires are used for the telephone, powder signals, etc., the bell system is usually operated by electric current from the main power line, but when the alternating-current power is off, the system is operated by current from a storage battery. When a signal is given at a pull-switch in any compartment, all the bells in that compartment ring. The single-stroke type of bell is used, and this system can be used with any number of compartments.

The signals used are as follows: 1 bell—stop if in motion, hoist if at rest; 2 bells—lower; 3 bells—men about to enter cage; 3 bells in return—men may enter cage; 4-1 bells—hoist slowly; 4-2 bells—lower slowly; 9 bells—danger signal; 5 bells—release cage (hoistman can move cage to any place he desires); 6 bells—ore; 7 bells—waste.

The signals for the levels are as follows: 4-4 bells—surface; 4-5 bells—first level; 4-6 bells—second level; 4-7 bells—third level; 4-8 bells—fourth level; 5-4 bells—fifth level; 5-5 bells—sixth level; 5-6 bells—seventh level; 5-7 bells—eighth level; 5-8 bells—ninth level; 6-4 bells—tenth level; 6-5 bells—eleventh level; 6-6 bells—twelfth level; 6-7 bells—thirteenth level; 6-8 bells—fourteenth level; 7-4 bells—fifteenth level; 7-5 bells—sixteenth level; 7-6 bells—seventeenth level; 7-7 bells—eighteenth level; 7-8 bells—nineteenth level; 8-4 bells—twentieth level;

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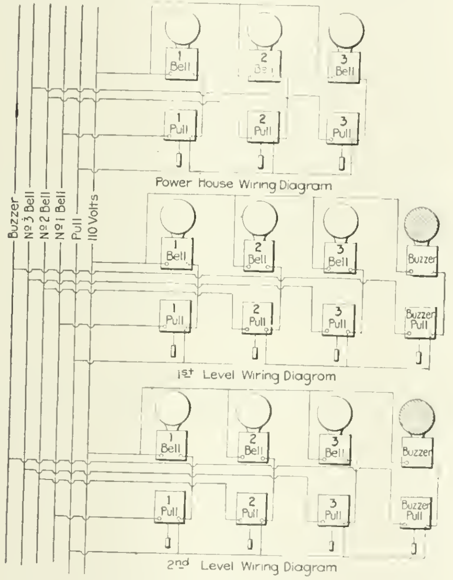
*Superintendent, Sable River Copper Co., Massey, Ontario, Canada.

8-5 bells—twenty-first level; 8-6 bells—twenty-second level; 8-7 bells—twenty-third level; 8-8 bells—twenty-fourth level.

To show the operation of the bell system, let us suppose that the timber skip is hooked below the cage and is at the surface. When it has been loaded and ready to lower, the 4-2 signal is given and the hoistman returns the signal. After this he lowers the cage until he gets 1 bell, which will be when the cage reaches the surface landing, and the hoistman stops the cage. The cageman then rings 3 bells and the hoistman returns the signal, whereupon the cageman may enter the cage. Let us suppose the cage is to go to the sixth level. The surface lander will then ring 5-5 bells and the hoistman will return the signal, after which the lander will give 2 bells and the hoistman return 2 bells and lower the cage to the sixth level. When the cage reaches the level, the cageman gets out and rings 4-1 bells and the hoistman returns the signal and hoists slowly. When the timber skip reaches the level, the cageman rings 1 bell and the hoistman stops the cage and returns the signal, whereupon the skip can be unloaded. This seems a long process, but in fact is very satisfactory after it has been in use for a short time. In the described movement of cage and skip, 56 bells had to be rung, but the operation is not as long as it sounds.



WIRING DIAGRAM FOR A BELL-AND-BUZZER SIGNAL SYSTEM

The skips run in counterbalance. The skip tender rings 6 or 7 bells, depending on whether he is going to hoist ore or rock. The hoistman returns this signal, and the lander at the surface fixes the proper dump and returns the signal. The skip tender then rings 1 bell to hoist, and the hoistman returns the signal and hoists the skip. From then on only the 1-bell signal is given to hoist, but the hoistman always returns the signal.

The bells are all set on the post of the station timber to the right of the compartment for which they operate, so that no mistakes will be made by pulling the wrong bell. The buzzer is set in the wall of the station back a short distance from the shaft. If the cage is desired at a level, the level signal is given on the buzzer and the cageman proceeds to the level when convenient. In the event that the cage cannot be sent at once, the cageman signals on the buzzer to inform the one calling that he has been heard. There is no buzzer in the hoisthouse, so that calls on the buzzer do not disturb or confuse the hoistman.

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Economy of Solid-Woven Belts*

By W. F. Schaphorst†

On account of the high cost of leather at present, the price of leather belting is becoming almost prohibitive. Leather is a good medium for conducting power. It has established efficiency records as high as 98% in actual tests; it is strong, tough, elastic; it can be made into endless belts with comparative ease; and it is especially good on drives where the belt must be shifted back and forth often from pulley to pulley. But in spite of these good features, leather belting has its faults. It is always stretching and unless properly cared for is affected by moisture, heat and cold. It cracks and grows hard and stiff on drying. There is no good reason, therefore, why users should not look to some other source for belting and if possible get a less costly and better belt.

The solid-woven belt is rapidly coming into prominence as the solution of the problem for the user and buyer. Consider for a moment the economies of this new entry into the belting field.

In the first place, most users have not bought belts correctly. Much money could have been saved on leather belts by selecting the most economical combination of belt and pulleys. Too many belt men and belt-drive designers have been in the habit of sizing up a machine with the eye and concluding offhand that a certain pulley will answer the purpose. Such a conclusion is no more than a guess, but the pulley is installed and thereafter the belt man may or may not have trouble.

Pulleys must not be too small, because small ones are liable to slip easily; and they must not be too large, because large pulleys are expensive. Both belt and pulley must be just right. A small pulley requires a wide belt—at least a wider one than a large pulley transmitting the same power and running at the same speed. Large pulleys, therefore, can be run with comparatively narrow belts. Fig. 1 shows a belt on small pulleys, the distance between pulleys being 30 ft. This drive costs more than the one shown in Fig. 2, although in the latter we have pulleys twice as large as those shown in Fig. 1. In Fig. 1 the belt costs too much. It is too wide and heavy. In Fig. 2 the belt costs one-half as much because it is just half as wide as that in Fig. 1. It is now plain that something is required of the user in making the selection of belts and pulleys. A little figuring must be done in order to sift the whole thing to the most economic size.

First, do just what is usually done—make a guess at the size of the smallest pulley. That is, what do you think the diameter should be? To guess intelligently, the speed of the small pulley must be known. [illegible] a pulley on a motor, how many revolutions per minute does the motor make? Also, how many revolutions must the driven pulley make? The diameters of the pulleys will be inversely proportional to these speeds; that is, a 1-ft. pulley of a given drive would make 4,000 r.p.m. if the 4-ft. pulley to which it is belted makes 1,000 r.p.m. Choose pulleys of such size that the speed of the belt will not be greater than a mile a minute. Steel pulleys may be safely run at 6,000 ft. per min. peripheral speed. You are now ready to compute the width of the belt, which is easily done for leather belts as follows: A single leather belt 1 in. wide running 800 ft. per min. will transmit 1 hp. And for other thicknesses use 500, 400 and 300 respectively for 2-ply, 3-ply and 4-ply.

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*Copyright, 1916, by W. F. Schaphorst

†Mechanical engineer, Woolworth Building, New York.

For solid-woven belting a prominent manufacturer gives the following rules: Single is equal to single leather; light double is equal to extra-heavy single or light double leather; regular double is equal to double leather; triple is equal to triple leather. This, before passing into the next phase of the subject, is a very good showing for woven belting. The rules are about equally applicable to either leather or solid-woven belting.

Now, knowing the belt width, you can easily decide on a pulley width. Generally the pulley is about an inch wider than the belt. It does no harm, to be sure, to use pulleys of even greater width, but never use those that are narrower than the belt. Once in a while one sees such drives, but they should never be tolerated.

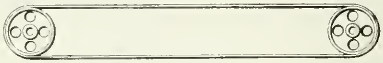

FIG. 1

FIG. 2

FIGURES SHOWING THE RELATION BETWEEN PULLEY DIAMETER AND BELT LENGTHS

Next find the total cost of the belt and pulleys. In order to do that the length of the belt must be known. To find this, multiply the diameter of the small pulley by 1.57; multiply the diameter of the large pulley by 1.57 also; multiply the distance between shaft centers by two; and then add all these products together. The sum will give the belt length closely enough for most computations, although it is not always absolutely accurate.

Everything is now known, except prices. These are given in transmission catalogs or must be obtained specially from the manufacturer if of a fluctuating nature. Next choose a larger diameter for the small pulley and do the computing all over again. Perhaps the total cost of larger pulleys and a narrower belt will be less, perhaps more. It is impossible to tell until one figures it. If the cost is less, try a still larger diameter for the small pulley, always remaining within the allowable belt speed.

If the cost is more, in either of the trials, choose a smaller pulley and try again. It is wise, generally to tabulate the results systematically for the avoidance of errors. Such a tabulation should include the following items: (a) Diameter of pulleys, (b) width of belt, (c) width of pulleys, (d) length of belt, (e) cost of pulleys, (f) cost of belt in dollars, (g) total cost, dollars. This tabulation will tell the whole story in condensed form. The final column, "Total cost, dollars," is the important one. The least total cost generally is the most economical where the distance between shaft centers is 20 or 30 ft.; but where pulleys are close together, judgment must be used in addition to figures. Usually, this method gives amply large pulleys—larger, in fact, than one would use on guessing the diameter, but large pulleys are generally best.

This applies equally to leather and to solid-woven belting, but on account of the much lower cost of the latter it is plain that it has an even greater advantage where the distance between shaft centers is great. At any distance, though, woven-belt drives cost less. To show this great difference in cost I quote the following from a letter in my possession: "Recently, on a new installation in a big East End plant, they figured leather belting would cost them $3,500. Comparing cost of solid-woven belting for the same installation, it showed a saving of just $2,218.40. Ours cost only $1,281.60, and additions were such that we could guarantee our belting to give them just as good service as best grade of leather." This manufacturer will not sell a belt if he knows finger shifters are to be used. "Usually," he says, "the belt is blamed instead of the finger shifters, when the belts wear out prematurely." His idea is to save the reputation of his belting. The old finger shifter should be tabooed. It is hard on any belt to allow it to scrape against a sharp object. A broad surface should be used to press against the belt.

It is claimed by some belt men that they cannot make a good joint in a solid-woven belt, but that is because they go at it in the wrong way. Being accustomed to leather belting, they are inclined to try to join woven belts in the same way, but that is illogical because of the difference in structure. Some of the new metal lacings and joints do satisfactorily on solid-woven belts, and some makers are successfully making woven belts endless.

There are other advantages that accompany woven belting, such as less pressure on the bearings due to the larger pulleys and lessened tension; power is saved; bearings and babbitt are saved; there is less slip and less belt wear; and the goodness of the belt runs all the way to the output, which is increased and improved because of the absence of slip and the steadiness of the large pulleys and the all-around economical combination.

Economy of Timber in Mining by Ohio Caving System

One advantage of the Ohio caving system, in use at the Ohio copper mine at Bingham, Utah, at the Inspiration copper mine in Arizona and elsewhere, is its extreme conservation of timber. Only enough timber is required to protect the men during the time of working instead of requiring permanent sets. After caving the timber is recovered by a grizzly and returned to the workings and used over again. At Ohio the cost of timber is about 1c. per ton of ore mined. No detailed estimates of Inspiration's costs are yet announced.

Details of Milling and Smelting

Limestone Precipitation of Weak Copper Solutions

Limestone precipitation of Inspiration's oxidized ores was mentioned briefly last week in the *Journal's* account of the A. I. M. E. meeting in Arizona, in connection with the proposed leaching of the Inspiration's low-grade carbonate and silicate ores. Rudolph Gahl in introductory remarks to his paper on the "History of the Flotation Process at Inspiration," referred to certain changes that had developed in the practice, since the writing of this paper. He stated that although the addition of hydrogen sulphide permitted a good recovery of copper carbonates with certain ores, it had not proved especially advantageous at Inspiration and that experiments with leaching had shown more satisfactory results on the carbonate and silicate ores. He added: "We intend to use limestone for precipitation of the copper that goes into solution, as electrolytic precipitation seems out of the question on account of the diluteness of the solutions; precipitation by iron was rightly objected to because of the unavoidable contamination of the water supply. We feel very hopeful about the success of our limestone precipitation, which, if it holds what it seems to promise, will develop into a novel feature of copper metallurgy."

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Finding Splinters in Fingers

Those who have to practice "first aid" in mines and reduction works will probably find the following of great help:

"Location in a busy clothing manufacturing district gave rise to the necessity for a simple method of determining the presence and location of foreign bodies, such as needles and splinters, in fingers," says Dr. Roscoe H. Webb, in the *Journal* of the American Medical Association. "A piece of black woolen cloth 8 in. square was fastened to a piece of adhesive plaster of equal size, and in the center an oval opening was made measuring five-eighths by one-half inch. By placing this over an electric light supplied with a reflector and placing the finger over the hole, excellent transillumination is obtained, and by making pressure with a pointed instrument over the suspected area, the object can be brought out more clearly. If the field is rendered bloodless while operating, the finger may be placed over the opening and the object can be again accurately located. This device is simple, inexpensive and indestructible. It is more easily adapted than pocket flashlights, etc., to the finger, and reduces to a minimum the number of cases requiring röntgenograms. Daily use for the last six months by several workers in the accident room has proved its efficiency."

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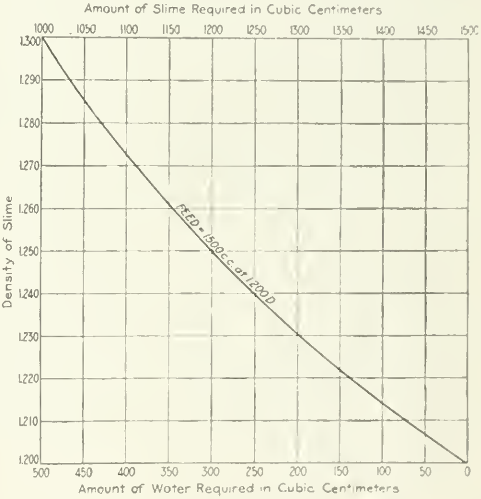
Crucibles Often Fail along the sides rather than on the bottom. The bottoms of a crucible in this condition may be removed and used as covers for other crucibles for several melts. Often the bottomless ring left above the point of failure can be used as a funnel through which charge can be fed into a crucible already in the fire.

Chart for Flotation Testing

By L. B. Pringle*

When testing flotation oils, it is often necessary to have a feed of constant assay, volume and density. It is also sometimes essential to use a feed in the laboratory machine that is identical with the feed used in actual practice, so far as possible. Some of the difficulties I have encountered, and the remedies applied when testing oils, are herein described.

Having about one hundred oils to test out as to their frothing and selective qualities, as compared to the oil used in regular practice at the mill, I collected about 200 lb. of the feed to the flotation machines, dried it and passed all through a 150-mesh screen. This was then thoroughly mixed, quartered and assayed. To compare the results of the mill machine with the laboratory machine (a Janney testing machine), I used the same oil that was being used in the mill, a charge of 500 grams and a volume of 1,500 c.c. I was greatly surprised to find that the results with the Janney were much lower than we were getting in actual practice. I then tried mixing feeds of various densities and used various amounts of oil, but in every case the concentrates were low and the tails high. I next tried drying more of the slimes at low temperatures, and again I got the same results. Adding a few drops of sulphuric acid lowered the tails but also lowered the grade of concentrates. This led to the conclusion that no matter how low the temperature was in drying, the galena and pyrite took on a film of oxide that interfered with the results when testing. The sul-



FEED CHART FOR FLOTATION TESTING

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*Mining engineer, Bonne Terre, Mo

phuric acid probably removed this film, also brought the calcium and magnesium carbonates to the top with the concentrates.

The mill slimes are mixed in Dorr tanks, and in one of the tanks I found the slimes to be free from old oil. Numerous assays and density determinations on these slimes showed the lead content to be practically constant, and the density to be from 1.250 to 1.280. Collecting some of the slimes and running them with the same oil as used before, I found my results from the Janney laboratory machine to check closely with those of the mill machine. Further experiments showed that a volume of 1,500 c.c. and a density of 1.2 gave the best feed for the Janney machine. As the density of the slimes from the Dorr tank was always above 1.2, but variable, I plotted a curve that showed the quantity of slime necessary at various densities and the amount of water needed, for a constant feed of 1,500 c.c. volume and density of 1.2. On several occasions afterward I needed to change the volume and density of the feed in making other tests, so I have derived a formula that may be applied to the original curve readings to determine the volumes of slimes and water needed for any other feed of a different volume and density. This curve and the accompanying formulas will be a great time saver to any experimenter meeting conditions similar to mine. The reduction formula may be used for any volume and density, providing the original slime density is not less than that required in the feed or greater than the curve is plotted for. Caution should be used, however, in the mixing of the final feed, as the solids settle rapidly in the slimes, and there is apt to be a loss in pouring, causing the final density to be lower than that calculated for. The use of large-mouthed bottles in mixing, rapid pouring and due care will eliminate this source of error.

The diagram and formulas will show the method used for plotting the curve, and the same method may be used for plotting any other curve that the experimenter should choose to adopt as a standard. (See equations 1, 2 and 4.) The reduction formula (see equation 3) explains itself. Numerous experiments have found the specific gravity of dry pulp in the slime herein mentioned to be 2.84 (S in equations 1 and 2). In equations 1 and 2, m is 463 grams.

CURVE FORMULAS

Let

m = Weight of dry material in charge;

V = Volume of charge, taken as 1,500 c.c.;

W = Weight of a unit volume of water, taken as 1;

S = Specific gravity of dry material (for slime, $S = 2.84$);

P = Density of charge, taken as 1.2.

Then

$$m = \frac{VWS(P-1)}{S-1} \qquad (1)$$

To find points for curve,

Let

d = Density of slime;

Q = Amount of slime required to make the charge;

$V\text{-}Q$ = Amount of water required for charge;

Then

$$Q = \frac{m(S-1)}{S(d-1)} \qquad (2)$$

In this particular case $Q = \frac{300}{d-1}$.

To find the amount of slime required to mix a feed of any other density and volume, from this curve, let

v = Amount of slime required, as shown on curve, of any density "d";

V_1 = Volume of new charge;

D_1 = Density of new charge;

Q_1 = Amount of slime needed for the new charge;

$V_1\text{-}Q_1$ = Amount of water needed for the new charge;

Then

$$Q_1 = \frac{v(D_1-1)V_1}{(D-1)V} \qquad (3)$$

In this particular case,

$$Q_1 = \frac{v(D_1-1)V_1}{300}$$

A general equation, eliminating m, for determining the amount of slime and water necessary for any charge, has been contributed by H. Rabling[1], and is as follows:

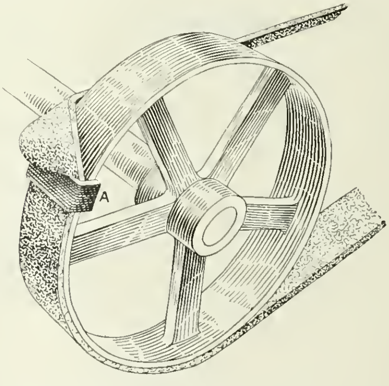
$$Q_1 = \frac{V_1(D_1-1)}{d-1} \qquad (4)$$

* * *

Placing Tight Belts on Pulleys

At a plant where a number of belts are used very tight and in consequence are difficult to place on their pulleys, the small device shown at A in the illustration makes the task of placing a tight belt an easy one, according to A. E. Holaday, writing in the *American Machinist* for Oct. 19, 1916.

The device is made of $\frac{1}{8}$ in. flat steel about 2 in. wide. It is bent at right-angles at the ends, the bends being made so that the contrivance will fit the width of the pulley face. The ends are about 2 in. long. By starting the belt on the pulley and holding this angle iron over the belt, the belt can be run on without difficulty. To avoid accidents the belt should be run on either by hand or at a very slow speed.



REPLACER FOR TIGHT BELTS

* * *

Pigs Are Prevented from Sticking in their casting mold in the following manner. Before the molten metal is poured, slacked lime is introduced into the mold. The heat of the molten metal drives off the water from the lime and leaves a powder (CaO) which keeps the mold and the pig separated.

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[1] Mining engineer, Bonne Terre, Mo.

Revision of the Mining Law--II

The following communications were received by the Mining and Metallurgical Society of America in answer to its questionnaire on the points involved in the proposed revision of the mining law of the United States. Congress declined to appoint a commission to draft a new mining code and it is now up to the mining industry itself to crystallize its ideas as to what the new law should contain. Readers are invited to contribute their views on the points involved in the questionnaire, which was printed on p. 719 in the *Engineering and Mining Journal* of Oct. 14, 1916.

J. Parke Channing (Sept. 15, 1916)—In regard to the size of the claim my opinion is that it should be 40 acres; that is, 1,320 ft. by 1,320 ft. In this way we more nearly preserve the length of lode allowed in the present mining claim of 1,500 ft. and we simply give it extra width to allow for the abolition of the extralateral right. Iron-ore leases in Michigan, Minnesota and Wisconsin are seldom, if ever, made on less than 40-acre tract, unless there should be a fractional $\frac{1}{16}$ section which is not up to the full 40 acres. I am of the opinion that where a country has been sectionized, undoubtedly these claims should correspond with the 40-acre tracts of the sections. In unsurveyed territory I am doubtful as to whether the provision should be made that lines be north-south and east-west. In cases of veins striking northeast and southwest this would lead to a great deal of confusion.

In this connection it is interesting to note that when the eastern end of Tennessee was sectionized, it was apparently recognized that the trend of the country was northeast and southwest and the meridian was made to conform with the general topography of ridges and valleys of the country. Incidentally this very nearly agreed with the trend of the copper formation. I think undoubtedly the first locators in a district would approximately determine the trend of the mineralization, and in districts where the formation curved, later claims would be properly oriented.

This rule of square location should, however, not be made too rigid, but provision should be made that in a location only two of the angles need be right angles, thus permitting a want of parallelism on one side so that the claim might butt up against another and yet change its general direction to conform to the strike of the lode. I was lately looking over some claim maps of Cuba, in which country I understand all angles must be right angles. The result was that in butting up against an adjoining property the line looked like that of a saw, which of course is ridiculous.

I very much favor the principle of permitting an amount equal to the assessment work to be paid in cash rather than, as is often the case, allowing it to be frittered away without benefit to anyone.

Charles A. Chase (Sept. 14, 1916)—I have reviewed the proposed outline of a mining law as offered by the New York Section, together with the subsequent discussions, and my conclusions are:

1. The classification of public lands seems unimportant, it being well enough to permit the prospector to seek mineral where he will. Mr. Parker's discussion of this is pertinent.

2. To require a claim of 40 acres seems less satisfactory than to make that a maximum for one claim, leaving 10 acres as a permissible minimum; and instead of requiring a large square, permit as many as four 10-acre square units to be placed in a row, thus giving considerable latitude in shape and size of claim. Having this latitude, conformity with legal subdivisions would be less objectionable and even attractive in the surveyed areas; further in unsurveyed areas the exclusive use of north-and south and east-and-west lines would facilitate subsequent reconcilement with the public survey on the occasion of the official survey for patent. I think it well worth while and practicable to avoid the infinite criss-crossing of claims.

3. Mr. Gardner's discussion shows the necessity of discovery at least antecedent to patent, if not to valid location. Permitting later discovery of mineral coupled with the requirement of full $100 worth of work each year beginning with initiation of claim, compulsory recording of each year's assessment and heavy penalties for fradulent affidavits might form a satisfactory procedure. The demand for record in the United States Land Office seems impracticable, these offices being in general too remote; such a record without the prior requirement of official survey (even in surveyed areas corroboration as to location is necessary) would be valueless, and worse, being dangerous in attempting to give something that it could not give without better machinery than has been suggested. Most locations originate through individual special knowledge of vacant ground, and that knowledge may be expected to be more accurate than a Land Office map based on inaccurate data.

4. If the claim may be varied from 10 acres to 40 acres, $100 is a reasonable average annual assessment. An actual cash payment 50% larger in lieu of work on the ground has much to commend it and, if this might be divided between county and national governments, might be acceptable to the Western public.

5. The crediting of large expenditures in one year to subsequent years seems fundamentally bad.

6. I see no sufficient reason for limiting possessory ownership by requiring patent. If the affidavit of annual labor is made compulsory, the possessory title permits simpler return to the public domain.

In general, there seems no sufficient reason why any patent, whether placer or lode, should not be secure from attack after a few years and be expressly made so in a new general law.

Court review of Land Office decisions should be made readily available.

In making these comments I have presupposed vertical boundaries subject only to existing extralateral rights. Previously offered current contributions have been useful to me in clarifying my own ideas.

Frank A. Ross[1] (Sept. 4, 1916)—Actual discovery of a valuable mineral deposit should be necessary to a final and valid location of a claim, but the new law should authorize preliminary locations without discovery and should protect the prior locator in his rights as long as he prosecutes a continuous and diligent search for mineral. This is to prevent trouble between two [illegible] locators on suspected ground, each striving to find mineral first. But all preliminary rights should determine upon cessation of work and title should revert to the Government.

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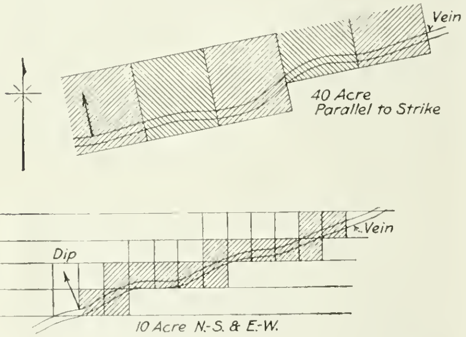
[1] Nonmember.

It is a moot question whether claims should be 660 ft. square or 1,320 ft. On surveyed land and in rare cases where veins strike due north-south or east-west, the 10-acre claims would offer certain advantages perhaps, but on unsurveyed lands and where the veins strike in any other directions than N-S and E-W it would be very difficult to locate them by staggered 10-acre claims, bounded by N-S and E-W lines, so as to cover enough of the vein on its dip to make the claim valuable. Other 10-acre claims would need to be located in the direction of the dip to protect the first location. See accompanying sketch.

On the other hand, if 1,320 ft. square were adopted and the claim might be staked out with one side parallel to the strike (where there is an outcrop) and as close thereto as possible, then the rest of the claim on the dip side would give ownership to a satisfactory depth of vein even without supplementary locations in direction of the dip.

Consequently I am strongly inclined to believe that claims 1,320 ft. square located according to the judgment of the locator and not confined to political divisions and subdivisions of surveyed lands or to north-and south, east-and-west lines on unsurveyed lands, will work better in practice and give more satisfaction all around, regardless of the crazy-quilt pattern of the camp map.



STAGGERED CLAIMS WITH N-S AND E-W LINES

Very few surveys of our mountainous districts are found to be correct, so that fractions are almost bound to exist in any event and must be covered. Again, on unsurveyed lands it would certainly bother any prospector to set out north-south or east-west lines that would hold on survey and he would find such a requirement very obnoxious, I think. The labor of staking claims in heavily timbered districts, for instance, is far greater than most persons imagine, and few lines are ever correctly run at first.

The number of claims locatable by one person or association should be unlimited, but assessment work or equivalent cash payments should be strictly enforced: failure to comply should work forfeiture of rights, and claims should be so posted or at least the records should be so marked as to serve as notice to the public. Present regulations as to marking notices and records of location should be amplified so as to enable the public to trace immediately the ownership of any ground that has been staked. For instance, present monuments are not sufficiently permanent and the same applies to the posted notices of location. Serial numbers should be given to each claim by the recorder, one series for preliminary notices of location and another for permanent; and these numbers should be carved or painted upon the monuments together with the office in which recorded. Preliminary notices should be filed within 30 days—the sooner the better.

If it is desirable to file any notice in the local United States Land Office, then six months after striking valuable deposits should be sufficient. But all notices should be filed at the county seat.

Annual assessment work should be at the rate of $5 per acre, but the payment of an equivalent amount of cash should be permitted in lieu of actual work for a period not to exceed two consecutive years upon a sworn statement of good faith and intention to perform the actual work in future. This would serve to tide over a short period of hard luck, but would prevent the holding of claims unworked and undeveloped. Actual work should be required under heavy penalty. Affidavits of same should be made and filed with the recorder annually. Failure to do so should work forfeit within a certain time, say 60 days after Nov. 1; in other words, before Jan. 1 of each year. The recorder should keep a proper record of each claim filed, showing assessments or lapses, etc. ("Recorder" means "county recorder.")

Owners should be permitted (by all means) to hold a group by doing work on one claim, provided that this work is development for the group and provided that the total expense of this work is equal to the number of acres in the said group multiplied by $5, all labor to be reckoned at current wages of the district. Sums expended in excess of the required amount for either single claims or groups should be credited upon the work of the following year or years and should be allowed in applications for patent, provided that no fractions of $200 be allowed if claims comprise 40 acres.

Filing in a United States Land Office is not necessary as regards preliminary or final notices of location, though there would be no objection to filing the latter if desirable for any reason. Present patent procedure seems to be reasonably satisfactory on the whole with the exception of scrutiny by land-office officials that are not conversant with mining methods and requirements. United States mineral surveyors have some improvements to suggest, I believe.

I see no objection to the seven-year limit, for the reason that valuable claims are certain to be patented before that time.

By all means provide for appeal from the decisions of the General Land Office.

L. K. Armstrong[2] (Sept. 7, 1916)—Referring to the amount of labor to be expended annually, I am opposed to the $200 requirement, as unpatented claims are usually in the hands of poor people and in the withdrawal of extralateral rights the 40-acre claim as a rule will carry no more vein value than 20 acres without abridgment of these rights.

Referring to notice of location and compulsory final entry, I am opposed to limited time for final entry and payment for land with penalty of forfeiture, for this would work a hardship on the claim owner. Patented land is a deterrent to development and so the making of mines, and will sooner result in consolidation of large interests.

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[2] Spokane, Wash. (nonmember.)

It is my observation, applied in many cases here, that land once patented is land idle. It is palpably unfair to ask that mineral lands be continuously developed after patent issues, without questioning the legality of such demand. It would seem to be wise to let this provision of the law stand; demand continuous annual assessment, as now, until patent issues without limiting time for this.

Frank A. Ross (Sept. 18, 1916)—I fully agree that, theoretically at least, mining locations made in conformity with meridional lines might somewhat simplify descriptions in certain instances; but I am equally convinced that the net practical result of such a requirement would be to increase greatly the difficulties of location and, quite probably, to create more or less confusion. Again, much more ground would need to be covered than if locations were made parallel to the known or supposed strike of veins. I shall briefly outline my objections, all of which are based upon practical experience with conditions as they are and not as they are supposed to be by some of our lawmakers. And I wish to preface my remarks with a declaration that staking claims is not the simple process that many imagine it to be. Out in the open, rolling country—yes; but in all mountainous regions, broken up, heavily timbered and brushed and mostly precipitous, the work of running claim lines is almost always severe. Professional men know this, but few laymen do. Therefore my objections to the meridional system are these:

In the first place, immense areas of mineral-bearing ground are still unsurveyed and will so remain, perhaps, indefinitely.

Second, a surprisingly large percentage of completed surveys are what is known as "office surveys"; that is, surveys by contract in which the Government has been outrageously cheated by the contractors. For instance, I once employed a surveyor to plat a group of claims in the Cascades, in a district that had been surveyed. Imagine my amazement when he told me as a great joke (!) on himself that, not being able to find the section corners, he had bought one of his own maps, made some years before and forgotten until then, because, as he said, "I didn't remember that that district was among those that came under my contract. Why! I never left my office when I made that survey!" Good joke, was it not? I have since been informed that such instances were by no means rare.

Third, in an astonishing number of cases where surveys have been run, no permanent monuments were erected, and it becomes a heartbreaking task to locate corners in any instance, but particularly in badly broken, timbered and heavily brushed districts; and prospectors, when about to locate, are quite shy about calling outsiders into a consultation. I was examining a property a few weeks ago and had occasion to trace certain section corners in the Bitter Roots, Montana. It took me and my assistant two whole days to find two corners. They were marked by flat stones, lying loosely on timbered talus slopes and chiseled so faintly that only through pure luck did my agile assistant tumble on to them. How on earth can one expect prospectors—strangers to the district, perhaps—to conform to meridional lines, or even to approximate them, under circumstances like these? And how many prospectors would do so? They can all strike bee-lines in any directions they may wish to go, but few carry compasses or known how to use them in coursing.

Fourth, when mineral is discovered it is of vital importance to stake the ground in the shortest possible time. If the discoverer is permitted to take the formation as his guide—down gulches or cañons and up again, through timber, brush and fallen rock—his work of locating is as easy as it can be made for him; but if he must first orient himself; or hunt for section corners, then I seriously doubt if he will do it; or, if he does, he will everlastingly "cuss-out" the Government that made such fool laws. Furthermore, if it happens that other men are frantically staking all around him, I can see several different kinds of confusion, disputes and even warlike acts, both before and after meridional surveys are made, particularly in an unsurveyed district. Beyond all doubt, many would lose valuable portions of their veins where the strikes of the latter were in directions other than toward the four cardinal points. But this could not happen if claims were staked parallel to the strike and if the monuments of the first line run indicated on which side the remainder of the claim was to lie.

Fifth, I claim that if vertical planes limit ownership, then there is positively no objection to the so-called crisscross locations. Permanent mineral monuments are easily established to which all claim corners may be tied; and these monuments themselves may be tied to section corners if anything is to be gained thereby, as in the making of a general map; etc. No confusion ever has arisen that could not also arise under the meridional system. In every stampede, claim lines always overlap each other and always will. Adjustments must follow, and there is no practical remedy for this condition.

The crux of the whole matter, to my mind, is the enforced establishment of permanent corner monuments together with the destruction of all obsolete monuments by the official mineral surveyor after he has noted their exact locations in his records.

Today our mining regions bristle with decrepit corner posts on lapsed claims that merely serve to libel the ground or to act as bases of blackmail suits.

Whether or not the claims comprise 10 or 40 acres is, I think, immaterial, although the suggestion to stake only a 40 where four claims are taken up is to the point as a compromise.

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Workmen's Compensation Act

By A. L. H. Street*

The clause of the California Workmen's Compensation Act which precludes recovery for injury to an employee due to his own "willful misconduct" has been considered by the Supreme Court of the state in a case where a miner working in one shaft of a mine was ordered to go to another when he should finish his work in the first. Instead of going directly to the second shaft he stopped for a short time in the shade of an ore bin on the surface, to rest, the day being insufferably hot, and was killed by a collapse of the bin.

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*Attorney at law, 829 Security Building, Minneapolis, Minn.

An award of compensation for his death was resisted on the ground that his own willful misconduct led to the accident, but the court holds that there is liability under the act, it appearing that the place was commonly used by employees for resting and had been regarded as safe. (Brooklyn Mining Co. vs. Industrial Accident Commission, 159 Pacific Reporter, 162.)

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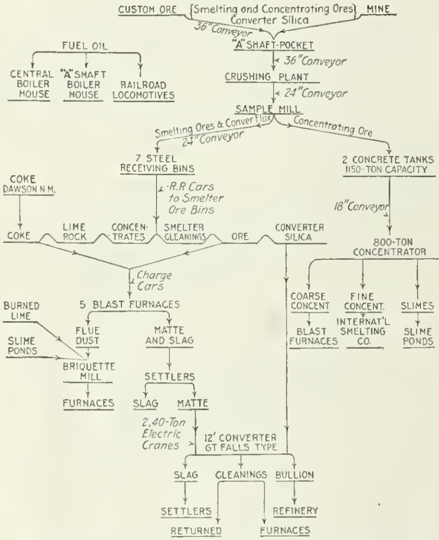
Old Dominion Operations Globe, Arizona*

Mining at the Old Dominion Copper Mining and Smelting Co.'s property at Globe, Ariz., is carried on along 8,500 ft. of the strike of the Old Dominion and other minor veins. Irregular replacement deposits occur in the limestone of the hanging wall. Mining is carried on at present to a depth of 1,200 ft. Access to the workings is gained through five shafts, three of which are 800 ft. deep, one 1,200 and the other 1,400. The last is the main operating shaft and is a five-compartment. In two of these, 3½-ton skips operate; three-deck cages operate in two others, while the fifth is devoted to pipe lines and cables. The skips are hoisted by a Nordberg 16x28x48-in. twin-tandem compound double-drum hoist. The drums are 7 ft. diameter and have a 5-ft. face on which 2,000 ft. of 1¼-in. rope is wound. The hoisting speed is 1,800 ft. per min. The cages are hoisted by a Nordberg 18x30x42-in. cross-compound geared double-drum hoist having drums 9 ft. diameter and 4 ft. face. Two-layer 1¼-in. rope is used. A hoisting speed of 1,250 ft. per min. is attained. A daily production of 1,200 tons of ore is mined partly by square-sets and partly by cut-and-fill. Of this ore, two-thirds goes to the concentrator and one-third is smelted direct. Electric haulage is employed underground on alternate levels from the 12th down. Three-ton locomotives are used with 20-cu.ft. side-dump cars.



GENERAL FLOW SHEET OF OLD DOMINION MILLING AND SMELTING OPERATIONS

Three types of pockets are used, namely: (1) 125-ton pocket with measuring transfer car from pocket to skip; (2) 250-ton transfer raises with 3½-ton measuring pocket for loading into skip; (3) 200- and 250-ton pockets with slide and 3½-ton measuring hopper for loading into skip.

The water question is a serious one. An assortment of various types of pumps, situated from the 10th to the 18th level, have an aggregate capacity of over 11,000 gal. per min. A pressure system of ventilation is employed, air being forced down two of the shafts, 75,000 cu.ft. per min. being forced down an 800-ft. and 100,000 cu.ft. per min. down a 1,200-ft. shaft. A total of 4,475 hp. is developed in the steam power plants and 1,500 kw. is developed by two mixed-pressure Curtis turbo-generator units operating at 2,300 volts.

The crushing-plant equipment consists of two No. 7½ gyratory crushers, one of which is used for smelting ore and one for concentrating ore. Reduction is continued in one 48-in. and two 36-in. Symons disk crushers. Reduction to 1-in. size is accomplished, screening being done by two trommels, 5 ft. diameter, one 8 ft. and the other 10 ft. long. A monthly tonnage of 37,000 is treated. In the sampling mill a 16-lb. sample is taken from each 100 tons of ore. Further crushing equipment consists of 36x16-in. and 27x14-in. rolls. The final pulp grinding is performed in Braun pulverizers.

The concentrator equipment is as follows:

Shaking screens, three Woodbury classifiers and jigs
Two Traylor rolls, 42x16 in.
Five 8-ft. by 36-in. Hardinge pebble mills
One 8-ft. by 48-in. Marathon mill
Deister Concentrator Co. tables and Senn vanners
Coarse concentrating vacuum tanks, Blaisdell excavator
300-ton 16-box Minerals Separation machine
Two Oliver filters

A tonnage of 800 is treated per 24 hr. and 3.5% copper is concentrated in the ratio of 2.9 to 1. The concentrate runs Cu 8%, insoluble 21%, iron 31% and sulphur 30%. Jigs produce 47%, tables and vanners 30%, and the flotation plant 23% of the total copper recovered. A concentration ratio of 10 to 1 is maintained in the flotation department. The reagent used has the following composition: Coal tar, 85%; pine oil, 3%; coal-tar creosote, 8%; turpentine, 4%. Three hundred tons per day is treated.

OLD DOMINION SMELTING DATA

Average tons charge per furnace per day	282
Per cent. coke to charge	12.85
Average blast pressure, oz.	21.5
Average cu.ft. air per min. per furnace	13,500
Average cu.ft. air per ton charge	68,926
Average tons air blown to furnace per day	647.648
Weight ratio—fuel and charge to air	1:2.034
Matte fall, %	18.33

The composition and analysis of the charge are shown in the following table:

COMPOSITION OF CHARGE		ANALYSIS OF CHARGE	
Ores	56.77%	SiO_2	22.2%
Concentrates	14.21%	Fe	31.5%
Flux	12.23%	CaO	1.8%
Fce. secondaries	2.29%	Al_2O_3	6.6%
Converter secondaries	14.50%	S	11.8%
		Cu	7.75%
	100.00%		

In the smelting department are five furnaces, one of which is 19 ft. 3 in. by 44 in., and four are 16 ft. 6 in. by 44 in., all with 5-in. tuyeres. The above details were given out to the members of the A.I.M.E. on their recent visit to the plant.

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*Data from pamphlet prepared for recent A. I. M. E. visitors.

Data on converter lining life are given in the following table which shows the operation of a converter from June, 1913, to December, 1915, during which time it was blowing 13,734 hr.

LIFE OF AN ORIGINAL LINING TO TIME OF FIRST PATCHING

Size of converter	12-ft. Great Falls type
Thickness of brick at tuyeres, in.	30
Total number of blows made	3,288
Average time of blow	4 hr. 11 min.
Total tons matte charged	85,578
Copper in matte, %	43.37
Tons bullion produced	35,431
Average time to blow 1 ton copper, min.	23.2
Average tons copper per blow	10.80
Average blast pressure	13.2
Air used to blow 1 ton copper, cu.ft.	178,411
Average air used per min., cu.ft.	7,691
Tons ore fed per ton matte blown	0.20
Analysis of ore fed: Cu, 6.90; SiO_2, 60.3; Fe, 10.1; CaO, 2.5; Al_2O_3, 6.5; S, 2.6	
Average weight of bar made, lb.	322

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Flotation at Mount Morgan*

Experiments in the flotation process have been carried on at the Mount Morgan mine, Queensland, Australia, for several years, and interesting results have been obtained. It may be noted that the Mount Morgan ore is a mixture of iron and copper pyrites with gold in a quartzose gangue. There are two types of ore in the underground workings—smelting ore containing 40 to 50% silica, and ore too siliceous for economical smelting. The material of the latter type is that treated by flotation, an approximate analysis showing 2% copper, 10% iron, 5½ dwt. gold, 73% silica, 1½% alumina, 3½% calcium carbonate and other alkalies, and 10% sulphur. By resolving these analyses into approximately component minerals, it appears that there is 6% copper pyrite, 16% iron pyrite and 78% coarse calcite, etc. The analysis is of course typical and does not represent an average assay of the class of ore.

Flotation experiments were carried on with a standard 24-in. Minerals Separation machine. Experiments were continued for three months, when it was then decided to convert the plant into a large-scale experimental unit treating 100 tons per day, in order that the concentrates produced would, to some extent, defray the expenses of the experiments. Ore from the shaft bin, approximately 6 in. in size, put into a bin of 400 tons' capacity, from which it was fed into a 24x16-in. Blake-type crusher. The machine handles 10 to 15 tons per hour and the power required for its operation was 20 to 26 hp. The crushed product, varying in size from 1½ to 2 in., was conveyed and elevated into bins above the ball mill.

Dry Crushing in Ball Mills

Eight No. 5 ball mills were put into commission, of which six were constantly in use, these mills making 20 r.p.m. They were driven by pinion-and-spur gearing from one mainshaft, the mills operating independently. The 6-in. steel balls were added regularly with the feed, so as to keep the normal weight of one ton of balls in each mill. Fifty-mesh screens were used, the average size of the crushed product being 10% to 15% plus 60-mesh. Each mill required 15 hp. when crushing at full capacity, which was approximately 0.9 to 1 ton per hr. Products from the ball mill passed into two fines bins, each capable of holding 150 tons. To prevent the escape of fine dust each bin was lined with sheet iron. It will be noticed that all crushing up to this point was dry.

From the fine bins the ore was fed into the Minerals Separation plant by two Challenge feeders, delivering into launders where water pipes were so arranged as to wet the ore with a minimum escape of dust. The feeders were accurate and could control any desired tonnage feeding.

The oil was supplied from a tank kept at a constant head by means of a ball valve that actuated a valve in the bottom of a feed tank at a higher level. The speed of each agitator of the Minerals Separation machine was 295 r.p.m., and the whole machine took from 55 to 60 hp., depending on the rate of feed. The first one to five boxes produced concentrates, and the product of No. 6 box was returned to the feed for retreatment.

The concentrates were first run into round tanks about 20 ft. in diameter and 10 ft. deep, with filter bottoms. These, however, were unsatisfactory, owing to the fact that the wet slime always kept to the outside of the tank and did not thoroughly drain. The difficulty was overcome by running the concentrates into a series of rectangular vats, 9 ft. 10 in. by 10 ft. 9 in., about 3 ft. deep, with cocoa matting resting on a sand-filter bed. The concentrates were run through these in series, three or four always being in operation, and each vat was filled up with concentrates. No trouble was experienced with this system. The drained water was perfectly clear, and the concentrates drained readily in 48 hr. to 7 or 8% moisture.

Preliminary Flotation Experiments

As a general rule acid is not used in the flotation of this class of ore, and the Mount Morgan ore is no exception. As typical of one of the many trial tests made on this plant before its conversion into a large steel unit, the following results were obtained from a special quantitative test on a certain stope of the mine. The rate of feed was 15 tons per hour, and the dilution 3.5 to 1. The duration of the run was 3 hr., and the oil used, 1 lb. per ton. The ordinary eucalyptus oil was used, and was added ⅔ to No. 1 mixer and ⅓ to No. 3 mixer. The product from each flotation cell was assayed separately, and it was found that the first cell gave concentrates higher in gold, copper and iron than any of the others, the per ton content ranging down from No. 1 gradually to No. 6. For instance, in gold, the first-cell concentrates assayed 55.52 oz. per ton, while the sixth-cell product assayed 18.77 oz. per ton. On the contrary, the silica content varied from 10% in the first cell to 50% in the sixth.

Tests were carried out on the concentration of ore by tabling before flotation. Vanning tests conducted in a dish in the laboratory on various stopes of the mine indicated that a recovery of 40 to 50% of the gold could be obtained, but only about 30% of the copper, unless the crude ore was high in copper. On conducting flotation tests on the residue from the tables more gold and copper were recovered. In the ore a high percentage of copper nearly always indicated a high gold content. The vanning concentrates, however, although much lower in copper than the flotation concentrates, were usually higher in gold. A careful series of tests indicated strongly that although the gold in bulk was associated with the copper, on fine crushing it was not so associated.

Tests were then conducted on a Wilfley table, several samples being taken every 9 in. along the table to a [illegible] how the gold followed the various table products. The feed of the table was crushed through 50-mesh screens in ball mills on the main plant and the feed sent direct to the table without classification. The table had a speed of 260 strokes per min., stroke of ⅝ in., fall, ½ in. per ft., rate of feed, 1.25 tons per hour. The best results—the concentrates having the greatest value—were, as might have been expected, obtained at the lower end of the table where the concentrate recovery is usually made, and the valuable content lessened as the head of the table was reached.

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*Excerpt from an article by W. Shellshear, in the "Proceedings" of the Australasian Institute of Mining Engineers, June, 1916.

An interesting feature of the experiments was the use of Sonstadt solution to determine where the gold occurred in quartz or pyrite. In carrying out this test a sample of flotation residue from a large-scale test was taken, assaying 4.4 dwt. gold and 0.55% copper. The sample was put through an 80-mesh screen and the —80-mesh product was then screened through 120 mesh. The sand that remained on the 120-mesh screen was used for the test. It assayed 5.13 dwt. gold and 0.74% copper. The Sonstadt solution was prepared by taking a saturated solution of potassium iodide in water and adding mercuric iodide until the required specific gravity was obtained. In this case 150 grams of the sand from the product between —80- and +120-mesh was added to the Sonstadt solution and stirred well. The solution had to be kept warm to prevent solidifying. The quartz product floated on top of the solution and was skimmed off, filtered free of solution and dried. The assays of the products were: For the quartz product, 3.91 dwt. gold, 0.05% copper, 1.45% iron and 95.50% silica. The mineral product contained 9.79 dwt. gold, 1.85% copper, 34.95% iron and 18.4% silica. As the mineral product contained 9.79 dwt. gold, the copper and iron in the quartz product certainly did not account for the total gold present. Therefore the test proved that a certain percentage of the gold was associated with the quartz.

RESULTS OF FLOTATION TESTS AT MOUNT MORGAN
(Period of One Week)

Mesh, I.M.M.	Crude Ore					Concentrates					Residue				Recoveries	
	%	Gold, Dwt.	Copper, %	Iron, %	Silica, %	%	Gold, Dwt.	Copper, %	Iron, %	Silica, %	%	Gold, Dwt.	Copper, %	Iron, %	Gold, Dwt.	Copper, %
+60	16.7	5.54	1.10	....	....	11	21.38	7.30	....	....	23.3	4.07	0.75	...	...	...
+80	4.7	5.21	1.32	....	....	6.6	19.28	8.79	....	....	6.6	3.26	0.47	...	...	...
+120	27.0	4.23	1.75	....	....	40.2	26.12	11.48	....	....	23.3	1.95	0.22	...	...	...
—120	51.6	7.67	2.44	....	....	42.2	40.82	13.23	....	....	46.8	1.63	0.19	...	...	...
Bulk	100	6.03	1.90	10.81	74.30	100	31.02	11.75	32.21	19.40	100	2.44	0.35	6.78	64.6	84.0

In order to obtain still more information on this matter, the original sample of residue was screened through 120-mesh, and this product was then screened through 180-mesh. The sand that remained on the 180-mesh screen was used for a second experiment. This test was conducted like the first one, the quartz product being floated off on top of the Sonstadt solution. Assays of the quartz product showed 1.30 dwt. gold, no copper and 0.79% iron. This test is of interest, as it clearly indicated that there was less gold associated with the quartz in the finer product. Hence it seemed reasonable to assume that a certain amount of the gold associated with the quartz was liberated by finer crushing. The residues after flotation were given a Wilfley-table test, and the plain indication was that the gold was in a fine, free state and distributed widely through all the table products.

Some of the flotation concentrates were tested for tellurium, but no trace was found. A sample, the —80-mesh product of the first flotation-box concentrate assaying 47.2 dwt., was panned to see if any free gold was present. After long and careful panning very fine free gold could be seen in the dish. The test proved that free gold floated, and that a certain portion of it, at any rate, was free in the concentrates. It seems reasonable to assume that the gold in the Mount Morgan siliceous ore was free and in a very fine state of subdivision.

The flotation tests showed that the recovery of iron was low. The results from many runs averaged 45 to 60%, the residue assaying 4 to 8% iron. The percentage of iron varied considerably according to the nature of the ore.

The results of laboratory tests indicated that, with a dilution of 1:1 poor recoveries would be obtained, while with thinner dilution, up to 7 to 1, recoveries would be normal. A rapid method of determining the dilution of feed on a large scale was worked out. In this method a number of 50-c.c. cylinders were filled up to the graduated mark with weighed quantities of water and ore, the latter being average crushed feed from the experimental plant. The pulp in the cylinders was then agitated and allowed to settle for five minutes, and the relative numbers of cubic centimeters of settled feed and of clear water were read off. The results obtained were used as standards for subsequent work. Tests on the large scale, checking the method against the ordinary one of weighing, showed that it gave good results, the method of taking the dilution being to fill a 100-c.c. cylinder with pulp out of one of the agitators. A number of large-scale tests showed that the results were not affected by having dilutions ranging from 2:1 and 5:1, provided the feed was not heavy. With a feed of over 20 tons per hour it was found impossible to work with a dilution under 3 to 1, owing to the work being adversely affected if the rate of flow of pulp through the machine was too great. Vanning tests showed that the quantity of fine slime in the feed varied from 15 to 20%. Experiments showed the value of fine crushing.

The Use of Different Oils

Tests were tried on different oils, principally eucalyptus and various blendes of eucalyptus with other oils. Laboratory tests backed up by large-scale operations indicated that of the eucalyptus oils used, those of the type *eucalyptus amygdalina* and *eucalyptus dives*, containing phellandrene, give better results than those of the other types which did not contain phellandrene. Eucalyptus distilled from local plants of the type *eucalyptus citriodora* and oil distilled from box were tried, but results were not so good as from oils of the phellandrene type. Turpentine, which is impossible to distinguish from the first distillate of eucalyptus, is too often used in large quantity as a diluent of eucalyptus and too much stress cannot be laid on the importance of exact specification being complied with before eucalyptus in large lots is purchased.

In the plant it was found that flotation was influenced by an excess of oil almost as much as by too little. Too much oil caused heavy float in the residue launder. Experiments on the large scale, adding oils continuously for a long period to the dry feed at the Challenge feeders, proved that the percentage of insoluble in the concentrates did not increase below normal.

Oleic acid and residuum oil were tried in the laboratory, but the results were not sufficiently good to be tried again on the large-scale plant.

The method adopted in the large-scale concentration plant showed that although in some cases very little extra gold was recovered by vanning and flotation tests, as compared with straight flotation, in most cases the extra recovery was appreciable, and this fact was really the main one in considering the erection of tables before flotation in the large treatment plant. Other advantages were the recovery of a large proportion of coarse iron concentrates which, when mixed with finely ground flotation concentrates, would give a product easy to handle. In addition there was a possibility of treating smelting ore in the concentration plant. The method adopted for the plant was, therefore, primary crushing to about 40-mesh and tabling, recrushing table rejects to 80- or 120-mesh and treating by flotation. The smelting ore required very fine crushing to get good recoveries. As no work was done in the large plant on this class of ore, only laboratory tests were carried out, which continued to show the advantage of combined treatment. The accompanying table is a brief summary of the results that were obtained by experimental plants at work on a large scale. The flotation costs may be summarized as follows: Supervision, 0.9d.; operating wages, 1.82d.; power, 1.46d.; material in general, 0.1d.; oil, eucalyptus and residuum, 4.98d.; maintenance, 2.85d.; plant and general maintenance, 0.62d.; and sampling and assaying, 4.45d.; a total of 1s. 5.18d. (about $0.35) for the whole operation.

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Metal Mine Accidents in 1915

There was a slight decrease in the number of men killed in the metal mines of the United States in 1915 as compared with 1914, according to the compilation of Albert H. Fay of the U. S. Bureau of Mines. The total number killed as reported to the Bureau of Mines by the operators was 553 in 1915, as compared with 559 in 1914, 683 in 1913, 661 in 1912, and 695 in 1911. The number of men reported employed, however, during 1915 was slightly less than the previous year, the numbers being 152,118 in 1915 as compared with 158,115 in 1914. The fatality rate, therefore, for 1915 was slightly higher than for the preceding year, being 3.64 per 1,000 men employed in 1915 as against 3.54 per 1,000 for 1914; 3.57 in 1913; 3.91 in 1912; and 4.19 for 1911.

The decrease in the number of employees is more apparent than real. In 1913 and 1914 the bureau collected accident and labor statistics from both mines and metallurgical works. These data were collected on separate forms so there is the possibility of including as mine employees many mill and smeltery men. In 1915, the same card contained forms for both mines and metallurgical works, and being filled out at the same time eliminated all possibility of duplication. The number employed at mines and metallurgical works for three years is shown in the accompanying table.

EMPLOYEES OF U. S. METAL-MINING INDUSTRY

Year	Mines	Mills	Smelteries	Total
1913	191,276	14,985	20,564	226,825
1914	158,115	15,128	27,879	201,122
1915	152,118	18,564	31,327	202,009

There were reported 35,295 nonfatal injuries for 1915, of which 35 were permanent-total disability; 574 permanent-partial disability; 7,242 other injuries of a temporary nature involving a loss of more than 14 days, and 27,444 minor injuries wherein the time lost was one to 14 days. The nonfatal injury rate per 1,000 men employed was 232 as compared with 191 for 1914. This increase is not necessarily significant of an increased hazard, but the real dangers are more nearly set forth by reason of better records at the mines and more complete reports to the bureau.

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Minerals Separation vs. Miami

In the suit of Minerals Separation, Ltd., against Miami Copper Co. in the United States District Court for Delaware, at Wilmington, a decree was signed by Judge Bradford, Oct. 5, 1916. The judge also signed an order staying the injunction on condition of the immediate filing of a bond for $250,000 and thereafter of monthly reports of the particulars of the Miami flotation operations, with leave to the plaintiff to move from time to time to increase the amount of the bond upon showing that the profits of the defendant from its infringing operations had exceeded the amount of the bond.

At the argument in open court Judge Bradford said that an infringer was to be treated as a trustee for the patent owner and that all the profits from the infringement were to be paid to the patent owner. In the discussion as to the amount of the bond, the defendant's counsel stated that three years ago the Butte & Superior company had stayed the issuance of a preliminary injunction against them in the suit of Minerals Separation, Ltd., by filing a bond for $75,000 and making monthly reports of its flotation operations. Plaintiff's counsel replied that these reports, filed in court from month to month, showed that the profits of the Butte & Superior company, due to flotation, were approximately $15,000,000 and therefore the bond was obviously inadequate. Judge Bradford then stated that of course a plaintiff can always move to increase the amount of a bond, and therefore he based the amount which he fixed in the case before him upon a rough estimate of a month's operations and gave leave to increase the amount from time to time, as previously noted.

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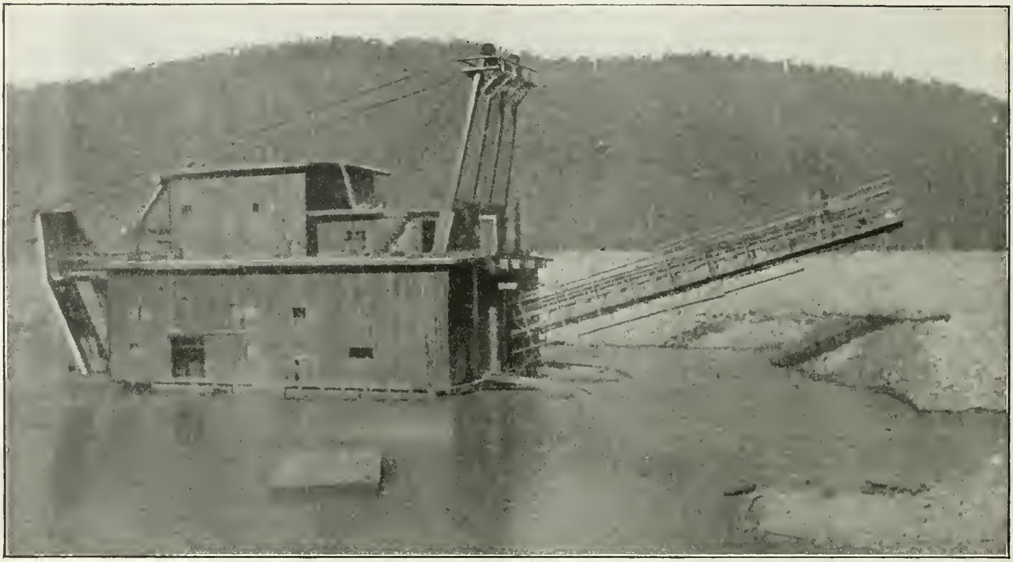
Broken Hill Proprietary Co., Broken Hill, N. S. W., Australia, for the half-year ended May 31, 1916, reports a working income of $4,885,487 from which other charges amounting to $2,950,276 are deducted, leaving $1,935,211 balance from which $573,969 in dividends were paid, leaving a balance of $1,562,604. There were 66,423 tons of ore raised from the mine. The crude-ore sections of the mills handled 56,820 tons of sulphide ore, producing 9,352 tons of lead concentrates, assaying 59.62% lead and 27.88 oz. silver per ton. The regrinding section dealt with 26,929 tons of tailings and produced 698 tons of lead concentrates assaying 53.10% lead and 28.38 oz. silver per ton. The zinc-flotation plant was closed down on Apr. 13 until a more regular market for its products could be obtained having treated 54,714 tons and produced 13,189 tons averaging 45.95% zinc, 12.8 oz. silver and 6.3% lead.

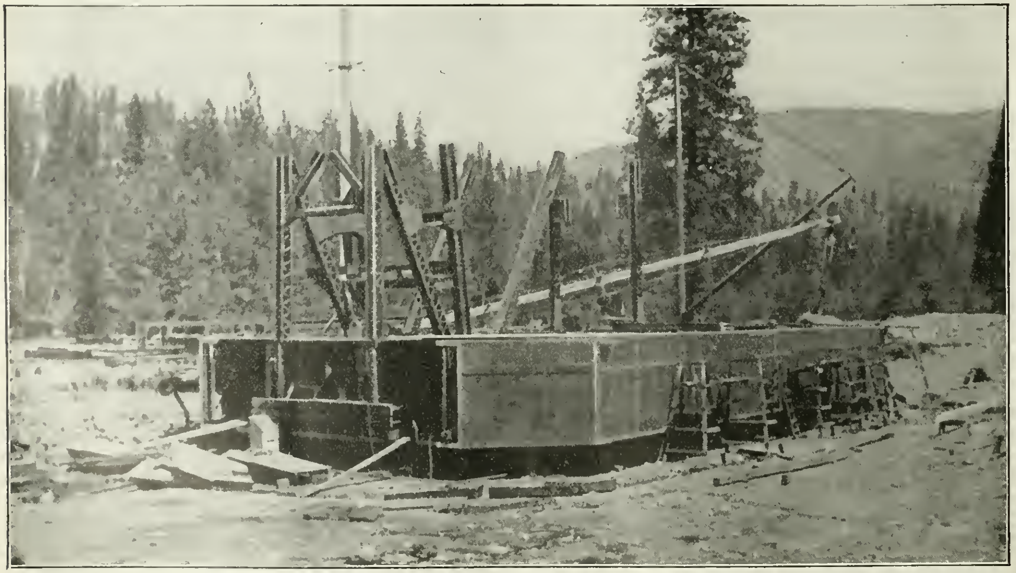
Due to the Christmas and Easter holidays and a strike for the 44-hr. week (which was subsequently granted) the mine was only worked 3½ months out of the 6.

At the Newcastle steel works the blast furnaces were in operation continuously giving an output of pig-iron of [illegible]974 tons. The rolling mills produced 36,862 tons of a varied product, consisting of blooms, billets, sheet steel, [illegible], fish-plates and joints and channels. The coke ovens [illegible]d 58,405 tons of coke, all of which was consumed in the blast furnace operations. As a byproduct, 615,581 [illegible] were produced and sold. The requirements [illegible] Australia warrant an increase in production and [illegible] way for an addition to the blast furnace [illegible] plants. The quarries produced 135,941 tons [illegible]

Photographs from the Field

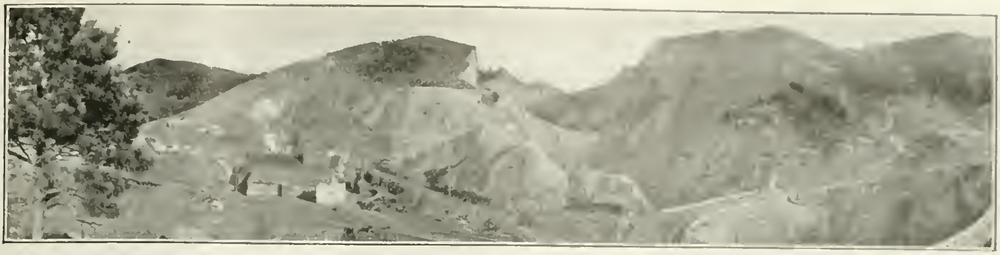


This small dredge of the Alta Bert Gold Dredging Co., near Trinity Center, Calif., has yielded some remarkable returns. The Alta Bert and other property in the vicinity have recently been purchased by the Estabrook interests of Boston and a modern steel dredge will probably be built

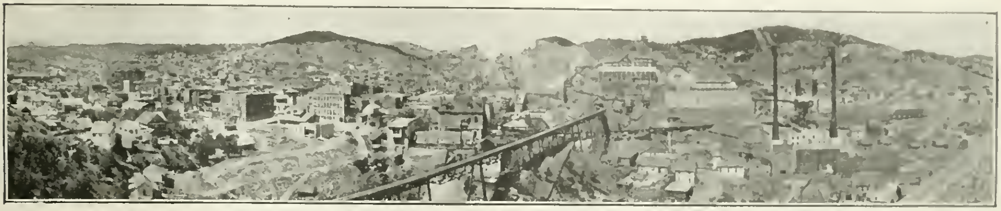


Hull of the new 9-cu.ft. all-steel dredge of the Pacific Gold Dredging Co., recently launched in Coffee Creek, Trinity County. This company is a subsidiary of the Yukon Gold Co.

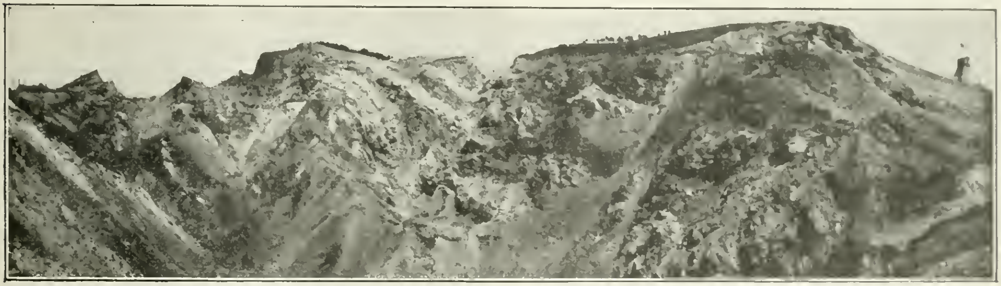
TRINITY COUNTY, CALIFORNIA, IS RECEIVING MORE ATTENTION FROM DREDGE OPERATORS



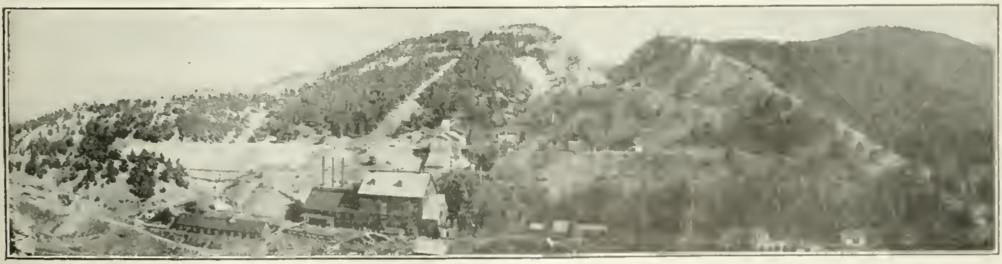
Homestake Mining Co.'s Terraville opencut, looking south



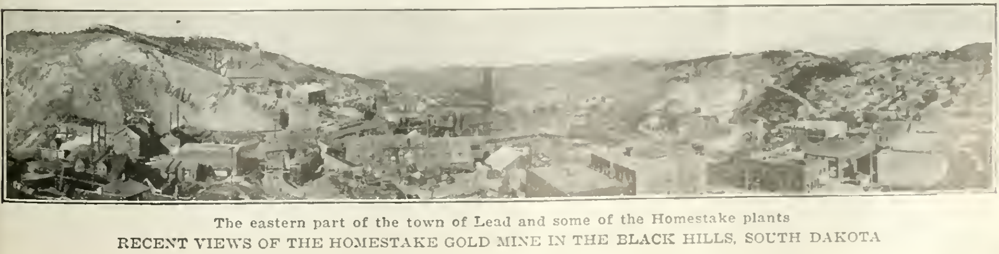
Homestake plants and central part of Lead, S. D. Taken from Ellison shaft



Homestake's opencut near Lead. B. & M. shaft at right; Highland shaft at left



Mineral Point 100-stamp mill and Father de Smet opencut in background



The eastern part of the town of Lead and some of the Homestake plants

RECENT VIEWS OF THE HOMESTAKE GOLD MINE IN THE BLACK HILLS, SOUTH DAKOTA

Correspondence and Discussion

Cerro de Pasco District, Peru

A good description of the Cerro de Pasco district, Peru, is so rare that when an article such as the one by Singewald and Miller[1] appears, it is of more than passing interest.

In 1904 I made an examination of the coal and copper properties of the Cerro de Pasco Mining Co., but was called back to report—as is too frequently the case—before I had really done much more than make a thorough reconnaissance. Upon my return I requested permission to publish some observations of scientific interest, but this was refused by the controlling interests. So much time has elapsed since then that I feel that I may now make a statement supplementary to the article referred to without violating professional ethics. I shall have to depend solely upon my memory, as my notebooks are not at this moment available.

The Cerro de Pasco copper deposits are due to the intrusion of a mass of rhyolite into a series of cretaceous sediments—limestone chiefly, so far as now known. The contact between the intrusive and the sediments is along a north-south fault, and it is due to this that the deposits immediately along the contact, as indicated by the open cuts, have such a marked north-south alignment. The formation of these deposits along the contact was accompanied by the usual contact products. Intense silicification of both the igneous and sedimentary rocks is the effect most noticeable at the surface. However, I believe that the sedimentaries have suffered more from the contact reactions than has the igneous rock.

These deposits along the contact were among the earliest exploited, and at the time of my examination the company's operations were chiefly confined to the vicinity of the old workings. However, replacement deposits occurred well out in the limestone to the east of the contact. The workings in a large deposit from a quarter to a half mile east of the contact had caved and buried a number of miners years previous to my visit and had not then been reopened. To the west of the contact in the intrusive rock mass occur the east-west vein deposits.

To make a comparison, I would say that the Cerro de Pasco district has its nearest analogue in the Bisbee district of Arizona. The Cerro de Pasco rhyolite corresponds to the intrusive of Sacramento Hill and the north-south fault corresponds to the Dividend fault of Bisbee. In both districts there is a marked silicified zone along the contact between the igneous rock and the sedimentaries. According to the present developments, the ore deposits in this zone are of much greater importance at Cerro de Pasco than at Bisbee. The two districts differ in a structural way in that the sediments of Cerro de Pasco dip in general to the east, away from the contact with the intrusive rock, whereas in Bisbee they dip in general toward the contact.

At the time of my visit the company had just got fairly started and, as the result of the lack of development, many things were puzzling which further work would have cleared up. I recall spending some time in a drift, studying the material in which it was driven for over a hundred feet long (as I remember it) and in which material it ended. The drift was not timbered. The material looked like a peculiar breccia. Finally, finding a cross-section of a small piece of old timber embedded in a wall, I decided that it must be old filling cemented, after a lapse of perhaps a hundred or more years, into quite a resistant mass.

It is to be hoped that someone will give us ere long the results of a comprehensive study of this interesting and important copper district. J. MORGAN CLEMENTS.

Chicago, Ill., Sept. 20, 1916.

Natural Gas Pipe Theory

Misther Editor—Fillin' me pipe with some av Tim's tobaccy, I sat down to study more about thim ixtralatheral rights av ile-drillers. Drowsy-like, I burnt me finger on a coupon-store match, an' whin I fell asleep at the nixt page, I was wishin' for an owld-time sulphur match. To h—— I wint afther it in me dream.

"What do ye want?" sez a 4th assistant deputy. "A bit av sulphur," sez I. "Have ye a card?" sez he. "I'm the pavin' conthractor," sez I (for manny's the raysolushun I've passed); "I'm studyin' the foundayshun." "Yes, sir; thank ye, sir," sez he, bowin' an' scrapin'; "this way, sir." An' with that he ushers me into a big room filled with rolls av asbestos an' sich like.

In a minute into the libr'y comes an owld man who greets me with a noncommittal smile, shakin' me hand with wan av his while he pats me wrist with the other. "Now, about that sulphur," sez he, "ye know we have plinty here." "So the preachers say," sez I, with a sickly grin. "Oh, thim!" sez he, lookin' a bit worried. "Ye mane the owld-fashioned kind. They're only ign'rant. But we won't argy the p'int. Will ye concede that there's plinty av FeS_2 hereabouts?" "'Tis indisputable," sez I, "bein' a primary ore or a kindergarten wan, as ye might say. Fool's gold, as some calls it." "The more fool thim, perhaps," sez he, "for 'tis the saycrit av much wealth in war times. An' will ye admit that there's some $CaCO_3$ above?" "I can't deny it," sez I. "An' how about H_2O?" he smiles. "I'll accipt that, with a grain av salt, more or less. Oceans av it, to be sure," sez I, gettin' a bit int'rested, but still ign'rant. "Yis, indade," sez he; "some NaCl, an' ye have all the reaygints. Now, do ye raycall that under great pressure ye sometimes do what ye wud not otherwise undertake?" "Well," sez I, "manny's the pressin' invitayshun I've had, an' me gran'mother was Scotch." "'Tis irrilivant," sez he. "What I ask ye is, will ye accipt pressure?" "If ye force it on me, I must," sez I, sweatin' a bit.

"Ah!" sez he. "An' ye notice how pressure makes heat. Pressure is another av thim saycrits av success.

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[1] "The Cerro de Pasco District, Peru," Joseph T. Singewald, Jr., and Benjamin Le Roy Miller, "Engineering and Mining Journal," Vol. 101, pp. 1015-18.

'Tis nawthin' but push an' persistence. Pull is imaginayshun.

Well, now, comin' back to sulphur. Many av the professor childern upstairs will tell ye that much av the sulphur was made from gypsum an' organic matter. Whin ye ask who made the gypsum, they tell ye that's in tomorry's lesson. Ye will notice that they're plumb wasteful av reaygints. Wan av thim blamed it on bacteria whin up ag'inst it for the inergy facthor.[1] Do ye know that FeS_2 + heat = $FeS + S$?" sez he, innocent-like. "Sure thing," sez I, jumpin' at the bait. "Howld on," sez he, raisin' his hand like a traffic cop. "Not until the pressure is rayduced. An' where wud it go, annyhow?" "I dunno," sez I, rubbin' me chin, "but 'tis ready to travel whin the road is open an' the 8-hr. bill's signed. I'm thinkin." "Did ye iver thravel far without a vehicle or else wan av thim f.o.b. Detroits?" sez he, raybukin' me an' continuin' to monopolize the conversayshun.

"Whin a crack happens, we fills it with what comes handy. If there's plinty av FeS_2 in the dope, some av the sulphur is loosened up ready to break away whin nice partners is near. If the crack ixtinds to wan av thim basins av salt wather, iverything that can goes into solushun. Heat an' pressure raises the sacherayshun p'int. Salt is a good loosener, an' as Huckleberry Finn sez, 'in a barrel av odds an' ends, things gets mixed up an' the juice kind av swaps around.' As the pressure varies a bit here an' there, so do the rayacshuns. I will give ye a few av thim an' ye can folly it up as ye like." An' with that he takes a bit av blue billy an' marks on a sheet av asbestos, like this:

$$FeS_2 = FeS + S$$
$$FeS_2 + H_2O = FeO + H_2S + S$$
$$H_2S + S = H_2S_2$$
$$3FeS_2 + 4H_2O = FeO + Fe_2O_3 + 4H_2S + 2S$$
$$4H_2S + 2S = 2H_2S_2 + 2H_2S$$
$$3FeS_2 + nH_2O + 3NaCl = NaCl.FeCl_2 + Na_2SO_3 + 4H_2S + FeS + FeO + (n\text{-}4)\ H_2O$$
$$CaCO_3 + H_2S + H_2O = CaSO_4 + CH_4$$
$$2CaCO_3 + H_2S + S + 2H_2O = 2CaSO_4 + C_2H_6$$
$$3CaCO_3 + H_2S + 2S + 3H_2O = 3CaSO_4 + C_3H_8$$
$$6CaCO_3 + 3H_2S_2 + 6H_2O = 6CaSO_4 + CH_4 + C_2H_6 + C_3H_8$$
$$CaCO_3 + H_2S_2 + H_2O = CaSO_4 + CH_4 + S$$

"The divil ye say," sez I, "'tis queer, but 'tis gud arithmetic. An' is that how ye make nacheral gas an' petrolyum?"

"Listen!" sez he. "In the first place I'm not what ye call me. I'm but the trustee av inergy for the Big Boss. In the sicond place, I'm not annything more than a dream ye're havin'. An' in the third place, yer pipe is out annyhow. But ye will often find some av thim things together, an' ye will hear all kinds av stories about thim bein' there. 'Tis like the egg an' the hen. Ye don't know which happened first, but if a hen cackles, ye should luk first to see if it's a rooster, an' if it is not, then ye shud have since enough to luk for an egg. Whin ye find sulphur, sometimes ye find gypsum an' sometimes ye don't. Whin ye find gypsum with or without sulphur, sometimes ye find nacheral gas, petrolyum an' sich like in some place that used to be uphill from thim. Whin ye find petrolyum there's some things ye always find close by. Go study it up whin ye're wide awake."

Jist then I wakes up with a joomp an' spills the hot coals av me pipe on the new parlor rug. "How long have I been asleep?" sez I. "About a minute or so," sez Kathleen, "but ye've been smokin' steady. I see in the evenin' paper that since somebody made a crack an' started to raise a little h——, the ile thrust announced that due to the increase in the supply av nacheral gas an' crude petrolyum the price av gasoline will drop until further orders."

"'Tis plausible," sez I. **Bill McGinty.**

Brooklyn, Oct. 16, 1916

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The Metric System

In the *Journal* of Apr. 15, 1916, there are two articles—one reprinted from the *American Machinist*—warning and protesting against the compulsory introduction of the metric system in the United States. Engineers abroad do not understand this point of view. The subject is not merely an internal American one, but one in which the whole civilized world is interested. It is really not gratifying for technical people—who are the pioneers of progress in the world—to see two great and influential technical journals like the *Engineering and Mining Journal* and the *American Machinist*, predestined to take the lead in helping energetically toward uniformity, rolling stones in the way of the men who are toiling for progress.

There are in this matter certainly lots of difficulties—also for technical journals—but one must not lose sight of the enormous advantages, which are so obvious that a great people like the American should earnestly try to overcome all obstacles. By introducing such a change it would of course be necessary to make regulations for at least 10 or 20 years as the time of transition. In trade and industries, within a period of 10 years, drawings and patterns surely become obsolete and need renewing. Well, this renewing may be done in the metric system as easily as in the present one.

Trading with all countries having the metric system is certainly to some extent handicapped because of the complicated American system of measures and weights. Perhaps also Americans are not aware of the difficulties foreigners have in studying the American technical and scientific literature, on account of the same impracticable system of measures.

May I be permitted to instance another point, even if not directly connected with the theme? Why are Americans always giving their metal production in pounds—generally seven or more figures—instead of in tons (no matter what kind of ton)? Certainly not because they are so fond of big figures, for if so, they would quote their huge production in ounces or drams. They do so because their fathers and grandfathers did so. Is it not strange that the people with the most important metallurgical industry of the world and so progressive in every respect should be so conservative in this matter?

In different parts of the British Empire we see also a "prometric-system movement," which is especially strong in India and South Africa. Once the British Empire has made the big change, America certainly will follow. I think it would be better for America to take the lead. Robert H[illegible]

Tsumeb, Southwest Africa, July 30, 1916.

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[1] Pantanelli, quoted in "Mineral Resources," 1910. Part II, p. 792.

Editorials

Quien Viva?

Since the days of Cortez the challenge in Mexico has been, "Who lives?" The priest Hidalgo, seeking to overthrow the Napoleonic rule, told his Indian followers that somebody or something lived, indicating to them by precept and example the well-known maxim, "The Lord helps those that help themselves." The Texans, both of *mestizo* extraction and Anglo-Saxon ancestry, endured for years the increasing tyranny imposed by the Dictator Santa Ana upon the land of their birth or adoption. Texans having resolved that Texas should live, Texas labored and brought forth itself—a lively infant which thrived for a decade, more or less, before adoption into the more congenial of the two neighboring families. While the children of the respective families have been making faces at one another over the back fence for the period ensuing since the said fence was built, some of the children have grown up to man-size in body and brain, while others remain childish.

The memorandum of facts and conditions submitted to the American members of the American-Mexican Commission, under date of Sept. 25, 1916, by the committee representing a conference of 45 companies is a calm and dignified presentation of evidence such as would receive scant consideration at a banquet presided over by one of the whilom companions of Alice in Wonderland. But the American-Mexican Commission, which has moved its headquarters from New London to the Hotel Traymore, in Atlantic City, N. J., should not be considered as a banquet or junket proposition, or even as anything so childish as the A B C of the nursery period—representing, rather, an algebraic exposition of the unknown quantities x, y and z, whose solution depends partly upon the equations submitted.

The companies represented in the conference are not owned by a small group of capitalists, as some childish or malicious folks are wont to allege, but are practically all stock corporations, the shares of which are widely distributed among many thousands of American citizens who cannot afford to lose the small savings and income which these shares represent. The total cash invested in the properties is $125,000,722. Plants were operated in 14 Mexican states, and in former times, such as in 1912 (under President Madero), there were 62,216 Mexicans employed, with the aggregate annual payroll of Mexicans and Americans amounting to $18,726,090 U. S. currency.

The total normal annual production of the 45 mines in question was: Copper, 74,984 tons of matte or bullion; zinc, 46,765 tons of ore; lead, 70,939 tons of bullion; silver, 31,892,735 oz.; gold, 252,843 oz. For the first six months of 1916 it is estimated that but 6,000 Mexicans were employed, the aggregate payroll amounted to $3,671,302, and the production of copper, zinc and lead, as above, was 23,156 tons, 11,183 tons and 2,928 tons respectively, and but 6,200,339 oz. of silver and 39,895 oz. of gold.

The memorandum is not presented as a demand for restitution of losses or for damages for injuries received, but to make clear the conditions necessary for industry to live. In brief, the American and Mexican mining and smelting interests concede the right of Mexicans to carry on their political affairs in their own fashion, provided that the rights of citizens of other countries are respected. This is in line with the rational philosophy of Herbert Spencer, which in principle teaches that true liberty is the right of the individual to enjoy himself to the limit in whatever way his fancy may dictate, provided that in so doing he does not infringe upon the rights of others. Unfortunately, the Spencerian system of deeds is not followed in a greater degree than is the Spencerian system of writing, irrespective of the number of pens employed. But organized society does not sanction offenders in this respect, and only the rational should be classed ultimately as among the elect. The inconsistent conduct of the de facto (*sic*) government and its inability or disinclination to protect lives and property are shown clearly and beyond cavil by a summary of conditions at different properties, dates being given and names omitted only to avoid being unduly offensive.

While the old legal rates of taxation on production were in themselves exacting, being based upon the gross value of the ore or bullion produced instead of the net product as is the practice generally in the United States, the new rates are regarded as grossly excessive and confiscatory. The new pertenencia tax introduces a rate per pertenencia, increasing in arithmetical progression with the number of claims held; being $2 per hectare on groups from one to 10 hectares, $4 each from 11 to 50, $6 each from 51 to 100, $8 each for groups containing more than 100 claim units. From 1891 to 1905 the rate was 10 pesos flat, and after 1905 it was 6 pesos each for the first 25 hectares and 3 pesos each for additional claims.

In a manner as concise as the wording of the Declaration of Independence, eight classes of decrees are cited and each class is described in brief and in particular. In conclusion, the benefits to humanity of a just and peaceful solution of the problem are touched upon, and it is suggested to the American members of the Mexican Commission that they seek to obtain from the Mexican members and through them from their government, positive and unequivocal assurances of the intention of that government in respect of American enterprises in Mexico, and an explicit understanding respecting future status and rights and obligations, and measures for enforcing them.

This manner of procedure is most commendable and could not be objected to by the proudest advocate of peace. Undoubtedly American character has taken on considerable refinement and punctilious regard for ethical niceties. In the rough-and-ready days when the boisterous volunteers of Scott and Taylor marched along singing "Green grows the grass and green grows the tree," the populace trembled as they whispered *"Ay,* *Dios mios, que ya vienen los gringos.*" Of late there has been a different intonation in the muttering of that once musical nickname.

Meanwhile, contemporaneous news items report various movements of General Villa and General Unrest. As we bow our heads in ignominious shame, let us consider what shall be our answer when challengd by the cry of "Quien Viva?"

Institute Membership

An announcement in the *Journal* to the effect that the American Institute of Mining Engineers had limited the increase of membership to five new members each month would cause a number of young mining engineers to wake up and protest. Such a move might be more or less beneficial, for the desire to do a thing is stimulated by prohibitive decrees.

A member of long standing recently expressed himself as greatly impressed with the value of the papers presented at the Arizona meeting; with the earnestness of the discussions; and, above all, with the value that young men obtain in the way of ideas and suggestions gained and new oportunities attained through meeting, on a basis of fellowship and equal footing (for the nonce at least if not for always), with the older and more experienced engineers. In spite of all the derision that has flavored discussions of dowsing-rod philosophy, there undoubtedly is such a thing as human magnetism; and the magnetic concentration of a modern Institute meeting is capable of producing results far more beneficial than may be imagined by an outsider. For the men who are unable to attend the big meetings, the different section gatherings at frequent intervals build up a fraternal conviviality and lead to an interchange of opinion that is not literally sectional.

There could be no more eloquent commentary on the advantages of Institute membership than a statement that many former members, who through ennui or penuriousness dropped out some years ago, have been so roused by an occasional peek through the fence that they marched proudly up to the gate and paid up all arrears so as to get in the game again.

Paying a National Debt

It is a habit with certain individuals who sometimes pose as mining experts to refer to the reserves of a mining district, or even of a single deposit, as being sufficient to pay off the national debt of this or that country. Usually the country specified is the one where the patter is to be used as a solvent to loosen up the cash of "tight-wads," since it is the latter class which hopes for big profits. The glamour of the phrase certainly appeals to the imagination, and a mining man without imagination is an ordinary plodder. By stimulating the imagination, a mental picture may be built up in pyramidal form, with silver bullion topping copper ingots and surmounted in turn by smaller but more attractive gold bricks.

But there is another kind of national debt which cannot properly be measured by any monetary standard. Each nation has a debt of honor and of respect always due and always payable to other nations and a debt of self-respect and protection to its own components. Although a monetary national debt may be, and usually is, refunded and increased or even at times successfully repudiated, the moral debt must constantly be paid or the nation ceases to exist. In some instances the moral debt of one nation to another may be converted to a monetary equivalent or substitute, with or without the accompaniment of force in the process of collection. But the entire fabled pavement of hell, figuratively conceived as a mineral deposit, would not suffice to pay the moral debt of a nation untrue to itself.

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Probably there was never before in the history of copper such a situation as exists at present—a situation wherein the supply that refiners expect to make during the next three months is all but completely sold out and belated consumers must pay high premiums for the relatively trifling quantity of copper for prompt delivery that is available from second hands. This situation is strongly reminiscent of what existed in spelter in 1915. In both cases the causes were the same; that is, deficiency in manufacturing (smelting or refining) capacity in the face of a plethora of raw material. The tension in zinc was relieved by swiftly providing more smelting capacity, which it was possible to do. Copper refining, on the other hand, requires larger and more complicated machinery and there is great delay in getting it, wherefore increase in production is not coming along so rapidly. But of course the solution of the problem in copper, as it was in zinc, is only a question of time. Similarly in the matter of aluminum, wherein there is perhaps the greatest stringency of all the metals.

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The scarcity and consequently the steeply increasing cost of news print paper is one of the serious questions of the day, but the Federal Trade Commission in a circular letter to publishers advising a cutting down of the size of Sunday newspapers makes a strange remark when it says that it "feels the elimination of certain features would meet with public approval and would not decrease the revenues of the publishers." It has been the theory heretofore that the producers of Sunday supplements, etc., were catering to a public demand. Why should they at great expense try to cram down the public throat something that the public does not want? Has it all been a mistake? Let the Federal Trade Commission explain itself. Some of us who have been looking vainly for a Sunday paper without the slush and comics will have great pleasure in witnessing an unraveling of this matter.

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It must be just as painful to a war-bride to be deserted at the altar as it is to one from whom the metaphor is borrowed, but this seems to be what has happened to the Tennessee Copper Co., which is undergoing a species of reconstruction involving the provision of a large amount of new capital. The Tennessee Copper Co. had contracted its production of sulphuric acid to another company for a term of years before the war began, and the benefits that were going to accrue to it were never so great as was intimated at one time when its shares were a center of attention in the stock market, but nevertheless, the enhanced value of copper ought to have made things easy for the company. Apparently the management of this company is now going to return to Adolph Lewisohn and his able coadjutors, who conducted its affairs so successfully during an earlier period.

BY THE WAY

Members of the A. I. M. E. trip were much interested while in Bisbee in the mining of the old Copper Queen slag dumps for resmelting at Douglas. Doctor Douglas is quoted as saying: "We never used to make a slag over 1 or 2% copper, but we are mining it now and getting 3% out of it."

*

Arizona of course is dry, but a learned judge has ruled that the law permits anyone to import any amount for personal consumption. The division superintendent of the railroad at Douglas is said to have come into his office one morning and asked his clerk: "William, how many cars of 'personal consumption' came in last night?"

*

The estate of Herman A. Frasch, president of the Union Sulphur Co., who died in 1914, has been reappraised for taxation with the result that its value is now put at over $10,000,000, or more than three times the first valuation. The chief change is in the price set on 505 shares of Union Sulphur stock which formed a large part of the assets. The official appraiser now puts this stock at $12,003 per share and claims that this is fully justified by the assets of the company and its present financial position. This is away ahead of any of the "war stocks."

*

American exports have finally passed the half-billion a month mark. Statistics issued recently by the Bureau of Foreign and Domestic Commerce, of the Department of Commerce, show that the exports for August amounted to $510,000,000, which is not only the record for this country, but for all countries. It is $35,000,000 higher than the previous high record, which was established in May, and $45,000,000 higher than the June total. Imports, on the other hand, showed a decrease for August, the total being $199,247,391. This is a decline of $47,000,000 as compared with June, the record month. It is greater than the total for any previous August, however. The exports for the year ended with August totaled $4,750,000,000 and the imports $2,300,000,000, both totals being far in advance of those for any similar period.

*

Anybody has a right to change his mind. Consistency is no virtue. Indeed, change of mind is an evidence of the intelligence that acquires new knowledge. The changes of President Wilson, however, are rather startling, judging from extracts dug up by the *Boston News Bureau*, as follows:

Extract from a baccalaureate sermon of June 13, 1909, by Prof. Woodrow Wilson.

> You know what the usual standard of the employee is in our day. It is to give as little as he may for his wages. Labor is standardized by the trade union, and this is the standard to which it is meant to conform. No one is suffered to do more than the average workman can do. In some trades and handicrafts no one is suffered to do more than the least skillful of his fellows can do within the hours alloted to a day's labor, and no one can work out of hours at all or volunteer anything beyond the minimum.
>
> I need not point out how economically disastrous such a regulation of labor is. It is so unprofitable to the employer that in some trades it will presently not be worth his while to attempt anything at all. He had better stop altogether than operate at an inevitable and invariable loss The labor of America is rapidly becoming unprofitable under its present regulation by those who have determined to reduce it to a minimum. Our economic supremacy may be lost, because the country grows more and more full of unprofitable servants.

Extract from a letter of Woodrow Wilson, dated Jan. 12, 1909, in reply to an invitation to speak at a banquet of anti-strike and anti-boycott advocates:

> I am a fierce partisan of the open shop and of everything that makes for individual liberty, and I should like to contribute anything that it might be possible for me to contribute to the clarification of thinking and the formation of right purposes in matters of this kind.

At a dinner in the Waldorf Hotel on Mar. 18, 1907, Dr. Woodrow Wilson spoke as follows:

> We speak too exclusively of the capitalistic class. There is another as formidable an enemy to equality and freedom of opportunity as it is, and that is the class formed by the labor organizations and leaders of the country.

The foregoing remarks expounded some good economics and sound sociology, which are quite different from the ideas unfolded in the address that thrust the eight-hour law down the throat of Congress.

*

Much valuable information may be gained from the columns of the daily newspapers. Particularly as regards subjects of interest to mining people, the information may be whatever is desired, and one's own estimate of value may be placed upon it. A New York daily gives us the following information, on successive days, about the tax on mines in Mexico:

> Mexico City, Sept. 22—The mining decree, providing that mining properties which are not worked for two consecutive months in each year shall be forfeited, is not aimed at owners of mining properties that cannot be worked because of natural difficulties or disturbed conditions, the Department of Fomento (treasury) explained to a representative of the Associated Press, but is directed at holders of large mining tracts making no efforts to develop them.
>
> Mexico City, Sept. 23—The Treasury Department last night issued a circular in answer to the appeals of individual mine owners for the remission of taxes on mining property. The circular declares that the titles given are in the nature of a lease of subsoil from the government, which is the sole owner of the land. The leases do not give absolute ownership, but only the right to exploitation. As long as persons hold titles they must perform their part of the contract by paying taxes, says the circular, whether or not the titleholder is in possession of the property or able to work it.

*

The late Robert S. Towne was a metallurgist, smelter and operator to whose accomplishments the writers of his obituary notices gave rather inadequate recognition. After a comparatively short time in the mining camps of Colorado, he became ore buyer and assayer for the Kansas City Smelting and Refining Co. at El Paso in 1886. The Sierra Mojada mining camp was then in its prime, and he established ore-buying agencies and finally organized the Mexican Ore Co. The heavy receipts of ore from Mexico resulted in building the El Paso Smelting Works by the controlling interests in the Kansas City Smelting and Refining Co.—August R. Meyer, Nathaniel Witherell and Mr. Towne. Meyer and Witherell at that time controlled the Kansas City company and the Arkansas Valley Smelting Co. Later the Mexican Ore Co. was consolidated with the three smelting plants and the name was changed to the Consolidated Kansas City Smelting and Refining Co. In those days all the ore from the Sierra Mojada was hauled by mule teams 70 mi. to Escalon; in 1890 Meyer, Witherell and Towne built the Mexican Northern Railway. In 1894 Mr. Towne organized the Cia. Metallurgica Mexicana and built his smelting plant at San Luis Potosi. When the American Smelting and Refining Co. was formed in 1899, he disposed of his holdings in the Consolidated Kansas City Smelting and Refining Co. and from that time on devoted himself to the smelting business at San Luis Potosi, to the Mexican Northern Ry., to the building of the Teziutlan plant of the Teziutlan Copper Co. and to various mining ventures, including the old Sombrerete mine, in Zacatecas and the Montezuma mines in Santa Barbara.

New Publications

Copper, from the Ore to the Metal. By Hugh K. Picard. 4½x7, pp. 130, illus.; 85c. Isaac Pitman & Sons, New York.

Transvaal Chamber of Mines. Annual Report for 1915. 7¼x9½, pp. 300. Transvaal Chamber of Mines, Johannesburg.

Technology of Marble Quarrying. By Oliver Bowles. Pp. 174, illus. Bull. 106, U. S. Bureau of Mines, Washington.

The Physico-Chemical Properties of Steel. By C. A. Edwards. 6¼x8¾, pp. 229, illus. J. B. Lippincott Co., Philadelphia, Penn.

Chisana-White River District, Alaska. By Stephen R. Capps. Pp. 130, illus. Bull. 630, U. S. Geological Survey, Washington.

Bibliography of North American Geology for 1915, with Subject Index. By John M. Nickles. Pp. 144. Bull. 645, U. S. Geological Survey, Washington.

Transactions of the American Institute of Metals. Vol. IX. Edited by Charles Vickers. 5½x9, pp. 423, illus. American Institute of Metals, Buffalo, N. Y.

Journal of the Iron and Steel Institute, Vol. XCIII, No. 1, 1916. Edited by George C. Lloyd, Secretary. 5¼x8¼, pp. 440, illus. Iron and Steel Institute, London.

Administrative Report of the State Geologist of Virginia for 1914 and 1915. By Thomas L. Watson. Pp. 45, illus. Virginia Geological Survey, Charlottesville, Va.

Elements of Mineralogy. By Frank Rutley. Revised by H. H. Read, with introduction by G. T. Holloway. 4½x7, pp. 394, illus.; $1.25. D. Van Nostrand Co., New York.

Upper Ordovician Formations in Ontario and Quebec. By A. F. Foerste. Pp. 279, illus. Memoir 83, Canada Department of Mines, Geological Survey Branch, Ottawa.

Investigation of the Peat Bogs and Peat Industry of Canada, 1913-14. By Aleph Anrep. Pp. 185, illus. Bull. 11, Canada Department of Mines, Mines Branch, Ottawa.

Mining Operations for Gold, Coal, Etc., in the Province of British Columbia, 1915. Annual Report of the Minister of Mines. Pp. 473, illus. Minister of Mines Office, Victoria, B. C.

Land and Marine Diesel Engines. By Giorgio Supino. Translated by A. G. Bremner and James Richardson. 6x8¾, pp. 309, illus. Charles Griffin & Co., Ltd., London, England.

Contents and Index of the Memoirs of the Geological Survey of India, 1884 to 1911. Vols. XXI-XXXV. By G. de P. Cotter. 6¾x9½, pp. 119. Geological Survey of India, Calcutta.

Official Index to State Legislation. A Cumulative Numerical and Subject Index and a Complete Record of all Bills Introduced in All State Legislatures. 8¼x11, buckram. Law Reporting Co., New York.

A Textbook of Practical Hydraulics. For the Use of Mining Schools, Technical Colleges, County and Hydraulic Engineers. By James Park. 5x7½, pp. 284, illus. J. B. Lippincott Co. Philadelphia.

Petroleum Withdrawals and Restorations Affecting the Public Domain. By Max W. Ball. Compilation by Lucetta W. Stockbridge. Pp. 427, illus. Bull. 623, U. S. Geological Survey, Washington.

Report on Mining Operations in the Province of Quebec During 1915. By Crawford Lindsay and J. A. Bancroft. Pp. 146, illus. Department of Colonization, Mines and Fisheries, Quebec, Canada.

American Fertilizer Handbook, 1916. The Standard Reference Book and Directory of the Commercial Fertilizer Industry and Allied Trades. 7½x10½, pp. 368; $1. Ware Bros. Co., Philadelphia, Penn.

Underground and Surface Water Supplies of Wisconsin. By Samuel Weidman and Alfred R. Schultz. 6½x9½, pp. 664, illus. Bull. XXXV, Wisconsin Geological and Natural History Survey, Madison, Wis.

Coal Miners' Pocketbook. Formerly the Coal and Metal Miners' Pocketbook. Principles, Rules, Formulas and Tables. Eleventh edition, revised and enlarged. 4x6¾, pp. 1172, illus., leather; $4. McGraw-Hill Book Co., New York

Harper's Hydraulic Tables for the Flow of Water in Circular Pipes Under Pressure, Timber Flumes, Open Channels and Egg-Shaped Conduits. By Joseph H. Harper, 4x6¾, pp. 192, illus.; leather; $2. D. Van Nostrand Co., New York.

Annual Report of the Under Secretary for Mines of Queensland, Including the Reports of the Wardens, Inspectors of Mines, Government Geologists and Other Officers, for 1915. Pp. 220, illus. Queensland Department of Mines, Brisbane.

Hydraulic Flow Reviewed. A Book of Reference of Standard Experiments on Pipes, Channels, Notches, Weirs and Circular Orifices, Together with New Formulas Relating Thereto. By Alfred A. Barnes, 6x9½, pp. 158, illus. Spon & Chamberlain, New York.

Report of the Selby Smelter Commission. By J. A. Holmes, Edward C Franklin and Ralph A Gould. Pp. 528, illus. Bull. 98, U S. Bureau of Mines. Supplied by the Superintendent of Documents, Government Printing Office, Washington, D. C., at $1.25 a copy.

Zircon, Monazite and Other Minerals Used in the Production of Chemical Compounds Employed in the Manufacture of Lighting Apparatus. By Joseph Hyde Pratt. Pp. 120, illus. Bull. 25, North Carolina Geological and Economic Survey, Chapel Hill, N C.

Annual Report of the Bureau of Mines, Mining and Mine Inspection of the State of Missouri, 1915. Pp. 182. Bureau of Mines, Mining and Mine Inspection, Mo.

Gives interesting data on accidents, mineral production, lists of mines inspected, etc.

Transactions of the International Engineering Congress, 1915. Mining Engineering. Pp. 371, illus. International Engineering Congress, San Francisco, Calif.

Gives the papers on mining presented at the Congress, which was held in San Francisco, Sept. 20-25, 1915.

Transactions of the International Engineering Congress, 1915. Metallurgy. Pp. 498, illus. International Engineering Congress, San Francisco, Calif.

Gives the papers on metallurgy presented at the Congress, which was held in San Francisco, Sept. 20-25, 1915.

Microscopical Determination of the Opaque Minerals. An Aid to the Study of Ores. By Joseph Murdoch. 6x9, pp. 165, illus.; $2. John Wiley & Sons, New York.

The application of the principles and methods of metallography to the study and identification of ores is of use to geologists and mining engineers. This book was commented upon editorially in the "Journal" of June 17, 1916, on page 1084.

Leather Belting. By Robert Thurston Kent. 6x9. pp. 200; $1.50. John Wiley & Sons, New York.

Aside from some typographical errors and occasional carelessness in writing, this book is a good compilation of belting theory as laid down by Taylor and Barth. It is doubtful if the book will appeal to the practical man, however. The treated slack-running belt is completely ignored. The contention throughout is that a certain rather high initial tension is necessary to produce best results, contrary to the recommendations of many experienced belt men. Owing to the present high cost of leather and the successful adoption of substitute belts such as cotton, canvas, rubber, camel hair, etc., space should have been devoted to such belts also despite the title.

Poor's Manual of Industrials for 1916. Seventh Annual Number. 6x9, pp. cliii + 3,112; $7.50. Poor's Manual Co., New York.

The regular annual volume of this well-known manual follows the general arrangement of the preceding issue and gives the latest income account and balance sheets of industrial companies including the large mining companies. It is impossible to say how many pages are devoted to the latter, as they are not given in a separate section. However, the present issue contains about 250 more pages than the 1915 volume, and probably about 500 pages are taken up with strictly mining companies. The general statistical information, which is revised to Aug. 15, is in most cases presented in comparative form, showing at a glance the growth of the business.

Fatigue Study: A First Step in Motion Study. By Frank B. and Lillian M. Gilbreth. 5x8, pp. 168, illus., $1.50. Sturgis & Walton Co., New York.

This book is supplementary to, or rather we should say introductory to, the motion study, which is the basis of the Taylor and Gilbreth system of scientific management. To secure the greatest economy in motion, which is the object of that system, we should first find out how the greatest fatigue is produced and the methods by which that fatigue can be lessened and its effects mitigated. To secure this, a fatigue survey is necessary, and this book describes how it should be done, how much fatigue could be eliminated and how it can be in part counteracted or alleviated. To those who are interested in this scientific-management system, this is a necessary part of the course and will be read with much interest.

Salt in Cheshire. By Albert F Calvert. 5½x8½, pp. 1232, illus.; $6.50. Spon & Chamberlain, New York, N. Y.

This elaborate volume claims to be the first connected and full account of the salt deposits of Cheshire, the most important in Great Britain; and we believe the claim is just. The immediate cause of its preparation at this time seems to have been the complex litigation and the appeals to Parliament for legislation, resulting from the surface disturbances and subsidences that have followed the exploitation of the salt deposits for centuries. Salt was made in [illegible] far back as the year 700 A.D., though it has been only within the past two centuries—and chiefly within [illegible] years—that the lower strata have been worked on a scale extensive enough to produce the surface disturbances

The book gives a general account of the geology of the district, the nature, composition and chemistry of the salt deposits and the methods of working them. It then goes at considerable length into the history of the operations and the past and present conditions of the trade The various companies and associations that have been concerned in the exploitation of the salt and especially the present Salt Union are considered at length, with the legislation affecting the district from time to time The historical sections include reprints of many old documents and tables of statistics.

It is seldom that so elaborate and complete a work has been compiled in relation to a single district. It is doubtless of great value to those directly connected with the industry. Geologically and historically it leaves nothing to be desired Only a part of it, however, can be considered of general interest.

Traité Géneral de Commerce des Minerais et Métaux, Combustibles, Alliages. Engrais, Etc. By R Pitaval and L. Ganet 6x9½, pp. 1,111, illus., 35 francs. R. Pitaval, Paris.

This volume is, as its name indicates, a general treatise on the production and uses of minerals and metals in common use and also of the rarer elements which are occasionally employed in the making of alloys and for other useful purposes. It is in short, a volume made somewhat on the plan of "The Mineral Industry" and is intended for commercial as well as for technical use The different chapters, each on one metal or mineral, give: (1) The production in different countries with notes showing the growth and evolution of that production. (2) The qualities and varieties of the substance under treatment, showing the different products sent to the markets, analyses, effects of impurities upon marketable value and the limits to the exploitation of the mineral. (3) The methods of sale in use in different countries with practical examples. (4) The markets for export and use in countries other than those of production. (5) Quotations and tables of the course of prices, past and present. (6) Uses and outlets for the product

A supplementary chapter gives much useful information as to freights, facilities for carriage and delivery and the trade in different countries. The volume is introduced by a preface written by M. D. Levat, the eminent engineer and author of a valuable work on the gold-mining industry He lays especial stress on the importance of the chapter on freights and transportation, which affect so strongly the markets in different parts of the world. Of course, final judgment on a volume like this can be passed only after continued use in practice, but so far as we have been able to examine it, the different articles are well and carefully written and the facts with regards to production, qualities, etc., are carefully and clearly arranged

Boston Creek Gold Area and Goodfish Lake Gold Area. By A. G. Burrows and P. E. Hopkins Pp. 21, with maps. Bulletin No. 29, Ontario Bureau of Mines, Toronto.

These areas have lately received considerable attention, and development has made some progress. The Boston Creek area is situated about 45 mi. northwesterly from Cobalt and is traversed by the Temiskaming & Northern Ontario Ry The area in general has an elevation varying from 700 to 1,050 ft. above sea level, and the country is somewhat rugged and broken. The Keewatin rocks have the widest distribution and contain gold-bearing veins. They consist chiefly of greenstones with some volcanic fragmental rocks and iron formation. Gold occurs usually native, but occasionally combined with tellurium, in quartz veins and veinlets in the Keewatin greenstone and later intrusions of granite and porphyry. The geology and mineralogy is in a general way similar to that of the adjoining Swastika, Kirkland Lake and Larder Lake areas, and gold is known to be widely distributed throughout the area. No bullion has as yet been shipped. Prospecting is aided by the excellent transportation facilities.

Goodfish Lake, 1 025 ft. above sea level, is situated 2 mi. northeast of Kirkland Lake in the Larder Lake mining division. A wagon road 9 mi. in length connects it with Swastika, a station on the Temiskaming & Northern Ontario Ry. Considerable prospecting was done during 1915, but when the report was written no work was in progress except at the La Belle Kirkland mine. The Keewatin is the oldest and most dominant of the rocks, consisting of lavas and altered diabases in about equal volume. Cutting these older rocks are dikes, stocks and flow-like masses of granite porphyry Gold occurs in narrow quartz veins and replacement deposits along the contact of porphyry with other rocks. The veins or stringers are generally [illegible] less in thickness, but there may be a series of them forming a lode deposit. Often two or three parallel slip planes coated with quartz and a thin film of molybdenite may form the orebody. Visible gold in a state of fine division occurs in many parts of the area The cessation of work by many properties would suggest that many of the deposits are low-grade.

Personals

W. E. Dunkle has gone to Seattle, Wash., from Alaska.

J. C. Fuller, recently in Cuba, has returned to New York.

R. Gilman Brown recently returned to London from Russia.

R. B. Brinsmade, recently in St. Louis, has gone to Pueblo, Mexico.

J. A. Martin, recently at Santa Rita, N. M., is now at Latouche, Alaska.

J. Edward Berg is manager of the Pueblo mine, in Whitehorse copper camp, Southern Yukon.

H. A. Prosser, of New York, and **Hugh Wright**, of Spokane, Wash., are now in Valparaiso, Chile.

J. Frater Taylor was elected president of the Lake Superior Corporation at the recent annual meeting.

Edwin E. Chase and son will be in the Granby District of British Columbia until the end of October.

Harold C. E. Spence has returned to Montreal, Canada, after three months spent in Newfoundland and Labrador.

E. W. Shaw, petroleum specialist of the Geological Survey, has returned from a business visit to the Tampico region of Mexico.

Mr. and Mrs. Willard S. Morse are now at Chuquicamata, Chile; Mr. Morse is connected with the Chile Exploration Co.

E. O. Ulrich, paleontologist with the U. S. Geological Survey, has returned from four months' field work in Illinois and New York.

John Hulst, former chief engineer of the Carnegie Steel Co., has succeeded M. A. Neeland as chief engineer of the Steel Corporation.

William P. Barba for 36 years with the Midvale Steel Works in various capacities has resigned his position as vice-president.

Fred D. Smith, of Ithaca, N. Y., has taken charge of the leasing and shipping operations on the Arkansaw mine at Landore, Idaho.

Walter Douglas and **James French**, of the Phelps, Dodge company, visited and inspected the mines and mills of the Detroit Copper Co. recently.

D. Foster Hewett, of the U. S. Geological Survey, writes from Peru that he has completed an examination of the vanadium mines at Minasragras.

Dr. R. C. Wallace, of the University of Manitoba, has returned from an inspection of the eastern portion of Manitoba for the Canadian Geological Survey.

W. M. Brewer has returned to Victoria, B. C., from the investigation of various mining properties on Vancouver Island on behalf of the British Columbia Department of Mines.

J. F. McKenzie, of the International Molybdenum Co., Renfrew, Ont., has been examining the Molly molybdenite mine, on Lost Creek, Nelson mining division, British Columbia.

Carl H. Beal, a graduate of Stanford University, has joined the petroleum force of the Bureau of Mines. Mr. Beal has been doing technical work in Oklahoma for the past two years.

E. E. Slick, general manager of the Cambria Steel Co. has been chosen a vice-president of the Midvale Steel and Ordnance Co., and will have charge of the operation of the various works.

M. A. Neeland, assistant to the vice-president and chief engineer of the United States Steel Corporation, has resigned to become consulting engineer of the American International Corporation.

Prof. James F. Kemp, head of the department of geology of Columbia University, has much improved in health. The trustees of the university have, however, granted him a further leave of absence for one year.

John Johnston, who has been connected with the Geophysical Laboratory of the Carnegie Institute, has resigned to accept a position on the technical staff of the American Zinc, Lead and Smelting Co., in the Joplin district.

H. D. McCaskey, chief of the mineral resource division of the Geological Survey, is on a trip of inspection and investigation on the Pacific coast. He will investigate several of the quicksilver deposits in that portion of the country.

W. M. Archibald, head engineer for the Consolidated Mining & Smelting Co., of Canada is to have charge of development on the Old Sport and Merry Widow groups in the Quatsino district, Vancouver, Island. These properties were recently secured by the Coast Copper Co.

The Arizona Delegates to the American Mining Congress, as appointed by the governor, are C. E. Addams, Ray; C. E. Mills, Miami; Capt. John C. Greenway, Warren; B. Britton Gottsberger, Miami; P. G. Beckett, Globe; J. W. Bennie, Clifton; Edward R. Oliver, Payson; John D. Burgess, Tucson; Van H. Brooks, Casa Grande.

H. H. Johnstone, for some years head underground boss in the Consolidated Mining and Smelting Co.'s Center Star-War Eagle group of mines at Rossland, B. C., after having for the last three months been acting district inspector of mines during the absence on sick leave of Inspector Jas. McGregor, has been added to the permanent mine-inspection staff of the British Columbia Department of Mines.

Edwin Higgins, having severed official connection with the U. S. Bureau of Mines, and the California Industrial Accident Commission, by resignation effective Nov. 1, announces his association with a number of California Mining companies and the California Metal Producers' Association as consulting safety and efficiency engineer. His permanent address is the Merchants National Bank Bldg., San Francisco.

A. C. Garde, formerly manager of the Payne mine, in Slocan district of British Columbia, and for several recent years having his headquarters at Prince Rupert, the western terminus of the Grand Trunk Pacific, left the latter place on Sept. 5 for Smithers, in Omineca division and near the railway, to take charge of the development of a mining property on which the occurrence of silver-lead and antimony ore has been reported.

Societies

Colorado Scientific Society held its first meeting of the new year in Denver, Oct. 7, and discussed the abolition of the apex law and extralateral rights. Speaking affirmatively for this end were George E. Collins, E. C. Stimson and Henry May, while the chief opponent in the debate was George Manley, dean of the law school of Denver University. The affirmative appeared to win, although this was not conducted as a set debate.

Franklin Institute, Philadelphia, has arranged a program of lectures for the winter of 1916-17, included in which are the following:

Oct. 18, 1916—"Scientific Research in Relation to the Industries," by Charles P. Steinmetz.

Dec. 14, 1916—"The Cooling of Water for Power Plant Purposes," by C C. Thomas.

Feb. 1, 1917—"The By-Product Coking Industry," by C. J. Ramshurg.

March 1, 1917—"Development and Progress in Aviation Motors," by Henry Souther.

March 15, 1917—"Design, Construction and Equipment of a Modern Military Aeroplane," by Jerome C. Hunsaker.

American Electrochemical Society—The 30th general meeting of the American Electrochemical Society was held in New York from Sept. 27 to 30, inclusive. The program included the following papers: "Atmospheric Corrosion of Commercial Sheet Iron," by E. A. and L. T. Richardson; "The Electrolytic Recovery of Lead from Brine Leaches" by O. C. Ralston and C. E. Sims; "Electrolytic Zinc Dust," by H. J. Morgan and O. C. Ralston; "Electrolysis of Vanadium Salts," by S. Fischer; "High Temperature Heat Developed during Electrolysis," by Carl Hering; and "The Possibilities of Developing Super-refractory Materials for Incandescent Lighting," by F. A. Fahrenwald. The social side of the convention was not forgotten, provision being made for amusement and shopping tours for the wives of the visiting chemists. A smoker for the men was held, attended by 800 to 900 chemists and a scenic trip up the Hudson on Sept. 30 concluded the meeting.

American Iron and Steel Institute—The eleventh general meeting will be held at the Planters' Hotel, St. Louis, Oct. 27 and 28. Friday will be devoted, as usual, to the reading and discussion of papers. The banquet will be held on Friday evening at the Club House of the Missouri Athletic Association, not far from the Planters'. The Local Committee is preparing an attractive program for "Seeing St. Louis" on Saturday. The following is a tentative list of the papers and addresses:

President's Address, by Elbert H. Gary.

"St. Louis and Its Industries," by Clarence H. Howard, St. Louis.

"The Duplex Process," by George B. Waterhouse, Buffalo, N. Y.

"Pulverized Coal as a Fuel for Metallurgical Furnaces," by James W. Fuller, Allentown, Penn.

"The Iron Ores of the Adirondack Region," by Frank S. Witherbee, New York.

"Progress in Hot Blast Stove Design," by Arthur J. Boynton, Lorain, Ohio.

Industrial News

George A. Muir has recently been made manager of the mining machinery department of the Mine & Smelter Supply Co. with headquarters in Denver.

P. H. Reardon has severed his connection with the General Machinery and Supply Co., San Francisco, Calif., having disposed of his interest to his associates. Joseph A. Buckley succeeds Mr. Reardon as president, A. L. Green is vice-president and H. F. Jurs, manager.

McFarlane-Eggers Machinery Co. has been organized with headquarters at 28th and Blake St., Denver, Colo. The company has taken over the business of Peter McFarlane & Sons Iron Works, and will manufacture a general line of mining machinery. Henry Eggers, formerly manager of the mining-machinery department of the Mine and Smelter Supply Co., is president, and Frederick McFarlane is secretary and treasurer.

New Patents

United States patent specifications listed below may be obtained from "The Engineering and Mining Journal" at 25c. each. British patents are supplied at 40c. each.

CLASSIFIER and Dewaterer. Walker J. Boudwin, Salt Lake City, Utah, assignor to the General Engineering Co., Salt Lake City, Utah. (U. S. No. 1,201,014, Oct. 10, 1916.)

HOIST—Electrically Operated Hoist. Fred L. Stone, Schenectady, N. Y., assignor to General Electric Co. (U. S. No. 1,200,264; Oct. 3, 1916.)

HOISTING and Conveying Means. Merian H. Dickinson, Seattle, Wash., assignor to Lidgerwood Manufacturing Co., New York, N. Y. (U. S. No. 1,200,712; Oct. 10, 1916.)

LEACHING—Apparatus for Extracting Metals From Their Ores. John C. Greenway, Warren, Ariz. (U. S. No. 1,200,832; Oct. 10, 1916.)

LEACHING — Process of Recovering Copper From Solution. George A. Schroter, Denver, Colo., and William C. Laughlin, Nogales, Ariz. (U. S. No. 1,200,534; Oct. 10, 1916.)

MINE CAR. Warren V. Johnson, Bloomsburg, Penn., assignor to American Car and Foundry Co., St. Louis, Mo. (U. S. No. 1,199,794; Oct. 3, 1916.)

MINE-CAR WHEEL — Capped-Hub Mine-Car Wheel. Ernest M. Hicks, Berwick, Penn., assignor to American Car and Foundry Co., St. Louis, Mo. (U. S. No. 1,199,789; Oct. 3, 1916.)

NITRIC ACID—Process for the Production of Nitric Acid From Nitrous Gases. Antonius Foss, Christiania, Norway, assignor to Norsk Hydro-Elektrisk Kvaelstofaktieselskab, Christiania, Norway. (U. S. No. 1,200,334; Oct. 3, 1916.)

POTASSIUM—Process of Obtaining Alkali-Metal Compound From Silicates. Walter August Schmidt, Los Angeles, Calif., assignor to International Precipitation Co., Los Angeles, Calif. (U. S. No. 1,200,887; Oct. 10, 1916).

REGENERATIVE FURNACE. Horace E. Smythe, Pittsburgh, Penn., assignor to The S. R Smythe Co., Pittsburgh, Penn. (U. S. No. 1,188,502; June 27, 1916.)

SCREEN—Wet-Screen. Maurice Peterson, Park City, Utah. (U. S. No. 1,199,300; Sept. 26, 1916.)

SEPARATION—Apparatus for Separating Coal, Ore, Etc. Frank Pardee, Hazleton, Penn. (U. S. No. 1,197,946; Sept. 12, 1916.)

SEPARATION—Method and Apparatus for Separating Minerals and Metals. John Fred. Hedman, Los Angeles, Calif., assignor of one-half to Thomas Spaulding, Los Angeles, Calif. (U. S. No. 1, 198,126; Sept. 12, 1916.)

SILICATES—Method of Treating Mineral Silicates. Joseph C. W. Frazer. William W. Holland and Ellis Miller, Baltimore, Md. (U. S. No. 1,196,734; Aug. 29, 1916.)

STEEL—Manufacture of Steel by the Basic Open-Hearth Process. Alfred Ernest Davies, Bilston, England. (U. S. No. 1,198,827; Sept. 19, 1916.)

STEEL FURNACE. Joseph L. Dixon, Detroit, Mich. (U. S. No. 1,198,626; Sept. 19, 1916.)

TRANSFORMER—Electric Transformer and Welding, Smelting and Like Apparatus. Richard Mack, Neu-Tempelhof, near Berlin, Germany. (U. S. No. 1,199,092; Sept. 26, 1916.)

Assessments

Company	Delinq.	Sale	Amt.
Alpha, Nev	Oct. 25	Nov. 15	$0.03
Andes, Nev	Oct. 11	Nov. 1	0.02
Blue Bell, Ida	Oct. 9	Nov. 9	0.002
Blue Bull, Nev	Oct. 16	Nov. 20	0.01
Blue Star, Ida	Sept. 25	Nov. 21	0.02
Cedar Creek, Ida	Oct. 23	Nov. 23	0.01
Chief Cons. Ext., Utah	Oct. 10	Nov. 1	0.002
Cornet, Ida	Oct. 20	Nov. 20	0.00075
Consolidated Imperial, Nev	Oct. 25	Nov. 15	0.01
Demijohn, Utah	Oct. 21	Nov. 10	0.005
Diam. Blk., Butte, Nev.	Oct. 12	Nov. 18	0.01
Diamondfield Bl'k B'tte, Nev.	Oct. 12	Nov. 18	0.01
Duluth, Ida.	Oct. 18	Nov. 18	0.001
Eagle Mountain, Ida	Oct. 2	Nov. 4	0.001
Enterprise, Ida	Oct. 19	Nov. 20	0.002
Four Timber, Ida	Oct. 1	Nov. 1	0.002
Friend, Ida	Oct. 21	Nov. 24	0.002
Giant, Ida	Oct. 5	Nov. 9	0.003
Hale and Norcross, Nev	Nov. 8	Nov. 20	0.03
Idaho & L. A., Ida	Oct. 16	Nov. 17	0.005
Idaho Mont, Ida	Oct. 30	Nov. 18	0.002
Independent, Ida	Oct. 7	Nov. 7	0.005
Manhattan Cons., Nev	Oct. 9	Nov. 8	0.01
Military, Ida	Oct. 25	Nov. 25	0.00025
Monarch-Pgh., Nev	Oct. 23	Nov. 27	0.01
Murray Copper, Utah	Oct. 9	Nov. 8	0.001
Naildriver, Utah	Nov. 4	Dec. 4	0.01
Ninemile, Ida	Nov. 2	Nov. 17	0.0015
Nonpareil, Ida	Oct. 23	Nov. 23	0.001
North Franklin, Ida	June 19	Nov. 23	0.005
North Tintic, Utah	Oct. 10	Nov. 1	0.002
Ophir, Nev	Oct. 25	Nov. 15	0.05
Raven, Ida	Oct. 23	Nov. 20	0.001
Seg. Belcher, Nev	Oct. 30	Nov. 24	0.02
Selma, Utah	Nov. 4	Nov. 23	0.005
Sierra Nevada, Nev	Oct. 12	Nov. 2	0.10
Silver Mt., Ida	Oct. 21	Nov. 24	0.002
Spearhead, Nev	Oct. 2	Nov. 2	0.01
Tarbox, Mont	Sept. 28	Oct. 28	0.005
Tobar, Utah	Nov. 2	Nov. 23	0.002
Tyler, Ida	Oct. 12	Nov. 13	0.0015

Editorial Correspondence

JACKSON, CALIF.—Oct. 16
(By Telegraph)

State Labor Commissioner's Proposal that the mine managers take back strikers and pay an advanced wage to worthy men at the end of three months rejected by the managers, who will resume work if the men return on the old wage scale. The managers say they have nothing to arbitrate or discuss. The South Eureka and Central Eureka are guarded while pumping water but no serious outbreak has yet occurred.

BUTTE—Oct. 15

Butte & London Mine, which is being developed by the Rainbow Development Co., is beginning to look up. A vein, assaying 8 oz. silver to the ton for a width of 10 ft., has been encountered in the south crosscut on the 1,600 level. The vein also carries some gold and copper. It is one of seven veins cut on the 1,600-ft. level.

Butte Copper & Zinc Co.'s Emma mine, operated by the Anaconda company, is shipping high-grade ore to the concentrator at Anaconda at the rate of 150 tons per day. The assays of the ore average 37½% zinc, 6% lead, and 10½ oz. silver. The Emma is one of the principal sources of supply for the new zinc concentrator at Anaconda and the zinc refinery at Great Falls. The Douglas mine in the Coeur d'Alene district is also furnishing about 100 tons of zinc ore per day.

Douglas Mining Co. Stockholders will hold a meeting Nov. 1 for the purpose of ratifying the action of the directors in selling the property of the company, situated in the Cœur d'Alene district of Idaho, to the Anaconda company for $256,050. It is to be an outright sale and the Douglas stockholders will get their proportion of the price. The Douglas company is capitalized for $1,200,000. The option which the Anaconda company took on the Douglas has still about five months to run. Meanwhile the Anaconda company is doing extensive development work on the property and is shipping ore to the Washoe concentrator and is paying the Douglas company a royalty of $3 a ton on the ore taken out. The Douglas has a good vein of zinc ore, but it is not phenomenal.

U. S. Mine Rescue Station Officers of the newly created mine-rescue station have established official headquarters at the School of Mines building where hereafter all the business of the station will be transacted. It has been announced that six engineers and other mine-rescue experts will be in charge of the mine-rescue car that is to be equipped with the most uptodate appliances for rescue and first-aid work. The payroll for this Federal service will amount to nearly $25,000 a year and, with local purchase of supplies, the department's total expenditure in Butte, it is said, will reach from $30,000 to $35,000 a year. Dr. W A. Lynott, a surgeon of the U. S. Bureau of Mines, is instructing the first-aid classes of the Butte mines and will hold several lectures on the subject to which the general public is invited. Dr. A. J. Lanza, of the U. S. Health Service, and Daniel Harrington of the Bureau of Mines, are at present in charge of the office at the School of Mines. The movement is expected to offer special advantages to the students of the School of Mines who will be in close touch with the activities of the station and receive special training in rescue and first-aid work.

Industrial Workers of the World invaded Butte and under some pretense or other secured a permit from the city clerk for the use of the City Auditorium. During the day detectives arrested two of the members carrying banners through the streets of Butte, announcing a meeting at the Auditorium and distributing posters which read as follows: "Fellow Workers—Come and do your duty. Open the jail doors or we will close the factories and mines. We fight for the freedom of those who dare to fight for us. Many Industrial Workers of the World organizers and strikers are jailed in the mining range. Speakers today in several languages. We do not want Russian methods." The police promptly took the matter in hand and when a crowd appeared at the Auditorium to attend the announced meeting, it was dispersed with some difficulty and members of the police force were met with threats. The number of Industrial Workers of the World members in Butte has increased in the last few weeks and has materially swelled the list of unemployed and unemployable that have swarmed into Butte, attracted by the high wages and the widely advertised prosperity of the town. In spite of the feverish activity prevailing in and about Butte in all lines of industry, the supply of workers now far exceeds the demand and Butte at this moment offers no inducement to the jobless, flocking to the city from every direction.

DENVER—Oct. 14

Denver Civic and Commercial Association proposes a mining bureau that will cooperate with similar bureaus in the Rocky Mountain region in a campaign to secure more recognition, from the Federal officials, of the assistance needed to develop properly the mineral resources. This proposed action is largely due to the withdrawals of so many large areas of mineral-bearing ground from location and entry. Fred Carroll, state commissioner of mines, has been requested to name delegates who will advocate the proposed measures at the forthcoming session of the American Mining Congress.

LEADVILLE, COLO.—Oct. 14

The Down Town Mines Co. has undertaken the extensive development of the drained territory accessible through the Penrose shaft. In the upper levels, the uncovering of several bodies of payable ore are reported but development as not reached a stage from which the exact value and importance of the discoveries can be learned. The opening of a large body of iron-manganese is practically assured by the work now in progress, but as yet no ore has been hoisted for shipping. The water in the property is now completely under control with the pumps throwing 2,500 gal. per min. to surface. The flow is reported to be falling off gradually as the ground slowly drains.

Strike Agitation pro and con is causing considerable uneasiness in the district. The Leadville branch of the Western Federation of Miners has filed with the State Industrial Commission a notice that a demand has been made on the operators for a wage increase to $3.75 and $4.25 per day. Union officials are busy organizing the miners and apparently intend attempting the achievement of recognition of the union and higher wages. No uniform increase throughout the district is possible, the operators claim. The profit margin on most of the ore output is claimed to be less than $1 per ton, and a great deal of it nets around 25c. per ton. The proposed increase from the $3.30 per day now paid would enforce the closing down of many low-grade mines and throw several hundred men out of work.

Leadville Unit plans have been altered in that it has been decided to sink the Jamie Lee shaft instead of the Harvard. The draining of the Fryer Hill basin to a depth of 407 ft. was accomplished through the Harvard, thereby unwatering the Jamie Lee and other shafts under the control of the United States Smelting, Refining and Exploration Co. The pumping machinery will remain in the Harvard and a large compressing plant is being installed at the same property. Hoisting machinery has been ordered for the Jamie Lee and sinking 300 ft. will be undertaken as soon as the shaft can be equipped. Several bodies of sulphide and carbonate ores have been uncovered in the Tip Top and other properties controlled by the Leadville Unit and a steady tonnage is being extracted. Indications uncovered through systematic sampling of old workings by a large force of men are reported to be highly satisfactory. Geological sections of the entire property controlled by the company are being made, a work that is proving of great value in planning the development.

SALT LAKE CITY—Oct. 13

Amendment of Utah Constitution to be voted upon at the general election Nov. 7, involves sweeping changes in the constitutional provisions for the taxation of mines. The present method of assessing mining property in the state is to assess surface ground of patented claims at the price paid the government, machinery and surface improvements at their value, and net annual proceeds at their value. The amendment proposes to multiply net proceeds of all mines three times for purposes of taxation, and to permit the taxing authorities to place their own valuation on the surface ground of nonmetalliferous mines. The proposed amendment repeals a present requirement that taxation shall be uniform and equal on all classes of property in the state and permits the classification of property for taxation, and the application of differing rates to various classes. It also permits the taxation of the shares of any company in addition to the taxation of the property represented. The proposed amendment is being vigorously resisted by mining, manufacturing and other business interests of the state. The Utah chapter of the American Mining Congress has become active in the matter and is sending literature on the subject to tax payers of the state. The proposed multiplication of mine proceeds for taxation is being urged by the taxing officers of the state on the ground that as mine proceeds have always been taxed at 100% valuation, while other property has been taxed at from 18% to 50% of its value, the valuation on mine proceeds should be increased in the same ratio as the increase on other classes of property which are being assessed at full value this year for the first time. The mining intersts naturally oppose this, contending that it would legalize and perpetuate an injustice through which the producing mines have suffered ever since statehood was achieved.

The Deep Creek Section or Clifton mining district in western Tooele County, one of the promising, but relatively little developed mineral areas of the state, is to have a railroad. Articles of incorporation of the Deep Creek Railroad Co., a Utah corporation, were filed recently. The company is capitalized at $450,000, all common stock, a large part of which has been subscribed by local men. There are no bonds, bonuses, or promotion stock. The company will build a line from Wendover on the Western Pacific, 119 mi. west of Salt Lake, south to Gold Hill, a distance of 44 mi. All of the material for the railroad has been purchased, and the contract for the grading and laying of track has been given to the Utah Construction Co.—work to be started at once. The officers are: Duncan MacVichie, a large owner in the Western Utah Copper, at Deep Creek, and through whose efforts the railroad was undertaken, president; T W Wiehe, chief engineer of the Western Pacific R R., vice-president; W. W. Armstrong, of the National Copper bank of Salt Lake City, treasurer; C M Levy, president of the Western Pacific R.R., director; E. O. Howard, Walker Bros., bankers, Salt Lake, director; Edmund T. Jones, and Harold R. Smoot, additional directors. Terminal arrangements have been made with the Western Pacific at Wendover. This company is naturally interested in the undertaking, on account of increased freights, etc. The Clifton mining district is 11 mi. long, north and south, by five miles east and west, so far as the mineralized area is at present known. Most of the properties are but partly developed, owing largely to the high cost of fuel and supplies. Heretofore everything had to be hauled by wagon road, 56 mi., at a cost of $12 and upward per ton. The roads were bad the greater part of the time. The new railroad running nearly due south, will cut across the west side of the Great Salt Lake desert and reduce the distance to 44 mi. to Gold Hill at the terminus. The principal property of the district is the Western Utah Copper, which has done more development than any other and is reported to have 100,000 tons of copper ore blocked out, assaying 4 to 5% copper and carrying gold and silver. This mine also has carbonate lead ores in another deposit, carrying about 15% lead and 12 oz. silver. Other properties more or less developed, are the Bamberger properties, the Ida Lull, etc., copper; the Cane Springs, gold-copper; the Alvarado, gold-copper; the Calavaras, gold, owned by the Western Utah Copper; the Gardener properties on Dutch Mountain, 35 mi. from Wendover, copper-gold; the Rodenhouse and Wilson Brothers properties at Gold Hill, and others. Bismuth and gold ore has been shipped from one of the Wilson properties. Altogether there are 27 mines and prospects. Irrigable lands in Deep Creek and neighboring valleys will be tapped by the new line. The railroad will cause much development to be done in this district, which will add to the mineral output of the state.

Changes in Tintic Power Lines are being made by the Utah Power and Light Co. The new work at Homansville in the northeastern part of the district has caused a change to be made from a 5,000- to an 11,000-volt line. The Topliff limestone quarries of the United States Smelting Co. and those of the American Smelting and Refining Co., which for some time have been supplied by a 44,000-volt line—formerly a part of the old Mercur system of the power company—are to be served in the future by the reconstructed line, carrying 11,000 volts.

MIDAS, NEV.—Oct. 14

Discovery of Cinnabar not far from the Gold Circle district is providing plenty of excitement. From all reports received so far, the discovery is apt to prove of considerable dimensions. Outcrops have been traced for 5 to 6 mi. and the surface width is said to be from 10 to [illegible] ft. Some large pieces of float have been found in the adjacent country and are reported to carry a high percentage of mercury.

JOPLIN, MO.—Oct. 14

A Record Sale Involving $30.000 for a [illegible] lease only partially developed was [illegible] here last week, the Merchants Mining Co. of [illegible] merce, **Okla.**, being at the selling end of the deal. The buyers have not been made public, but are said to be Eastern investors. The transaction is significant of the popularity of the Oklahoma section of the Joplin district at this time. More than a hundred drills are operating in this section, blocking out new ore runs. New companies are being formed daily, and new leases taken. The Picher company, which started the development of this field, is just now getting started at production in a thorough manner and is turning out, with its five mills at Picher, not far from 300 tons of concentrates weekly, and its plants are not yet running at full capacity. The Admiralty Zinc Co. is also getting its mills in steady operation and a score or more of smaller companies are getting into the producing list. It now appears that in a short time this section of the district will rival in ouput the sheet ground district at Webb City-Carterville, and it is claimed that ore will be mined in Oklahoma profitably when the lean ore mines in other parts of the field are forced to close down, on account of the superior richness of the dirt.

ST. LOUIS, MO.—Oct. 14

National Lead Co. has purchased the Jackson tract west of Bonne Terre for $60,000, and 640-acre Pine tract near Elvins for $176,000, where the lead is about 900 ft. deep—the deepest in the district.

Drilling Is Being Pushed along the Big River in Washington County, near Irondale, by two New York men. It is reported some excellent cores are being obtained. Local men are also drilling near Hughes Mountain, in Washington County, near the porphyry contact.

North American Mill at Fredericktown is being remodeled and will soon be in operation after several years' shutdown. It is reported that the Schulte lands, where some good lead and nickel sulphides were found with the diamond drill years ago, have been taken over.

Jones Shaft at Elvins is nearly completed, but a heavy water flow has been struck at 525 ft. that is making it very difficult to continue the work. A steam pump is being installed with a capacity of 2,000 gal. per min. It is hoped this will enable the shaft to be bottomed at about 560 ft., which will carry it under the rich ore said to occur on this 40-acre tract.

More Lawsuits Brought by Farmers living along Big River bottoms against St. Francois County lead mining companies are impending. The old trouble of slimes overflowing and damaging farm lands during freshets is again the bone of contention. Some of the companies are building large settling ponds to eliminate the trouble—but they are not moving fast enough to suit the farmers.

Einstein Mine, in Madison County, is being reopened by Ladenburg, Thalmann & Co., of 25 Broad St., New York, and a new 100-ton mill is under construction to treat tungsten ore. This occurs as wolframite in a narrow fissure vein in granite that was first worked for its argentiferous galena many years ago. At that time a smeltery, mill, hotel and miners' houses were erected, and an expensive granite dam thrown across the St. Francois River. Several cars of lead ore, assaying from 20 to 100 oz. silver per ton, were shipped, but the heavy tungsten, then regarded as bothersome gangue rock, was wasted.

DULUTH, MINN.—Oct. 14

M. A. Hanna Co. Has a Drilling Crew busy on exploratory work in the Round Lake district, 7 mi. east of Hayward, Wis. The company has options on many tracts of land in the neighborhood. Local rumors state that a considerable tonnage of ore has been developed. The district is a new one.

Successful Bidder for Ore Dock No. 6 of the Duluth, Missabe & Northern R.R. was the Barnett & Record Co., of Duluth. The dock is to be built at West Duluth, replacing No. 2 Dock, a wooden structure now being dismantled. The contract calls for 29,000 cu.yd. of concrete to be placed on wooden piling. The new dock will be 2,300 ft. long, with 384 pockets of 300 tons capacity each. The American Bridge Co. has the contract for structural work.

A Municipal Lighting Plant is the latest frill demanded at Hibbing. Village officials have requested bids on a plant to cost between $300,000 and $500,000. The mining companies, who pay practically all the village taxes, have entered a vigorous protest, claiming that the purchase of current from the Great Northern Power Co. would be much cheaper. In line with previous practices in "the richest village on earth," the plant will probably be built. The proposed site is situated over a considerable orebody, adjacent to the Sellers and Mahoning mines.

Contract for a $100,000 Clubhouse has been let to Lounsberry-McLeod Co. It will be built at Morgan Park for employees of the Minnesota Steel and Universal Portland Cement companies. The building will be of concrete and stucco construction with pressed brick trimming, size 100x150, three stories and basement, fireproof throughout. Some features are, a large swimming pool, lounging room, shower baths, auditorium, reading rooms and a dormitory for employees of the two companies. The three-acre tract surrounding the building will be laid out in tennis courts, track, etc. The same company has a contract for 40 additional dwellings to be erected in Morgan Park.

TORONTO—Oct. 14

Discovery of Iron Ore, of high quality, **is reported** to have been made on one of the uncharted islands off the East Coast of James Bay. A prospecting party, headed by Alex. A. Gemmell, of Toronto, has staked 4,000 acres which it is claimed cover almost continuous iron-ore deposits, including a dike running 7 mi. with a width of from 40 to 60 ft. The ore is said to carry 50% metallic iron with about 0.5% phosphorus. An open harbor close to the deposit will furnish good transportation facilities. The Ontario Bureau of Mines has asked to have samples forwarded for analysis.

A Zinc Deposit in Nova Scotia—reported to be of unusual richness—has been acquired by Toronto men, represented by F. C. Sutherland & Co., of Toronto. The deposit is in Cape Breton, N. S., about 30 mi. northwest of North Sydney. The ore formation is reported wide and traceable for a long distance. Selected samples assay as high as 34% zinc, 2½ to 4½% copper, 10% lead and some old and silver. Another outcrop of less width has been followed for 1,000 ft. and is also reported to carry high zinc, with some lead and copper. H. H. Sutherland has gone East to complete arrangements for the development of the property on an extensive scale. The owners have been offered contracts for large quantities of zinc, lead and copper and have planned operations with a view of making heavy shipments at the earliest opportunity. The property is situated within 4 mi. of a good harbor and within 15 mi. of coal.

The Mining News

ALASKA

ALASKA MINES CORPORATION (Nome)—Construction of steel and concrete machine shop begun; first of kind in Nome field. Will be used in assembling two new 15-cu.ft. bucket dredges during 1917.

VALDEZ CREEK PLACER (Valdez)—Report received at Boston office from Manager Pierre Bouery, says details of efficient mining worked out and plant now ready for placering. Ditch capacity considerably increased and now has 3,500 in. water always available.

ARIZONA

Cochise County

TWO PEAKS MINING CO. (Turner)—New copper-mining company incorporated to develop 750 acres in Whetstone Mountains, 20 mi. west of Tombstone.

Gila County

AMERICAN ORES AND ASBESTOS (Globe)—Opened asbestos deposit on Cherry Creek in Sierra Ancha Mountains; production for 18 months contracted to Philadelphia manufacturers.

MIAMI CONSOLIDATED MINES (Miami)—New organization to develop 1,200 acres of ground adjoining Live Oak and Keystone areas of Inspiration on southwest; capitalized at $2,500,000; John S. Cook, Globe, and Louis Lefkovitz, Miami, incorporators.

Greenlee County

ARIZONA COPPER (Clifton)—September production, 2,090 short tons copper.

Mohave County

ARIZONA ORE REDUCTION (Chloride)—New 150-ton reduction plant in process of erection to use complex-ore process invented by George F. Goerner; plans to turn out bullion by Jan. 1.

BLACK RANGE (Oatman)—Road building surface excavation reported as uncovering quartz vein for 200 ft., several feet wide, assaying about $23 per ton. Strike made near old shaft from which drift will run at 150-ft. depth to tap orebody.

Pinal County

MAGMA COPPER (Superior)—New zinc mill will operate soon; ore will come from recently struck body on 1,200-ft. level, sampling 7% zinc, 48 oz. silver, $1.40 gold, and 1¼% copper.

ARIZONA RAY COPPER (Ray)—New organization of Los Angeles and Oatman mining men to develop large tract adjoining both Ray Consolidated and Ray Hercules; Edmund L. Hiatt, superintendent.

Yavapai County

PLACER MINING IN KIRKLAND DISTRICT revived by optioning of claims along Hassayampa Creek by Colorado men—dredge construction contemplated.

OCTAVE (Prescott)—Plans to resume milling; new orebody being blocked out on 1,200-ft. level.

JEROME DAISY (Jerome)—Constructing trail from Arkansas & Arizona; camp building and sinking of shaft will begin soon.

LUCKY STRIKE (Kirkland)—Recently incorperated to work Stein Copper Co. properties—will commence work soon. Planned to push development on extensive scale.

CONSOLIDATED ARIZONA (Humboldt)—September production 1,170,000 lb. copper, largest in company history. Smeltery, damaged by fire last summer, now repaired.

PITTSBURG JEROME COPPER (Jerome)—Power transmission line completed. Hoisting and shaft sinking equipment delivered. Ten power drills expected to supplant present three by Oct. 20.

McMAHAN (Kirkland)—Will resume development, Nov. 1. During operation ending last May owing to expiration of contract for sale of ore to smeltery, ore shipments from development work assayed 4.2 to 17% copper. Property has large tonnage low-grade on surface assaying 1 to 3% copper.

CALIFORNIA

Amador County

KENNEDY (Sutter Creek)—Two new boilers being installed. Raising tailing dam to additional height of 25 ft. nearing completion.

KEYSTONE (Sutter Creek)—Mine and mill closed for 60 days for annual repairs. Mine not affected by labor strike, as men were receiving additional 25c. a day as premium for advancing development and extraction.

CONSOLIDATED AMADOR (Sutter Creek)—New sawmill completed, equipped with modern machinery for sawing and framing mine timbers; tracks being laid from mill to collar of shaft. Grading under way for new steel hoist. Unwatering shaft progressing steadily; below 500 level more care and less speed necessary because of bad condition of old timbers. Expected to complete unwatering by end of present year. Labor strike does not interfere; character of skilled labor required, receiving larger pay than usual operation, exempted this mine from demands made by labor union.

CENTRAL EUREKA (Sutter Creek)—Mill closed down and only work done is keeping water out of shaft and drifts. Following labor strike mill ran on ore remaining in bins and this now exhausted. Mine did not pay in September, because of development of new orebodies. During month, 223 ft. of drifts and raises were driven and 2,646 tons ore crushed. Costs for the month totaled $13,367, receipts being $9,063. Ore averaged $3.38 per ton. Recent geological examination by Mr. Julian indicated existence of new orebodies that were being explored when labor strike caused management to close down with other Mother Lode mines.

Calaveras County

CALAVERAS CONSOLIDATED (Melones)—Development progressing steadily and satisfactorily, disclosing oreshoot 300 ft. long and wider than tunnel. Discovery made at 1,000-ft. point from portal. Recent record shows advance of 28 ft. in 48 hr. in tunnel driving. W. J. Loring, general manager; J. A. Davis, superintendent.

Inyo County

DARWIN LEAD-SILVER (Darwin)—Has applied for listing stock on New York Curb. Company has 300,000 authorized shares, par value, $5; 70,000 in treasury.

Nevada County

PRUDENTIAL & NORAMBAGUA (Grass Valley)—Properties taken under bond and purchase option by San Francisco and Eastern men represented by F. M. Shideler, of San Francisco, and Frank L. Rodgers, of Connecticut. Both properties said to have good ore. Prudential opened to depth of about 1,000 ft., equipped with mill and some mining machinery.

Plumas County

CLEGHORN BAR, on middle fork of Feather River, containing about 50 acres of placer ground, worked in early days in a crude way, has been disposed of to Oakland men represented by George C. Richards, mining engineer. J. W. Egbert and William Metcalf were owners.

DIVING EQUIPMENT received at Quincy for installation on middle fork of Feather River by Robinson & Becker, of Toll Gate, consists of gas engine, dynamo, air compressor, diving suits and other essential apparatus. Situation is above Hartman Bar. As there is fall of 4,000 ft. in elevation in distance of 2 mi., expected that difficulty will be met in placing machinery, which will be lowered by cables.

Shasta County

POTOSI (Redding)—Property 6 mi. west of Redding, idle since 1871, being opened up under superintendency of A. S. Howe. Property belonged to late Senator J. P. Jones, of Nevada.

Tuolumne County

DUTCH-APP-SWEENY (Jamestown)—W. J. Loring, manager, just returned from Boston, is preparing for installation of Minerals Separation flotation plant. Development of App during winter expected to be followed by installation of a modern mill.

COLORADO

Boulder County

GILLESPIE (Sunset)—Property being developed by Neighbor & Harris under lease. Payable ore opened; concentrates from milling tests assay 4 oz. gold and 200 oz. silver a ton.

WHITE RAVEN (Ward)—Rich silver ore pocket opened on 340-ft. level. New Leyner compressor installed and additional machine drilling equipment will be purchased. Extensive development work under way. Vein of lead ore opened on White Raven Extension. Frank Davis, manager.

COLD SPRING (Nederland)—Actively developed by Hinman Brothers. Shaft being sunk to 400-ft. level. Leyner drill sharpener installed. Several pockets high-grade tungsten ore opened recently. Ore from dump being shipped to Clark mill at Stevens Camp and to Rare Metals Co.'s plant at Rollinsville.

Clear Creek County

TEK (Idaho Springs)—Main tunnel opened 3.5 ft. vein ore assaying 3 oz. gold and 7 oz. silver a ton.

Lake County

FIDELITY GOLD (Leadville)—Has opened 4-ft. vein in lower tunnel; ore reported high gold with considerable silver and copper. Vein cut by 1,200-ft. tunnel after $75,000 expenditure. Strike locally regarded as of considerable importance.

San Juan County

BEN BUTLER (Silverton)—Regular shipments of ore being made to Durango smelting plant.

DORA (Silverton)—Property being developed under management of John Hughes. Mill overhauled and operating.

CONTENTION (Silverton)—Tailings from old North Star mill in Little Giant Basin shipped over Contention tram to milling plant and treated by flotation. Excellent recovery and high-grade product made.

San Miguel County

TELLURIDE SHIPMENTS during September: Tomboy 56 cars; Smuggler-Union 35; Black Bear, 20; Liberty Bell, 12; Columbia one car; total 124 cars.

HIGHLAND MARY (Ophir)—Vein of payable ore opened. J. D. McAlpine, manager.

IMES (Sawpit)—Shaft sunk 75 ft. opened small vein ore containing copper, lead, and zinc.

TOMBOY (Telluride)—In September mill ran 29 days; crushed 13,000 tons; bullion, $29,700; concentrates, $64,000; total yield, $93,700; expenses, 65,600; profit, $28,100.

Summit County

GIBSON HILL MINING AND MILLING (Breckenridge)—This company, recently organized and composed of Pueblo men, has acquired New York and Eli Lambert groups on Gibson Hill, and Morning Sun group in Barton Gulch, about 20 claims in all. Crew already driving tunnel in Barton Gulch and tunnel to be started at once on New York group. Development on large scale will be prosecuted.

Teller County

CRESSON CONSOLIDATED GOLD (Cripple Creek)—Sept. 1 reports $1,127,754 cash in bank, together with 95 cars ore in transit valued at $90,000 net. August shipments yielded profit $110,016. Engineer Louis Noble reported $4,162,157 developed ore Sept. 1, an increase of nearly $32,000 over Aug. 1 report after month's extraction.

ILLINOIS

Madison County

NEW STAUNTON COAL (Livingston)—New hoisting record made under normal working conditions recently at Livingston shaft, when 5,287 tons coal, filling 116 railway cars, hoisted in 8 hr. Shaft 287 ft. deep; total number trips, 1,800; average time per trip, 16 seconds.

MICHIGAN

Copper

WYANDOTTE (Houghton)—Stoping on 9th and drifting on 10th level. Another mill test will be made soon.

ISLE ROYALE (Houghton)—September production 1,130,000 lb. from over 75,000 tons rock averaging 14.2 lb. per ton.

CALUMET & HECLA (Calumet)—Will shortly begin addition to Lake Linden leaching plant to hold two 50-ft. diameter tanks, increasing plant capacity by about one-third. Flotation process experiments reported successful. September production of various subsidiaries: Ahmeek, 2,309,955 lb.; Allouez, 896,184; C. & H., 6,257,177; Centennial, 100,800; Isle Royale, 1,010,723; La Salle, 119,269; Osceola, 1,700,522; Superior, 220,582; Tamarack, 512,666; White Pine, 385,577 lb.; total for month, 13,573,725 lb.; total for nine months, 120,055,000 lb.

MINNESOTA

Cuyuna Range

HILL CREST (Ironton)—Initial shipments made recently from pit. Company leased 600-ft. strip adjoining from Cuyuna Realty Co., which tract will be hydraulicked.

CUYUNA REALTY CO. (Ironton)—Tract of 160 acres adjoining Pennington and Hill Crest pits will be operated soon. Portion adjoining Hill Crest leased to that company and will be stripped. Remaining portion will be operated as underground mine.

CUYUNA-MILLE LACS (Ironton)—Over 85,000 tons manganiferous iron ore shipped in 1916, all to American Manganese Manufacturing Co. at Durbar, Penn. Planned to sink another shaft soon as suitable location determined.

Messabi Range

TENER (Chisholm)—"C" shaft being concreted.

MINORCA (Virginia)—Exploration work has defined a mine. Machinery will be purchased and installed. Property worked at one time but ore played out.

WEBB (Hibbing)—Considering feasibility of operating washing plant throughout winter—innovation on Mesabi Range. Washing process reported to raise iron content from 10 to 12% in ore.

SHENANGO (Chisholm)—Drilling explorations in bottom of pit greatly increased available tonnage. Preparations being made to conduct operations by milling method. Approximately 7,000 tons shipped daily.

STATE OWNED IRON MINES—More than 3,000,000 tons iron ore shipped from 15 state owned properties thus far, making 1916 banner shipping season. Leading shippers are Leonidas, 46,000 tons; Woodbridge, 42,000; Pool, 16,000; Hanna, 11,000; Waconta, 7,000; Grant, 15,000; and Mesaba Mountain, 12,500 tons.

MISSOURI

Joplin District

BROOM CORN (Commerce, Okla.)—Sinking new shaft on account of heavy flow water and increased output.

LULU V (Spring City)—Will start up mill again soon after six months' shutdown account heavy flow water.

PREMIUM (Galena, Kan.)—Wilcox & Watson, of Joplin, behind company which has contracted for new mill on Lone Elm lease at Galena.

NORFOLK (Joplin)—Planning 400-ton mill in West Joplin sheet ground field. Boiler of 250-hp. capacity now being installed for shaft sinking. Lease thoroughly drilled.

KING JACK and MIZPAH (Commerce, Okla.)—Names changed by Commerce Mining and Royalty Co., which owns them, to Concentration No. 1 and No. 2. Both operating full force after several months curtailed operations.

CAMPBELL (Spring City)—Mine worked for five or six months with large profits by small company taken over by Raymond & Allendorf, of Oronogo Circle Co., who are erecting bin and connecting with tram to Aladdin mill. Operations in well roofed soft ground at 150 ft.

MONTANA

Beaverhead County ..

BOSTON & MONTANA DEVELOPMENT (Wise River)—Arrangements made for first ore shipment from company's Elkhorn mine—25 tons from new shaft. Planned to construct 100-ton concentrator; machinery and material ordered. Mill expected ready for operation by spring. Considerable development work going on both at Elkhorn and Spain mine in French gulch. From latter about 75 tons ore being shipped per week to Washoe smeltery.

Deerlodge County

GOLD LEAF MINING (Anaconda)—Company incorporated to exploit properties in Granite and Ravalli Counties in what is known as the Frog Pond Basin. Capital stock, $200,000; par value, $1 per share.

Fergus County

E. SUTTER AND ASSOCIATES, of Lewistown, have shipped three cars of high-grade copper ore that netted approximately $1,000 per car. Also have low-grade deposit.

UNITED STATES GYPSUM (Heath)—Making preparations to erect plaster mill. Company has 300 acres under lease and estimates available gypsum at 7,000,000 tons.

BARNES KING (Kendall)—September report announces option on Woodrow Wilson claims in Rimini district relinquished since all shipping ore in sight exhausted and values decreased from $4.62 to $16.6[illegible] per ton. Conditions at [illegible] Piegan Gloster and Shannon mines near Marysville satisfactory. Gloster mill treated 4,0[illegible] of ore producing $15,000 bullion. Under contr[illegible] for purchase of Shannon, about $20,000 will be paid to owners. At North Moccasin in Fergus County, tonnage treated 2,713, bullion valued $15,000, an average of about $6 per ton.

Lewis and Clark County

NEW YORK & MONTANA TESTING (Helena)—Reported that company headed by [illegible] E. Fryberger will build $30,000 custom mill for treating low-grade ores of Helena district.

MARYSVILLE GOLD (Marysville)—Development work on various options has opened number promising deposits. Crosscut and drift on Mount Pleasant cut good milling ore up to $10 per ton. Another vein cut 100 ft. north of Mount Pleasant by another crosscut, assayed high in free gold. Shaft on Honey Comb furnished several thousand dollars worth shipping ore assaying up to $50 gold.

Lincoln County

SNOWSTORM (Troy)—Mill of 300-ton daily capacity removed from Larson, Idaho, will probably be in operation about Nov. 1. Reported 400,000 tons of ore developed averaging 7% lead, 8% zinc and 3 oz. silver per ton. Tests indicate 85 to 90% recovery of lead and silver and 40% zinc. Ore is treated by flotation process.

Mineral County

TARBOX (Saltese)—Compressor plant and power drills now in operation, permitting better progress. Shaft now down to 550 ft., will be extended to 600 level. Management expects shipping ore regularly by end of year. Building of concentrator and flotation plant is planned for coming spring to treat second-class ores.

Powell County

CUTRIGHT (Elliston)—Regular shipments of copper ore, assaying 5% copper being made from mine to Pittsmont smeltery at Butte. Mine in Snowshoe gulch, 15 mi. from Elliston. Owners plan increase mining equipment in near future. Adjoining properties being rapidly developed.

Silver Bow County

TIMBER BUTTE MILLING (Butte)—Zinc concentrator of 700-ton daily capacity to be enlarged to 1,000 tons. A 1,500-ton annex will treat copper tailings of old Butte Reduction Works.

NEVADA

Esmeralda County

JUMBO JUNIOR (Goldfield)—Property being developed from Jumbo Extension workings. Work on 880-ft. and 1,750-ft. levels exposed large silicified zone yielding encouraging assays.

REORGANIZED KEWANAS (Goldfield)—Raise started near face of north drift, out about 700 ft. from working winze. Reported recent assays vary from $10 to $50 over width of 12 to 30 in.

ATLANTA MINES (Goldfield)—Footwall crosscut passed through 90-ft. vein matter before encountering shale. Vein estimated 60 ft. thick. South drift started near center. Occasional good assays obtained.

Humboldt County

RAGGED TOP (Lovelock)—Humboldt County Tungsten Mines and Mills Co. incorporated as operating company of the Ragged Top mines and the mill at Toulon. New road from mines to mill, about 10 mi., completed; will be operated as toll road.

LOVELOCK QUICKSILVER (Lovelock)—Five-day run of the recently completed furnace resulted in ten flasks of "quick," which were shipped to San Francisco. Furnace has capacity of five tons per day. Reported company has about 400 tons on dumps ready for treatment; seven men are employed.

Lincoln County

PRINCE CONSOLIDATED (Pioche)—Shipments of crude ore to smeltery continue at rate of about 3,100 tons per week. Mill at Bullionville running one shift treating about 100 tons per day. Additional equipment ordered will bring capacity to 250 tons per day.

Lyon County

NEVADA DOUGLAS (Ludwig)—Installing additional leaching tanks for oxidized ore to handle 500 tons per day. Archie J. Orem, superintendent.

Nye County

TONOPAH ORE PRODUCTION for week ended Oct. 7 was 8,602 tons valued at $170,776 compared with 9,398 tons for week previous. Producers were: Tonopah Belmont, 2,915 tons; Tonopah Extension, 2,580; Jim Butler, 1,1[illegible]; Tonopah Mining, 900; West End, 6[illegible]5; Re[illegible] Eula, 219; Halifax, 178; North Star, 6[illegible] cellaneous leases, 139 tons.

MONARCH PITTSBURG (Tonopah)—D[illegible] and raising on large contact vein r[illegible] countered on 1,000 ft. level.

PIONEER CONSOLIDATED (Pi[illegible])—In addition to company mining and milling [illegible] four lessees are working.

TONOPAH (Tonopah)—Crusher plant of D[illegible] Power and Milling Co., sub[illegible] of the T[illegible] company, destroyed by fire, cause unknown. Loss not large as main mill buildings not affected.

GIPSY QUEEN (Tonopah)—Pumps pulled resulting from unexpected flow. Unwatering shaft will be resumed soon as arrangements made for additional pumping capacity.

UNION AMALGAMATED (Manhattan)—Compressor being placed at Bath shaft and incline will be sunk additional 120 ft. Vein in bottom of drift, 500-ft. level, reported to average $80 per ton.

BUCKEYE BELMONT (Tonopah)—Development largely confined to 1,200-ft. level where conditions described as favorable. Has taken over Chipps Creek Consolidated and controlling interest in Empire Plumas gravel properties in Plumas County, Calif.

RESCUE-EULA (Tonopah)—On 950-ft. level, intermediate levels from the winze and No. 5 raise are both in ore of good grade. From bottom of winze a crosscut is being run toward Maggie May claim.

TONOPAH MINING (Tonopah)—Acquired working control Louisiana and Brownie mines of Louisiana Consolidated Co. in Esmeralda County, about 50 mi. west Tonopah. Reported oreshoot on 120 level developed 365 ft. long, 4 to 6 ft. wide assaying $12 to $15 per ton, mostly gold. Milling tests indicate recovery 92%. Mill of 250 tons daily capacity proposed.

NEW MEXICO

Grant County

OCTO MINING (Lordsburg)—Filed articles of incorporation; William Davis manager; contract for 500-ft. shaft let Wright Brothers, Bisbee, Ariz.

Sierra County

LOOKOUT (Kingston)—Miller & Davidson, of Lake Valley, sacking ore assaying 2,250 oz. silver and 41 oz. gold to ton.

NEW JERSEY

AT BAYONNE after week of rioting resulting in several deaths and many wounded, situation quiet. Strikers' meeting held Oct. 18 to consider question of return to work—three Federal mediators expected to attend. Notice served on Bayonne mayor that city would be expected to pay damages resulting from strike violence. Statement authorized by Standard Oil Co. says strike started with three unskilled laborers paid $3.20 for eight hours—rest of strikers forced out by intimidation. Since Aug. 1, 1915, wages increased 23%, which, together with effect of changing to 8-hr. day, increased costs over 46%.

SOUTH DAKOTA

Lawrence County

ORO HONDO (Deadwood)—Shaft 2,000 ft. deep will be continued 1,500 ft. farther. Diamond drilling has been in progress on bottom level for several months.

CUSTER PEAK (Nahant)—Shaft 250 ft. deep will be continued to zone of secondary enrichment. This is probably biggest copper prospect in Lawrence County.

ELK MOUNTAIN (Lead)—Close corporation headed by L. P. Dove, formerly instructor in chemistry and assaying in Lead public schools. Running Deadwood-Standard mill on ore from adjacent Slavonian group with satisfactory results.

TROJAN (Trojan) — Facilities for receipt and sampling of custom ore being installed at cost of $12,000. Raise excavated from Portland mine to surface railway tracks. Track scales will be put in. Crushed ore will drop to underground bins, avoiding freezing in winter, and thence hauled to mill. Company pays for ore upon delivery and agreement as to value. Mill capacity 350 tons daily, with improved slime treatment. Tube mill will be installed at once to take product of chileans. Portal of Portland tunnel being concreted 150 ft.

HOMESTAKE (Lead)—Will erect new hospital at cost of $50,000. Building and foundations for reception of three new tube mills in regrinding plant completed and awaiting arrival of machinery; enlargement will enable all of sands originating in Lead mills to be reground before entering cyanide treatment circuit. New hoisting plant at B. & M. shaft not put in commission owing to nonarrival of skip parts. New boiler and electric plants operating. Five-stamp tungsten mill handling 20 to 25 tons daily. Tailings enter cyanide circuit where gold content is saved. Reported that precious metal pays all costs of handling ore—tungsten concentrates clean profit. Ore averages around 1% WO_3.

TENNESSEE

TENNESSEE COPPER (Copperhill)—Reorganization to be effected Nov. 8 upon approval of two-thirds of stockholders; new corporation to be formed under name of Tennessee Copper and Chemical Co., capitalized at 400,000 shares, of which 200,000 are offered share for share for old stock; remaining 200,000 shares new stock underwritten by Adolph Lewisohn & Son and by J. S. Bache & Co., of New York, at $14 net per share and offered pro rata to old shareholders at $16. Plan provides $2,800,000 net, of which $2,750,000 will be loaned Tennessee Copper Co. to settle $1,140,000 indebtedness to Russian government growing out of destruction of acid plant by fire, and provides little working capital over other indebtedness.

UTAH

Beaver County

INDIAN QUEEN (Frisco)—First car ore shipped since resumption of work. Ore came from raise above tunnel level, and from dump, being worked over. K. S. Jordan, manager.

BEAVER COPPER (Milford)—Ore opened in four places on 100-ft. level, showing from 1 to 12 ft. in thickness. Drills ordered and stoping to be started soon. Lewis Merriman, superintendent.

MOSCOW (Milford)—September shipments totaled 10 cars compared with 9 in August. New Cullen shaft down to 1,100, station cut, drifting started for oreshoots at greater depth. Recently copper and zinc ore added to output, formerly largely lead-silver.

Juab County

PLUTUS (Eureka)—Control taken over by Chief. Drift from 1,000 level of Chief started for this ground.

BECK TUNNEL (Eureka)—Lease given recently on block adjoining Yankee, in north end of property.

EUREKA-LILY (Eureka)—Large cave opened in winze from 500 level shows some mineralization. Plan to sink main 500-ft. shaft to greater depth.

EUREKA LILY (Eureka)—Sinking shaft—now down to 650. Strong fissure being followed shows mineralization. Three shifts worked, and 5 ft. a day made. Property adjoins Tintic Standard.

TINTIC STANDARD (Eureka)—Five hundred tons ore shipped September from new strike brought $17,000, or about $34 per ton. Furnishes funds enough to sink new shaft to level producing ore.

SIOUX CONSOLIDATED (Eureka)—Retimbering parts of shaft being done by contractors, who will sink from 600- to 1,000-ft. level. Now sinking winze from 600 on fissure mineralized with copper.

GODIVA (Eureka)—Lessees drifting on 700 to reach body of ore mined from winze on level above. Six blocks ground worked by lessees. Some Godiva ore carries $3 to $4 gold besides other metals.

CHIEF CONSOLIDATED (Eureka)—Homansville shaft down 575 ft. Station being cut and drifting started. Water encountered but sinking to be resumed soon as pumps—ordered—have been installed.

RIDGE & VALLEY (Eureka)—Orebody followed for 300 ft. on 1,600, cut on 1,700. Small pump will be installed to handle 40 gal. per minute flow, recently developed. Work being carried on through Gemini.

EUREKA MINES (Eureka)—Drifts being driven into this ground from lower levels of Gemini. Drift on 1,300 struck ore of stoping dimensions, running well in silver and lead. Company recently incorporated; new producer for Tintic district promised.

TINTIC MILLING (Silver City)—Good progress made in installing eight new roasters and other equipment, increasing capacity to 300 tons a day. Six roasters are in place, and other two will be ready by end of month. Another car precipitates ready for shipment. Arrangements being made so that shut down of only two or three days will be necessary for changing over to new equipment.

GEMINI (Eureka)—Another car high-grade silver ore shipped from Carlson-Backman lease, expected to run about 500 oz. silver, in addition to lead, copper and gold. Previous car brought about $14,000, of which 50% was royalty. High-grade silver ore occurs in pipes or shoots surrounded by bodies of lower grade, but shipping material. High-grade being followed by two raises from 1,400.

Salt Lake County

COTTONWOOD KING (Salt Lake)—Lessee working in western end of Giles group opened ore. Cottonwood King workings have showing in tunnel.

ALTA TUNNEL AND TRANSPORTATION (Alta)—Tunnel at head of Silver Fork—in 2,000 ft.—approaching vein. Clements claims lying beyond face of tunnel recently acquired. Two shifts working.

VICTOR (Mammoth)—Reported that property will be opened at depth through Iron Blossom. Opened to depth of 800 ft. Much undeveloped territory. Lessees working on 250 level, with small hoist; main hoist destroyed by fire last year.

OHIO COPPER (Bingham Cañon)—Referee in bankruptcy enjoined from confirming sale of property to bondholders' committee. Stay granted at request of North American Liquidation Co. to allow plans prepared giving stockholders chance to rehabilitate company.

MICHIGAN-UTAH CONSOLIDATED (Alta)—Reorganization of Michigan-Utah. Contract made for sale of 400,000 shares at 25c. a share. Ore sold by lessees since Jan. 1 brought $78,200, affording company net profit of $11,896. Lessees shipping two cars daily from above Grizzly and Cleaves tunnels. Company crosscutting from Copper Prince tunnel, to cut Lavinia and City Rocks veins known to continue to depth.

WASHINGTON

NORMAN MINES (Northport)—Deep development of Great Western and Last Chance mines disappointing and lease on properties will be relinquished.

WISCONSIN

MAUDE (Benton)—Lead orebody encountered at 115-ft. level on James Calvert lease.

DOMESTIC (Benton)—In sinking new shaft on McCabe-Buchan lease, a 6-ft. width of rich jack ground was penetrated.

CANADA

British Columbia

PATHFINDER (Kettle River)—This North Fork property will soon ship 30 tons daily to Granby smeltery.

BIG COPPER (Greenwood)—Three teams hauling ore to Deadwood for shipment by rail to British Columbia Copper Co.'s smeltery. Mining operations in charge of James Poggi.

CONSOLIDATED MINING AND SMELTING CO. (Trail)—Over 175 tons of fabricated steel required for new addition to leaching building of electrolytic zinc plant. New building 165x200 ft.; erection well under way. Steel all comes from Pittsburgh, Penn., but fabricated in Vancouver, B. C. Shipments of ore to Trail smeltery for year now total over 375,000 tons.

BRITISH COLUMBIA COPPER (Greenwood)—Installing pumping plant to elevate water from Similkameen River to distributing point 1,700 ft. above river, through pipe line 6,000 ft. in length. Pumping equipment consists of Gould triplex pumps; pipe line composed of 4-in. high pressure hydraulic pipe in lower section and steel pipe of 6 in. diameter at discharge. Water will supply mine, camp and 50-ton experimental concentrating plant building to test Copper Mountain ores.

Ontario

ST. ANTHONY (Sturgeon Lake)—Purchased by the Lewisobns and D. M. Steindler, of New York.

DOME (Porcupine)—Open cut ore, generally assaying about $4, has recently assayed over $6.

PLATT (Porcupine)—Under option to Coniagas. Extension Schumacher vein system cut with diamond drill.

McKINLEY-DARRAGH (Cobalt)—Good ore, of varying values, being developed on vein recently struck in winze at 300-ft. level.

BOSTON CREEK GOLD (Boston Creek)—New company formed to develop Kenzie. High-grade gold ore found on 100- and 200-ft. levels.

NIPISSING (Cobalt)—In September mined ore of estimated value $236,873, and shipped bullion and customs ore of estimated value $413,753. New discovery made on Cobalt Lake fault.

MURRAY-MOWGRIDGE (Bourke's Station)—Two shafts sunk 2,000 ft. apart on same vein, which in No. 1 shaft is 17 ft. wide and in No. 2 3 ft. wide. Sampling done in both shafts is reported to show average of $10.05 per ton.

TRETHEWEY (Cobalt)—At recent shareholders' meeting deal involving sale of property for $125,000 was definitely abandoned, and property will be operated by company. September profit was $10,000. Cash and silver on hand totals $101,000.

MAIDENS MACDONALD (Porcupine) — This property, worked under option by La Rose Consolidated has two shafts down 115 and 112 ft. respectively on high-grade vein 9 to 12 ft. in width. Machinery from old University mine at Cobalt will be installed.

WEST DOME (Porcupine)—Material and labor shortage responsible for cancellation of plant order. Opening up and blocking out ore will be continued. Ore averaging about $7 per ton being brought up from 300-ft. level on veins Nos. 1 and 2.

TEMISKAMING (Cobalt)—Report for quarter ended Sept. 30: Total bullion in storage and transit, 707,287 oz.; cash on hand, $25,074. Development totaled 1,053 ft.; stoping, 3,288 cu.yd. Main shaft, 1,325 ft. down, must continue 300 ft. to reach lower contact. Largest orebody on 500 level where vein is 8 to 14 in. wide and assays very rich.

BEAVER (Cobalt)—Quarterly statement for period ending Aug. 31 shows bullion on hand, ore at smelters and ore at mine ready for shipment to value of $313,905; cash on hand, $43,030; total, $356,935, as against $686,965 for period ended May 31. Company has been spending considerable money at Kirkland Lake on McKane property, which shows 35 ft. of $9 ore on 300-ft. level.

AFRICA

Rhodesia

GOLD PRODUCTION IN AUGUST reported at 80,909 oz., increase of 3,909 oz. over September, but a decrease of 1,636 oz. from August, 1915. For eight months ended Aug. 31 total was 601,954 oz. in 1915, and 619,964 oz.—or $12,814,656—in 1916; an increase of 18,010 oz. this year. Other production in August was 18,326 oz. silver, 351 tons copper, 1 ton wolframite, 675 tons asbestos, 13,551 tons chrome ore, 48,816 tons coal. The diamonds reported were 128 carats.

The Market Report

Metal Markets

NEW YORK—Oct. 18

The principal markets were dull during the last week at substantially unchanged prices. There was the most active demand in lead, but in the main this was on account of contracts settled at average price.

Copper, Tin, Lead and Zinc

Copper—Business was relatively light—the aggregate being much less than in the previous week. That which was done was mainly for delivery during the first quarter of 1917 and was booked at 27½c., r.t., equivalent to 27¼c., cash, New York. There was a small amount of business running forward to the middle of 1917 done at at lower prices and also a small amount for prompt delivery and November-December, quotations ranging from 29c., r.t., for prompt down to 28@28¼c. for December. Sales of first-quarter copper during the last week included some for export.

Copper Sheets, base price, nominally 37½c. for hot rolled and 38½c. for cold rolled for delivery at mill convenience. Earlier deliveries mainly on toll basis. Wire 32@32½c., nominal.

Visible Stocks of Copper in Europe on Oct. 15: Great Britain, 3,880; France, 1,740; afloat from Chile, 1,250; afloat from Australia, 3,800; total, 10,670 gross tons, or 23,900,800 lb. This is an increase of 299 tons over the Sept. 30 report.

Exports from Baltimore for the week included 2,913,276 lb. copper bars and ingots to Archangel, Russia; 181,825 lb. brass tubes and rods to Liverpool; 377 tons sheet brass to Genoa, Italy.

Tin—Business was rather slow, especially in spot. Futures were quoted at 40⅞c. on Oct. 13, declined to 40¾c. on the 16th, and advanced to 40⅞c. on the 18th.

Lead—There was an active demand from consumers who take in their supplies on average contracts, but outside buying was light. Several of the large producers are completely sold out both for October and November. On the other hand, consumers appear to have covered their expected requirements. There was a strong demand for Missouri brands consequently the St. Louis market stiffened further.

Spelter—This market was very dull. Good inquiry on Oct. 17 was reported, especially from refiners who buy common spelter and convert it into high grade, but no considerable volume of business appears to have resulted. For the moment the chief business is in high grade, intermediate and brass special. Galvanizers are not buyers to any considerable extent, and irrespective of the terms for spelter, buying from them is not expected in view of the present situation in the steel business. Although the market was dull, large producers displayed no nervousness and offerings at concessions by small producers were promptly cleaned up. However, the market showed a slightly weaker tone. Business in brass special was reported done at 10¼c. High grade was quoted at 15@16 cents.

The quotation for zinc on Oct. 11 in our table last week was given at 9.50@9.92½c. by a misprint. It should have been 9.50@9.62½c., St. Louis on that day.

Zinc Sheets are in good demand and base price remains $15 per 100 lb., f.o.b. Peru, Ill., less 8% discount.

Other Metals

NEW YORK—Oct. 18

Aluminum—Spot supplies still scarce and contract deliveries slow on good demand. Quotations 65@67c. per lb. for No. 1 ingots.

Antimony—The improvement continued further, considerable transactions being consummated. The reduction in stocks, which no longer are heavy, contributes to the strength of the present position. Some producers have no spot metal at all. We quote 13@14c. for early deliveries.

Quicksilver—Considerable business was done at $80 per flask. San Francisco reports, by telegraph, $77.50, market steady.

Nickel—Market steady and unchanged at 45@50c. per lb. for ordinary forms; with 5c. premium for electrolytic metal.

Minor Metals—Current quotations for **Bismuth** are $3.15@3.30 per lb., New York—**Cadmium** is quoted at $1.30@1.50 per lb.—**Cerium**, electrolytic, is sold at $8@9 per lb.—**Cobalt Metal** is quoted at $1.35 per lb. **Magnesium** is steady, with sales at $3.50@3.75 per lb. for 99% pure **Selenium** is from $3 up to $5 per lb., according to size of order.

Gold, Silver and Platinum

NEW YORK—Oct. 18

Gold—After a suspension of about a month gold receipts from Ottawa were resumed by the arrival at New York on Oct. 17 of $5,500,000. Most of these receipts are understood to be South African gold.

Silver—The market has remained steady for the past week without special feature. Supplies being eual to demand.

Mexican dollars at New York were quoted Oct. 13 at 52⅛@55⅛c.; Oct. 14 at 52¼@55¼c.; Oct. 16 at 52½@55⅛c.; Oct. 17 at 52¼@55¼c.; Oct. 18 at 52⅜@55⅜c. Supplies are still rather scarce.

Platinum—Business is reported fair to good, at $90 per oz., market strong, but the supply is said to be sufficient.

Zinc and Lead Ore Markets

Joplin, Mo.—Oct. 14—Price quotations per 2,000 lb.: Blende, high, $71.40; 60% zinc, premium ore, $70; medium grades, $69@65; low, $62. Calamine per ton 40% zinc, $45@35. Average selling price, all grades of zinc, $58.23 per ton.

Lead, high price, $87.60; base price, $87@80. Average selling price, all grades of lead, $75.79 per ton.

Shipments of the week, blende 8,534 tons, calamine, 407 tons; lead, 1,110 tons. Value, all ores the week, $604,720; the year to date, $29,422,530.

Lead price advances have been a notable feature of the past month, going this week to an $87 base. Zinc blende advanced on premium ore to $70, while in three weeks medium grades have climbed to $69 from $50 base.

There was no cessation of the active demand during the week, which closes as strong as have the past four weeks. In five weeks 43,600 tons of zinc have been shipped out of this district, some 13,000 tons more than produced, proving that the reserve stock is becoming limited.

Platteville, Wis., Oct. 14—Quotations of the district are according to the following figures: Base price per 2,000-lb. ton for material assaying 60% zinc, is $60 for premium ore down to $55 for medium grade. For material assaying 80% lead, the base price per 2,000-lb. ton is $76. Shipments for the week were 4,035 tons of zinc ore, 35 tons of lead ore, and 701 tons of sulphur ore. For the year to date the figures are 100,625 tons of zinc ore, 3,463 tons of lead ore, and 24,424 tons of sulphur ore. Shipped during week to separating plants, 4,443 tons of zinc ore.

This is the largest week's shipment ever reported from this district and decreases the surplus stock in bins. The production is fully maintained by incoming new properties taking the place of the low-grade producers, which were forced to close down on account of lower prices.

Other Ores

Antimony Ore—Continues in demand, but little is available at present, the lower prices lately ruling having automatically restricted production.

Molybdenum Ore—It is reported that several orders for ferro-molybdenum could not be placed in this market, the present supply of ore being too uncertain and too small. The quotation remains unchanged at $1.50@1.75 per lb. of MoS_2.

Tungsten Ore—Business done, as reported by all sellers, was at $17 per unit, which we quote as the market.

Charles Hardy reports as follows, under date of Oct. 17: "Since my last report the tungsten market has continued exceedingly active and again several hundred tons have changed hands. Europe has been the main buyer, taking, to my absolute knowledge, about 150 tons. Quite an equal amount has been absorbed by our home market, and $17 has again been paid for high-class material. A considerable amount of ore, showing objectionable impurities, has changed hands at lower figures, which are sometimes quoted in the market as business having been done at $15, or even below. A further contract for forward delivery, as a matter of fact, for delivery up to January, 1918, has been closed at $17. This is the second contract closed within the last fortnight, and it appears as if the consumers have come to look upon $17 as a fair price under present conditions. The market for ferrotungsten remains good, with considerable inquiries from abroad and prices have advanced to about $2.70 for the highest grade."

Iron Trade Review

NEW YORK—Oct. 18

Little change in conditions in the iron and steel markets. Export demand continues large, though shipments are temporarily held up by fear of submarine activities.

The pig-iron market is very active, with large sales both domestic and for export. Alabama furnaces are very busy; more basic iron is being made in the South than ever before, and foundry demand is also good.

SILVER AND STERLING EXCHANGE

Oct.	Sterling Exchange	Silver: New York, Cents	Silver: London, Pence	Oct.	Sterling Exchange	Silver: New York, Cents	Silver: London, Pence
12			32 5/16	16	4.7563	68⅛	32 9/16
13	4.7569	67⅞	32 7/16	17	4.7563	67⅞	32 5/16
14	4.7563	68	32½	18	4.7563	67⅞	32 5/16

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine.

DAILY PRICES OF METALS IN NEW YORK

Oct.	Copper: Electrolytic	Tin: Spot.	Lead: N. Y.	Lead: St. L.	Zinc: St. L.
12		. .	.		
13	27 @27¼	41⅛	7.00	6.87½ @6.92½	9.50 @9.62½
14	27 @27¼	41⅜	7.00	6.87½ @6.92½	9.50 @9.62½
16	27 @27¼	41½	7.00	6.87½ @6.92½	9.50 @9.62½
17	27 @27¼	40⅞	7.00	6.90 @6.92½	9.25 @9.37½
18	27 @27¼	40⅞	7.00	6.90 @6.92½	9.12½ @9.37½

The quotations herein are our appraisal of the average markets for copper, lead, spelter and tin based on wholesale contracts for the ordinary deliveries of the trade as made by producers and agencies; and represent, to the best of our judgment, the prevailing values of the metals, reduced to basis of New York, cash, except where St. Louis is basing point.

The quotations for electrolytic copper are for cakes, ingots and wirebars. Electrolytic copper is commonly sold at prices including delivery to the consumers and is subject to discounts, etc. The price quoted for copper on "regular terms" (r.t.) is the gross price including freight to the buyer's works and is subject to a discount for cash. The difference between the price delivered and the New York cash equivalent is at present about 0.25c. on domestic business. The price of electrolytic cathodes is 0.05 to 0.10c. below that of electrolytic. Quotations for lead represent wholesale transactions in the open market for good ordinary brands. Quotations for spelter are for ordinary Prime Western brands. Only St. Louis price is given, St. Louis being basing market. We quote New York price at 17c. per 100 lb. above St. Louis.

Some current freight rates on metals per 100 lb. are: St. Louis-New York 17c.; St. Louis-Chicago, 6.3c.; St. Louis-Pittsburgh, 13.1 cents.

LONDON

Oct	Copper: Standard: Spot	Copper: Standard: 3 Mos	Copper: Electrolytic	Tin: Spot	Tin: 3 Mos	Lead: Spot	Zinc: Spot
12	123	118½	142½	180[illegible]	181½	30½	56
13	123	118½	143	18[illegible]	181¼	30½	56
14							
16	123	118½	143	179½	180	30[illegible]	54[illegible]
17	123½	119	143	178½	178[illegible]	30[illegible]	[illegible]
18	123½	120	143	178[illegible]	179[illegible]	30[illegible]	[illegible]

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2,240 lb. Copper quotations for electrolytic are subject to 3% discount. For convenience in comparison of London prices in pounds sterling per 2,240 lb., with American prices in cents per pound the following approximate ratios are given, reckoning exchange at 4.80. £1[illegible] = [illegible]; £[illegible] = 4.29c.; £30 = 6.43c.; £4[illegible] = 8.57c.; £[illegible] = 12.85c. Variations, £1 = 0.21½ cents.

PITTSBURGH—Oct. 17

The decrease of 137,773 tons in the Steel Corporation's unfilled obligations during September represents the fact that some of its subsidiary companies were almost entirely out of the market, having already sold ahead as far as they desired. Much more tonnage could have been booked had the obligations been desired.

The whole steel situation has continued to gain in strength, with no weakness appearing at any point. It is the common view that the steel mills will be under high pressure throughout 1918. Steel production is now at a heavier rate, weather conditions being exceptionally favorable.

The cruder materials are advancing, pig iron stiffening almost daily, while heavy melting steel is up to $19, an advance of $1.50 in a fortnight. Coke has advanced sharply and coal is bringing record high prices, these developments tending to strengthen further the steel market.

Pig Iron—All sellers are reserved and are looking for higher prices. We quote: Bessemer, $24; basic, $20; foundry, $20@20.50; malleable, $20; forge, $19.50, all f.o.b. Valley furnaces, 95c. higher delivered Pittsburgh.

Steel—There are still no regular offerings of billets or sheet bars at any price. The market is regarded as $45 to $50, as formerly.

Ferroalloys

Ferrosilicon—For 50% alloy $86@89 per ton at furnace is quoted. Advance to $100 expected. For bessemer silicon from $30 for 9% up to $41 for 10% at furnace.

Spiegeleisen—Ordinary 20% is $35@45 at furnace; high grade, 25@30% is $55@65 according to size and terms of order.

Ferromanganese—It is reported that one or two of the steel interests, usually making ferromanganese only for their own use, have sold for next year's delivery at $162. Price of the merchant sellers continues at $165, with imported at $165, with occasional shading.

Iron Ore

Of the Lake Superior iron ore shipments in September 7,871,851 tons went to Lake Erie ports.

Shipments of iron ore from Lake Erie docks in September were 4,937,462 tons. The tonnage on docks, Oct. 1, was 7,230,024 tons, being 755 962 tons less than last year.

Coke

Connellsville—Spot furnace coke has been advancing almost daily, consumers being short in receipts on contract and bidding higher and higher prices. Today a week ago a sale at $4 40 represented a new high price, but advances have continued, and last evening and this morning there have been perhaps half a dozen sales at $5.25. Absolutely authentic information has been obtained that two first-half contracts have just been made at $3.75, aggregating about 35,000 tons a month. The regular asking price is now $4. About three-fourths of the coke to be bought for first-half is now under cover, at prices ranging from $2.75 to $3.75. Foundry coke has been advancing in sympathy with furnace. We quote: Spot furnace, $5.25; contract, $3.75; spot foundry, $5@5.50; contract, $3.75, per net ton at ovens. The Pittsburgh coal market has experienced the greatest rise in the past week it has ever experienced in such time. Buyers are readily paying $3.25 for ordinary steam and $3.75 for gas coal, per net ton f.o.b. Pittsburgh district mine, for spot shipment. The car scarcity has grown acute.

Anthracite Shipments in September were 5,544,-676 gross tons, being 12,279 tons more than in August but 118,081 tons less than in September, 1915 For the nine months ended Sept. 30 the total shipments were 48,556,940 tons in 1915, and 49,930,416 in 1916; increase, 1,373,476 tons, or 2.8% this year.

Chemicals

NEW YORK—Oct. 18

Arsenic—Demand and supply about even, with prices unchanged at $6@6.25 per 100 lb., New York.

Copper Sulphate—Demand good and prices firmer at $12@12.25 per 100 lb., according to size of order.

Nitrate of Soda—Sales fair, with prices a little easier at $2.90 per 100 lb. for spot. Imports into United States seven months ended July 31 were 751,234 gross tons, an increase of 314,290 tons over last year.

Sulphuric Acid—Demand good, with market a shade easier, under sharp competition. Quotations $1 per 100 lb. for 60-deg.; $1.25@1.50 for 66-deg. acid.

Sulphate of Ammonia production in Great Britain is reported by the Inspector of Alkali Works for 1915 as follows: Gas works, 173,675 tons; iron works, 15,142; shale works, 58,826; coke ovens 145,406; producer gas, etc., 33,218; total, 426,267 gross tons, or only 155 tons less than in the preceding year.

STOCK QUOTATIONS

N. Y. EXCH.†	Oct. 17
Alaska Gold M.	12
Alaska Juneau	7
Am.Sm.&Ref.,com.	110¾
Am. Sm. & Ref., pf.	116¾
Am. Sm. Sec., pf. A	95½
Am. Sm. Sec., pf. B.	88
Am. Zinc	47¼
Am. Zinc, pf.	77½
Anaconda	93¾
Batopilas Min.	1⅜
Bethlehem Steel	546½
Bethlehem Steel, pf.	133
Butte & Superior	63⅝
Chile Cop.	21
Chino	54¾
Colo.Fuel & Iron	54
Crucible Steel	85½
Dome Mines	24½
Federal M. & S.	19
Federal M. & S., pf.	40
Great Nor., ore ctf.	43
Greene Cananea	51¼
Homestake	133½
Inspiration Con	64
International Nickel	52¾
Kennecott	52½
Lackawanna Steel	85½
Miami Copper	38
Nat'l Lead, com.	68¾
National Lead, pf.	115
Nev. Consol	22¼
Ontario Min.	6¼
Quicksilver	2¾
Quicksilver, pf.	3½
Ray Con	25½
RepublicI.&S.,com.	75¼
Republic I & S. pf.	112¼
Sloss-Sheffield	60½
Tennessee Copper	23½
U. S. Steel, com.	113¾
U. S. Steel, pf.	120¼
Utah Copper	94½
Va. Iron C. & C.	44

N. Y. CURB†	Oct. 17
Beaver Con.	.40
Buffalo Mines	‡1
Butte & N. Y.	1⅛
Butte C. & Z.	7¾
Caledonia	.58
Can. Cop. Corpn.	1 11/16
Cashboy	05
Cerro de Pasco	38
Con. Ariz. Sm	1¾
Con Coppermines	2⅝
Con. Nev.-Utah	.25
Crystal Cop.	1¼
First Nat. Cop.	4⅝
Florence	.72
Goldfield Con	61
Goldfield Merger	07½
Granite	40
Hecla Min	5
Howe Sound	5¼
Jerome Verde	2¼
Joplin Ore & Spel	50
Kerr Lake	4 11/16
Magma	17½
Majestic	52
McKinley-Dar-Sa	.60
Mother Lode	34
Nevada Hills	20
N. Y. & Hond	14¾
Nipissing Mines	7⅜
Oro	.03
Ray Hercules	3⅝
Rochester Mines	.58
St. Joseph Lead	18¾
Standard S. L.	1¼
Stewart	3/16
Success	.37
Tonopah	5⅜
Tonopah Ex.	4⅜
Tribullion	3/16
United Zinc	4½
White Knob, pf.	1⅛
White Oaks	4⅜
Yukon Gold	2¼

SAN FRAN.*	Oct. 17
Alta	.03
Andes	.11
Best & Belcher	.06
Bullion	.01
Caledonia	.28
Challenge Con.	.05
Confidence	.10
Cons. Imperial	‡.01
Con. Virginia	.11
Gould & Curry	.03
Hale & Norcross	06
Jacket-Cr. Pt.	.04
Mexican	13
Occidental	65
Ophir	17
Overman	‡ 06
Savage	.10
Seg Belcher	02
Sierra Nevada	.29
Union Con	.56
Utah Con.	.01
Belmont	4.50
Jim Butler	.92
MacNamara	.12
Midway	.22
Mont.-Tonopah	.21
North Star	.15
Rescue Eula	.21
West End Con	.67
Atlanta	.09
Booth	.10
C.O.D. Con.	.03
Comb. Frac.	06
D'field B.B.	.05
D'field Daisy	05
Jumbo Extension	.35
Round Mountain	.38
Sandstorm Kendall	.04
Silver Pick	.18
Central Eureka	.05
Argo	.08
Ariz. Central	.10
Big Jim	1.25
Lazy Boy	.06
Oatman No. Star	‡.14
Tom Reed	2.15
United Eastern	3.50
United Western	06

BOSTON EXCH.*	Oct. 17
Adventure	3½
Ahmeek	104
Algomah	1
Allouez	69
Ariz. Com., ctfs.	12⅛
Bonanza	.25
Butte-Ballaklava	2⅛
Calumet & Ariz.	75
Calumet & Hecla	570
Centennial	21
Copper Range	67⅛
Daly West	2⅛
East Butte	15
Franklin	8¾
Granby	91½
Hancock	13
Helvetia	.25
Indiana	3
Island Cr'k, com.	44
Island Cr'k, pfd.	90
Isle Royale	33¼
Keweenaw	6
Lake	13¼
La Salle	4
Mason Valley	4⅛
Mass	15⅛
Mayflower	2½
Michigan	4
Mohawk	93⅛
New Arcadian	6½
New Idria	14½
North Butte	20⅛
North Lake	1⅛
Ojibway	1¼
Old Colony	2
Old Dominion	70
Osceola	89
Quincy	89
St. Mary's M. L	86½
Santa Fe	2⅜
Shannon	9¼
Shattuck-Ariz.	29
So. Lake	5½
So Utah	25
Superior	15
Superior & Bost.	4
Tamarack	43½
Trinity	7
Tuolumne	.70
U. S. Smelting	72
U. S. Smelt'g, pf.	51⅛
Utah Apex	3 11/16
Utah Con	14½
Utah Metal	7¼
Victoria	4¾
Winona	5
Wolverine	46½
Wyandot	1¼

BOSTON CURB*	Oct. 17
Bingham Mines	9⅜
Boston Ely	76
Boston & Mont	.78
Butte & Lon'n Dev.	65
Calaveras	5⅛
Calumet-Corbin	02½
Chief Con.	2
Cortez	.35
Crown Reserve	.45
Davis-Daly	2⅜
Eagle & Blue Bell	1¾
Houghton Copper	1⅛
Iron Cap Cop., pf.	5⅜
Mexican Metals	.30
Mines of America	2¼
Mojave Tungsten	3¾
Nat. Zinc & Lead	.55
Nevada-Douglas	1 11/16
New Baltic	2½
New Cornelia	17
Ohio Copper	.18
Oneco	.80
Raven Copper	‡.07
Rex Cons	.27
Rilla	.11
United Verde Ext	38¾

SALT LAKE*	Oct. 17
Big Four	95
Black Jack	10
Cardiff	7 40
Colorado Mining	.15
Crown Point	.05½
Daly-Judge	7.95
Emma Cop	2 87½
Gold Chain	20
Grand Central	68
Iron Blossom	1 62½
Lower Mammoth	.05
May Day	.13
Opohongo	‡ 01½
Prince Con	1 30
Seven Troughs	‡ 03
Silver-King Coal'n	3 00
Silver King Con.	3.67½
Sioux Con	.16
So. Hecla	2.12½
Uncle Sam	.04
Wilbert	.06
Yankee	.18

TORONTO*	Oct. 17
Adanac	‡.25
Bailey	07¾
Chambers Ferland	17
Coniagas	4 90
La Rose	.57
Peterson Lake	.20
Right of Way	05
Seneca Superior	.09
T. & Hudson Bay	65.00
Temiskaming	61
Wettlaufer-Lor.	.11
Dome Exten	.31
Dome Lake	.60
Foley O'Brien	.70
Hollinger	6.85
Jupiter	.26
McIntyre	1.43
Newray	.60
Porcu Crown	.66
Vipond	.36
West Dome	.33

STOCK QUOTATIONS—Continued

COLO. SPRINGS	Oct. 17
Doctor Jack Pot	09
Elkton Con	13
El Paso	.40
Findlay	.03½
Gold Sovereign	.06
Golden Cycle	2.29
Granite	.74
Isabella	22½
Jack Pot	‡.05
Mary McKinney	.31
Portland	1.94
Vindicator	1.90

LONDON	Oct. 4
Alaska Mexican	£0 15s0d
Alaska Tre'dwell	4 0 0
Burma Corp.	4 7 6
Cam & Motor	0 10 9
Camp Bird	0 7 6
El Oro	0 9 6
Esperanza	0 11 6
Mexico Mines	3 17 6
Nechi, pfd	0 13 6
Oroville	0 17 6
Santa Gert'dis	0 12 0
Tomboy	1 1 6

* Bid prices. † Closing prices. ‡ Last Quotations.

MONTHLY AVERAGE PRICES OF METALS

Silver	New York 1914	New York 1915	New York 1916	London 1914	London 1915	London 1916
January	56.572	48 855	56.775	26 553	22.731	26 960
February	57 506	48.477	56 755	26 573	22.753	26 975
March	58 067	50.241	57.935	26 788	23.708	27.597
April	58.519	50.250	64.415	26.958	23.709	30.662
May	58 175	49 915	74.269	26.704	23.570	35.477
June	56.471	49.034	65.024	25.948	23.267	31.060
July	54 678	47 519	62.940	25.219	22.597	30.000
August	54.344	47 163	66.083	25.979	22.780	31.498
September	53.290	48 680	68.515	24.260	23.591	32.584
October	50 654	49 385	......	23.199	23.925	...
November	49.082	51.714	......	22.703	25.094	....
Dec.	49.375	54.971	......	22.900	26.373	. .
Year	54.811	49 684	....	25.314	23 675	

New York quotations cents per ounce troy, fine silver: London, pence per ounce, sterling silver, 0.925 fine.

Copper	New York Electrolytic 1915	New York Electrolytic 1916	London Standard 1915	London Standard 1916	London Electrolytic 1915	London Electrolytic 1916
Jan	13.641	24 008	60.756	88 083	65.719	116.167
Feb	14 394	26 440	63.494	102 667	*	133.167
Mar.	14.787	26.310	66.152	107.714	*	136.000
April	16 811	27.895	75.096	124 319	*	137.389
May	18.506	28.625	77.600	135 457	*	152.522
June	19 477	26.601	82.574	112 432	95.333	137 455
July	18.796	23.865	76.011	95.119	91.409	125.500
Aug	16 941	26.120	68 673	110 283	82.333	126 304
Sept	17 502	26.855	68 915	113.905	85.250	134 071
Oct.	17.686	....	72.601	.. .	88 000	
Nov.	18.627	......	77 744	...	93.273	... .
Dec.	20.133	......	80.773	......	100.430	. .
Year	17.275	......	72.532	....	....	....

Tin	New York 1915	New York 1916	London 1915	London 1916
January	34 260	41.825	156.550	175.548
February	37 415	42.717	176.925	181.107
March	48 426	50.741	180.141	193 609
April	47 884	51.230	166.225	199.736
May	38 790	49.125	162.675	196.511
June	40.288	42.231	167.636	179.466
July	37 423	38.510	167.080	168.357
August	34.389	38.565	151.440	169.870
September	33 125	38.83	152.625	171.345
October	33 080	....	151.554	.....
November	39.224	....	167.670	......
December	38.779	....	167.000	....
Av. year	38.590	....	163.960	....

Lead	New York 1915	New York 1916	St. Louis 1915	St. Louis 1916	London 1915	London 1916
January	3 729	5.921	3.548	5 826	18.606	31.167
February	3.827	6.246	3.718	6.164	19.122	31.988
March	4.053	7.136	3.997	7.375	21.883	34.440
April	4.221	7.630	4.142	7.655	21.094	34.368
May	4.274	7.463	4.182	7.332	20.347	32.967
June	5.932	6.936	5.836	6.749	25.170	31.011
July	5.659	6.352	5.531	6.185	24.611	28 137
August	4.656	6 244	4 520	6.088	21.946	29.734
September	4 610	6.810	4 490	6.699	23.151	30.786
October	4.600	..	4 499	....	23.994	...
November	5.155	..	5 078	. . .	26.278	... .
December	5.355	.....	5.266	. . .	28 807	...
Year	4 673	.. .	4 567	.. .	22.917	..

Spelter	New York 1915	New York 1916	St. Louis 1915	St. Louis 1916	London 1915	London 1916
Jan.	6.386	16.915	6.211	16.745	30.844	89 810
Feb.	8 436	18 420	8.255	18 260	39.819	97.762
Mar	8 541	16.846	8.360	16.676	44.141	95.048
April	10.012	16 695	9.837	16.525	49.888	99.056
May	14 781	14.276	14.610	14.106	68.100	94 217
June	21.208	11 752	21.038	11.582	100 614	68 591
July	19.026	8.925	18.856	8.755	97.250	50.750
Aug	12.781	8.730	12 611	8 560	67.786	51 587
Sept.	13.440	8.990	13.270	8.820	67.841	52.095
Oct.	12.800	....	12.596	.....	66.536	.....
Nov.	15.962	....	15.792	....	88 409	... ...
Dec.	15.391	....	15.221	.....	89.400	...
Year	13.230	......	13.054	......	67.553	....

New York and St. Louis quotations, cents per pound, London, pounds sterling per long ton. * Not reported.

Pig Iron, Pitts.	Bessemer‡ 1915	Bessemer‡ 1916	Basic‡ 1915	Basic‡ 1916	No. 2 Foundry 1915	No. 2 Foundry 1916
January	$14.59	$21.60	$13.45	$18.78	$13.90	$19.70
February	14.55	21.16	13.45	18.93	13.90	19 51
March	14.55	21.81	13.45	19.20	13.95	19 45
April	14.55	21.65	13.45	18.95	13.95	19 45
May	14.61	21.78	13.60	19.11	13.83	19.58
June	14.70	21.95	13.67	18.95	13.77	19.34
July	14.94	21.95	13.91	18.95	13.68	19.20
August	16.01	21 95	15.31	18 95	14.75	19.25
September	16 86	22.88	15.95	19.58	15.70	19.53
October	16.95	..	15.96	....	15 80	..
November	17.57	....	16.47	....	17.20	..
December	19.97	. .	18.44	.....	18.95	. .
Year	$15.82	......	$14.76	......	$14.95	......

‡ As reported by W. P. Snyder & Co.

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Graphite Industry in New York

By Robert W. Jones*

SYNOPSIS—Development of graphite mines has been fraught with difficulties due to lack of proper methods. However, 67,500,000 lb. has been produced since 1880. The major part of this output has come from the eastern Adirondack region. Graphite is found in veins, both in metamorphosed sediments and in igneous rocks.

The production of graphite in New York State, while never at a very high figure, has been remarkably steady, there having been only one year since 1880 when there was no output. During this period there has been produced from the New York mines a total of approximately 67,500,000 lb. with a reported value of $3,830,751, or an average of almost $0.057 per lb. Nearly this entire output has come from the eastern Adirondack region, covering an area extending north from Saratoga Springs to Crown Point and west about 15 or 20 mi. from the eastern boundary of the state.

In New York State the mining of graphite has generally been carried on under difficulties. The area is underlain with igneous and metamorphic rocks, folded and faulted to such an extent that it is extremely difficult to follow any individual bed or deposit for a distance. Over these formations there is found a deposit of alluvial materials varying in thickness, but in all cases making prospecting a difficult task. Another difficulty to overcome in prospecting is the presence of an extremely heavy underbrush. If the deposits were localized as to formations, the prospecting would be comparatively easy, but almost every formation here is known to carry graphite in more or less workable deposits. The deposits are found in great abundance. Many are of low grade, and in most cases those of commercial importance are held at too high a figure to make them profitable. At all the important outcrops transportation would cut into the cost of production to a great extent.

MAIN HAULAGEWAY IN GRAPHITE MINE, KINGS STATION, N. Y.

Ticonderoga First Center of Graphite Mining

Owing to the great abundance of graphite the deposits were brought to the attention of the prospector at an early date. Probably the earliest commercial enterprise of any size was that of the Lead Hill mines, a short distance northwest of Ticonderoga. T[illegible]

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*17 Magnolia Terrace, Albany, N. Y.

Ticonderoga as the center of the industry in the United States. The Lead Hill mines were worked by the Dixon company and produced a high-grade product for many years, until, because of mining conditions and a lowering of the grade of ore, the enterprise was transferred to the Lake Side mines at Hague on Lake George. This ore was of a different character, and on account of a difficulty in mining and in the disposition of tailings, the mines were abandoned. A large body of ore was opened up at Graphite, about 5 mi. west of Hague, and is now the largest producing graphite property in the state.

Mills Built before Development of Proper Milling Methods

During several years there was considerable activity in the graphite industry with a consequent increase in prospecting and in the promotion of graphite-mining corporations. The region to the west and southwest of Crown Point at Bear Pond, Clear Pond, Rock Pond, Buck Mountain Pond and Chilson Lake (Eagle Lake) was the center of this excitement and was thoroughly prospected, although with little knowledge of conditions as to the orebodies or the requirements of the finished product. Mills were erected at Rock Pond, Chilson Lake and Buck Mountain Pond. Transportation was difficult, and milling was undertaken before milling conditions were known. The mills are now in ruins and the mines abandoned. The next attempt of any magnitude was made near Porterville, Saratoga County, where a large concrete mill was constructed before an attempt had been made to open the mine. This mill was constructed on plans similar to the other abandoned enterprises, using stamps for crushing with separation in buddles. This enterprise differed in one condition from the others. There was an abundance of ore exposed in two parallel beds with ideal conditions for mining and milling. Financial affairs have kept this property in a nonproducing condition. At a short distance east of Porterville, near Kings Station, several attempts have been made to mine and mill graphite with ore similar to that at Porterville. This property has been taken over by the Graphite Products Corporation, of Saratoga Springs. A new mill has been constructed, the property has been opened by an opencut and through underground workings and at present is making a comparatively large output of high-grade flake graphite. A number of parallel graphite-bearing quartzite beds have been opened and with the present arrangements make excellent conditions for mining, milling and transportation of ore from the mine to the bins.

The ore bed that is being worked at present has a thickness of about 25 ft. The ore is sharply divided at the foot from the lower barren quartzites by a bed of clear quartz. The hanging wall is indefinite, the ore gradually passing out into a micaceous quartzite. A short distance north is found a large body of graphitic schist having at one place a thickness of over 50 ft. Farther to the north is found a small bed of what appears to be a high-grade graphitic limestone, although in milling it will not show the returns that are being made from the quartzites.

There are several grades of ore found in the Adirondack region. Graphite is found in veins, in metamorphosed sediments and in the igneous rocks. It is probable that the early output was made from vein material, as this showed as a coarser crystalline flake and attracted the attention of the early prospector. The output from the igneous rocks has not been very great. The metamorphosed limestones have made some output, although the milling returns from this class of ore have not been so great as was expected. This ore is deceiving. In hand specimens and in carload lots it appears as a high-grade ore. The flakes are large, some of them reaching a diameter of over 1½ in., but in milling it is found that the percentage of good flake is not high. Samples taken from what has been milling ore have seldom yielded, even in picked specimens, more than 3%. Of this amount about one-third will have a diameter of ¼ in. or more. The rest will average a little larger than $\frac{1}{16}$ in. One great difficulty in the milling of limestone ores is caused by the large amount of heavy minerals present of such size that it is necessary to crush fine in order to liberate the graphite, which is completely surrounded by or intermeshed with the other minerals in most cases. Outcrops of these ores occur at Kings Station, Chilson Lake, Ironville and Crab Pond.

The igneous rocks, which in most cases are pegmatites, yield a product somewhat like that from the limestones, except that the flakes are crowded together into thicker bundles. The mill return is about the same as from the limestones. This thickening of the plates makes a product for which there is not the demand that there is for the smaller free flake. While in most cases the pegmatites are more brittle than the limestones, yet with the presence of graphite the toughness of the rock is increased, making it more difficult to produce a commercial flake. No attempt has been made to work the igneous deposits on a commercial scale. These ores are exposed at Breeds Hill, Spuyten Duyvil Creek Valley and Crab Pond.

MILL OF THE GRAPHITE PRODUCTS CORPORATION, KINGS STATION, N. Y.

Graphite of Metamorphic Origin

The metamorphosed sandstones and shales are responsible for the entire commercial production of graphite from this district at present. These deposits are found throughout the graphite-producing area in great abundance, although not all of commercial value. Owing to the banded nature of the rock, milling is comparatively simple, although the presence of mica offers some difficulties to economical separation. The thickness of these deposits varies from a few feet to as much as 40 ft. with outcrops several miles in extent. Feldspar, being one of the main rock minerals, has in almost all the outcrops disintegrated to such an extent that the surface ore can be mined easily. This disintegration is due to the presence of sulphides. Pyrite and chalcopyrite are found throughout the ore in lens-shaped masses, having in some localities a thickness of as much as 2 in. and covering an area 4 or 5 in. square. At one locality an attempt has been made to save the chalcopyrite. The graphite content of the ore varies, reaching in a few exposures as high as 10%. The average is about 7%, figured on the recovery from the mill. Prominent exposures of this class of ore are found at Rock Pond, Bear Pond, Spuyten Duyvil Creek Valley, Graphite, Porterville, Kings Station and North Pond. These ores also outcrop between Lake Champlain and Lake George, west and northwest of Whitehall and extending as far north as Putnam Corners. Although it has high-grade ore in many localities, the Whitehall district has never made a success in the production of graphite.

The usual mining methods have been to follow the ore either by an incline or an adit. The property at Graphite is opened through an adit that has followed to a great extent the folding of the quartzite, resulting in a great variety of grades. On account of the low dip and thick orebodies, in most cases, it has been the custom to open side drifts with a slight incline and in an almost parallel direction with the main passageway. These are either with a fall or a rise toward the main line. In the case of a raise either electric power or mules are used for haulage. Crosscuts are then run between the drifts, leaving inclined pillars of ore for support. Owing to the presence of a solid and tough-bedded quartzite hanging wall, it is not necessary to use timber to a great extent. This method of mining has been carried on at the property of the Graphite Products Corporation, extending the inclines from the main haulageways through to the surface along the dip. The intention at this property is to cut the different parallel beds with one main haulageway, drifting along the bed both ways and mining through raises.

Milling methods are kept secret. In general there are two methods—one using stamps and the other rolls for crushing, preceded by jaw crushers. The rough treatment is given at the mine, and the product is then transported to the finishing mill. The Dixon mill at Graphite is equipped with rolls, although stamps were formerly used by this company. The output of the mine is approximately 175 tons per day. The Graphite Products Corporation mill is equipped with stamps. Ten are dropping at present. The intention is to add five more before long.

Mineral Output of Sweden

The official report of Swedish mineral production shows the following in metric tons:

	1914	1915
Iron ore ...	6,586,630	6,883,308
Coal	366,639	412,261
Gold ore ...	639	221
Silver - lead ore	3,100	2,671
Molybdenite	7	37
Copper ore..	8,839	10 549
Manganese ore	3,643	7,607
Zinc ore ...	42,279	55,937
Nickel ore .	156	1,642
Pyrite	33,313	76 324
Feldspar ..	20,818	12,105
Quartz	36,128	33,818
Graphite ..	56	87
Powdered pyrolucite	81	126

The production of iron ore from the Kirunavara deposits was reduced from 2,728,363 tons in 1914 to 2,076,512 tons in 1915 owing to the difficulties of shipping from Narvik on account of the war. The electrolytic production of zinc at Trollhattan was increased from 2,299,761 kg in 1914 to 8,588,381 kg. in 1915.

The metal production, with the exception of iron, was: Gold, 37 kg.; silver, 751; lead, 1,917,678; copper, 4,560,581; zinc, 8,588,381 kg.

Tribute to E. P. Mathewson

There is no mistaking the sincerity of the tribute that was paid to Edward P. Mathewson on Oct. 13, according to the Anaconda *Standard* when the officials, the superintendents and the foremen, and the whole army of employees gathered in front of the general office building to bid farewell to the manager, who is leaving for the East after 11 years of service. During this time he was the friend of every man in the Anaconda Copper Mining Co.'s employ, a confidential adviser always of each one in his work and interests, and a leader in coöperation to run the big plant at highest efficiency, and to make Anaconda better for the part everyone has played in giving his best to the effort for every public good.

It was a personal tribute in every way—to the personality of Mr. Mathewson, and personal on the part of everyone who made up the group assembled on the terrace. The cheers and the good wishes were given in one big volume, but each was expressing his feeling for himself and not merely as one of the throng. It was with dimmed eyes that the men dispersed after the parting scene, and few of them cared to dissemble their feelings.

There has been no such scene in Anaconda as Mr. Mathewson faced at 3:45 o'clock yesterday when Frederick Laist, metallurgical manager and lieutenant of Mr. Mathewson for many years of wonderful accomplishment, escorted him to the south door of the building. On the lawn and terrace were the men of the two shifts and of the other departments. The shift cars to the city had been held for the men coming from work, and furnaces had been banked so the men on the later shift could get away for a half-hour. The day-shift men had been let off a half-hour early so they could attend, and the employees of the foundry and other industries had been released even earlier so they could be present. The number was augmented by citizens who had motored to the works to share in a demonstration that so empathically expressed the sentiments of the community.

Members of the band had taken instruments and they played the national airs while the crowd was gathering.

Mr. Laist's Address

The exercises were brief as they were impressive. As the party stepped through the doors, Mr. Laist spoke as follows:

"Gentlemen: During all the years that Mr. Mathewson has been with us he has always been fair and considerate in his treatment of everyone. He has done more than any other man to make this smelter a better place to work in and Anaconda a pleasanter town to live in. We owe him a debt of gratitude for what he has done for us, and in token of our appreciation and of our regret at his departure we want to give him something to remember us by—something that will be [illegible] of our feeling toward him and something that will remind him of the great state in whose welfare he [illegible] an interest.

"Mr. Mathewson, on behalf of the local employees of the Anaconda Copper Mining Co., I take great pleasure in presenting you with this golden loving cup and this painting by Montana's great artist. The latter, particularly, we hope, will give pleasure to Mrs. Mathewson as well as to yourself—and in order that she may not forget us and may know how highly we all appreciate her many kindly acts, we desire to present her with these jewels. We hope that they will remind her of the happy years spent here whenever she wears them."

Mr. Mathewson's Response

Mr. Mathewson has made many a happy speech in Montana, but he never gave a better talk than he did yesterday, for the words were straight from his heart and went straight to the hearts of the men. So affected was he by the scene that for a time he could find no words at all, and it was only by a supreme effort that he could make any response. "I cannot tell you," he said, "what it means to me to say good-by to you. I hate to leave Anaconda, for the happiest days of my life have been spent here. I am leaving only because of the opportunity to learn some metallurgy that is new to me, and the chance is one that must not be rejected. I never had a better set of men with whom to work than I have had here, and I am leaving behind me the best men in the world in the best organization on God's green earth.

"One consideration that has prompted me to leave is that I can spend my declining years near my old home. I don't consider myself an old man yet, but I know I can't last forever. I have done all I can for Anaconda and have tried to be square with all of you. I know that you are my good friends, and I ask that you show it by giving my successor the same unwavering loyalty and devoted coöperation that has been given me by everyone."

The big throng joined in cheers for Mr. Mathewson and for Mrs. Mathewson as she waved her hand to them, and as they turned back into the office building the crowd dispersed while the band played "Auld Lang Syne."

The gifts to Mr. Mathewson, in which men of every department on the hill joined, are a magnificant solid-gold loving cup and a painting by Charles M. Russell, Montana's famous cowboy artist. The picture represents a vast herd of buffaloes fording the Missouri, while in the distance are seen the weird hills and buttes of its shores. It is a striking scene of the days that have become historic and is in the best style of the painter, whom it represents at the pinnacle of his art.

On the massive cup is engraved:

"Presented to
Edward Payson Mathewson
by his
Friends and Fellow-Workers
Anaconda, Montana
Oct. 14th, 1916."

To Mrs. Mathewson was presented a magnificant diamond lavalliere and diamond cluster ring, in platinum settings.

At Carpenters' Union Hall that night, Local No. 88 held a special session, at which Mr. Mathewson was a guest of honor and was presented with a solitaire diamond stickpin and receiving tray as a special tribute of the affection he has won from the carpenters. A. G. McLean was the chairman of the evening, and on the platform with him were seated Frederick Laist, L. V. Bender, H. S. Ware, W. N. Tanner and W. C. Capron. Mr. McLean referred to Mr. Mathewson as "the best member Local 88 ever had," and the packed hall rang with applause. Mr. Mathewson responded along the same lines as in the afternoon and with the same manifest emotion. Then a happy inspiration came from some member to demand that he give again a couple of the anecdotes with which the honorary member had regaled the meetings of the union in the past, and these brought the session to a close in the spirit of good fellowship that had been growing for years.

The Anaconda Gun Club presented Mr. and Mrs. Mathewson with a solid-silver tea set in recognition of the especial interest taken in the prosperity of the club and the advancement of the sport here under Mr. Mathewson's leadership and inspiration.

From the platform of the private car "Washoe" Mr. Mathewson on Oct. 16 waved au revoir to thousands of Anacondans who had gathered at the train to pay him a tribute that was a climax of the demonstrations in his honor.

The Actual Departure

He had been escorted from his residence to the train by the two bands, the business men and the school children in a long line of march. For everyone the honor paid was an expression of personal feeling. The members of the musical organizations had memories of the encouragement which Mr. Mathewson had given them from the first and the interest he has taken, especially in the concerts on the common during the summer and winter seasons alike. The schoolchildren were paying in part their debt of gratitude for the benefits realized from the playgrounds, institutions that constitute some of the many good works accomplished by him in his activity for Anaconda, and the business men felt that their presence would acknowledge in some degree what has been done to make the city busy, active and prosperous.

On both sides of Main St. the crowds had gathered in deep lines. The people followed the car to the depot, and as it stopped beside the train, they gathered around it for the words of farewell. The space between the station buildings and the park was packed by 6,000 or 7,000 people who had joined in the most spontaneous demonstration ever given in Anaconda. Mr. Mathewson was at a loss for words to respond, for the scene had fairly overwhelmed him. At last he spoke but briefly, though effectively: "I have always known Anaconda is the best place on earth," he said, "but not till today did I ever realize how good it is. For myself and my family I want to say that we have spent the happiest years of our lives here, in the best place where we have ever lived. And if anybody from Anaconda ever comes our way, the door will always be open; there'll not even be a latchstring to bother about pulling. I will not say good-by, for all of us will come back to visit Anaconda as often as it is possible. So the word will be only au revoir, and thank you for the outpouring in the name of friendship."

From the automobile to the train progress was checked by the large crowd of people assembled, and then the lines moved closer to the rear platform of the car, where Mr. and Mrs. Mathewson and their children stood until the train disappeared from view.

Copper Smelting at Naltagua in Central Chile

By Mark R. Lamb*

SYNOPSIS—Owing to uncertain supply and high price of coke, the blast furnaces at Naltagua will be superseded to a great extent by reverberatory smelting. The French company operating there has decided to install two reverberatory furnaces arranged for coal-dust firing; capacity is to be provided for crushing all ores so that they may be smelted in the reverberatories when this method is most economical.

The French company, Société des Mines de Cuivre de Naltagua, has been operating a number of years at its mines near El Monte, Chile, about one hour by train from Santiago.

The ores of the company mines are short of the sulphur necessary for obtaining a suitable matte fall, and this condition has forced the company into purchasing sulphide ores. It is the desire of the smelter superintendent to burn off as little sulphur as possible and to make as high-grade a matte as can be converted satisfactorily in the basic converters.

Some of the company ores, as well as some of the purchased ores, consist largely of fines, and this has been one of the problems that have lately been solved by the purchase of two reverberatory furnaces to use coal-dust firing. The coke and coal market in Chile has been extremely variable and a source of much worry to the smelters, coke having reached prohibitive prices and at times being unobtainable at any price. At present the supply as well as the price has improved from the point of view of the buyer.

Coal, though produced in the country and of good quality, cannot be obtained in sufficient quantities to meet Chilean requirements. This is entirely due to lack of modern mining equipments, as the coal seams are thick and easily mined and are practically at the seacoast, near transportation. Before the Chilean mines are properly equipped, it is likely that the transportation situation will be normalized sufficiently to permit competition of American coal. Already the price of coal has dropped, and it is likely to go lower, as the ships that come out for nitrate must come in ballast or bring some such freight as coal.

The Naltagua company, as well as its sister company, Catémou, has made a long-term contract for fine coal, for which there is little demand in Chile. This fine coal will be delivered at El Monte in railroad cars and sent thence in an aerial tramway to the terminus of a short steam railway which takes all such materials as coal, purchased ore and supplies directly to the smeltery, and returns with bar copper for export. The coal will be discharged into bins, whence it will be drawn through a rotary drier, to be then crushed in a "pulverator" and finally pulverized in a tube mill. Small quantities of this pulverized coal will be stored over the firing end of the reverberatory furnaces. A noteworthy feature of the installation is that the coal drier itself will be coal-dust fired.

COPPER SMELTING WORKS OF THE SOCIÉTÉ DES MINES DE CUIVRE DE NALTAGUA IN CENTRAL CHILE

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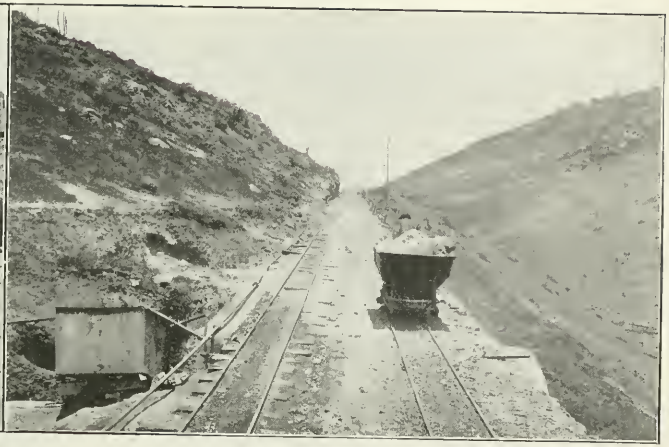
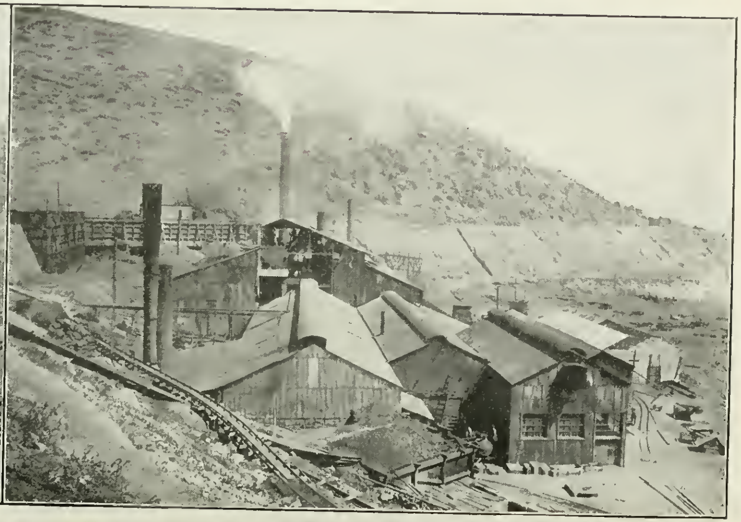
*Mining engineer, manager in South America for Allis-Chalmers Manufacturing Co., Santiago, Chile.

COKE AND ORE STORAGE AT EL MONTE



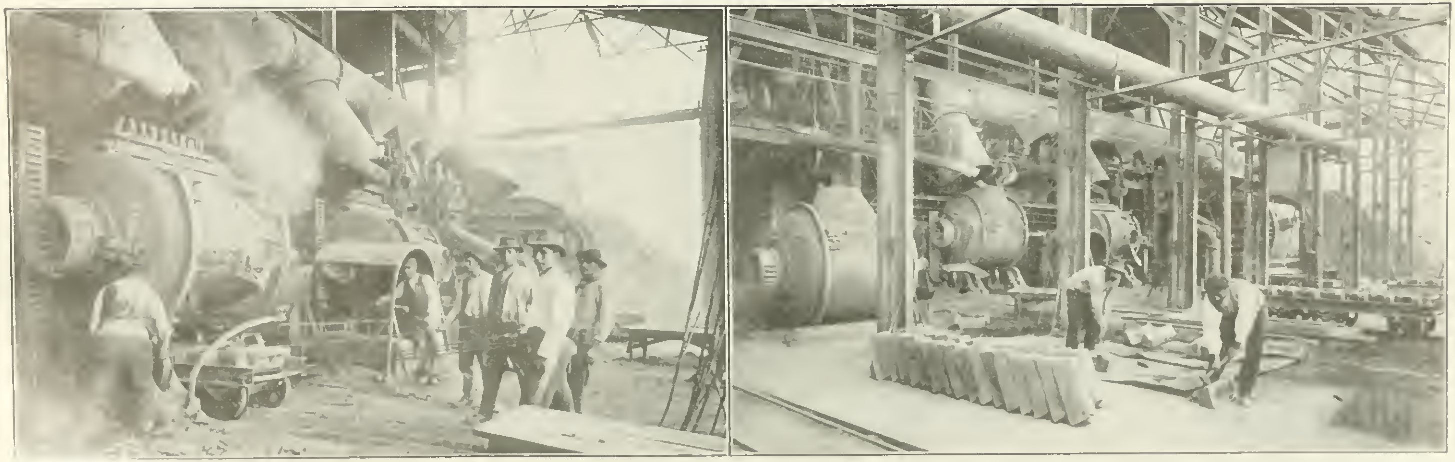
GRAVITY INCLINE TO SMELTING WORKS

STORAGE BINS AT WORKS



SIDE VIEW OF NALTAGUA SMELTING PLANT

FEED AND TAPPING FLOORS OF THE TWO 40x120-IN. BLAST FURNACES—REVERBERATORIES NOW BEING ADDED



THE CONVERTING PLANT OF THE NALTAGUA SMELTING WORKS IN CENTRAL CHILE—NOW USES BASIC LINING

The installation of these reverberatories provides a flexibility of operation that will result in important savings in operating expense. For example, when coke is high-priced, the reverberatories can be fed with a larger percentage of coarse ores, which, though more difficult to fuse, will be smelted more cheaply with low-priced coal in the reverberatories than with coke in the blast furnaces. When the conditions of fuel prices are reversed, the coarser ore will be sent to the two 40x120-in. water-jacket furnaces and only the fines to the reverberatories. Waste-heat boilers following the reverberatories will provide about 300 hp., which is half the present consumption, and as power at present costs them nearly 3c. per hp.-hr.. the saving will be important.

A good smelting mixture is obtained, because of the large offerings of ores from which the company can choose, and it is expected that a fuel ratio of 7 : 1 will be attained. The ores will be dried, as at times they arrive saturated, and it is figured that the evaporation of this water can be done more cheaply in a drier than in the reverberatory itself. At first the ores will not be crushed finer than 2-in. ring, but provision is made for crushing all ores fine enough for smelting in the reverberatories when the prices of coal and coke warrant it.

With the influx of American capital that has begun to reach Chile, there is going to be a keen rivalry for labor, and the cost of this is certain to rise. All the companies are taking the necessary steps to retain their present labor and attract the additional men required. This refers not only to common labor, but to the technical men on the staffs of the various companies, because men go where conditions are most agreeable. When the Anaconda plant at Potrerillos and Mr. Braden's new venture at Aguirre are in full swing, there is going to be a hard fight for labor, and the company that is broad-gage enough to build up an attractive camp is not going to be short of people. The Naltagua company has always had a good supply of labor; as quarters for the men and living expenses are low, the biograph and various sports serve to clinch the argument.

Copper from Chile now goes to the States exclusively, and this is resulting in the appearance of dollar exchange. I received yesterday, for the first time, a check on the Banco de Chile drawn in dollars and am advised that it has just been made possible to open a dollar account in that bank. This is a long step forward.

Platinum Production in 1915

The production of refined platinum in the United States was 8,665 troy oz., according to statistics compiled by J. M. Hill, of the United States Geological Survey. California and Oregon produced 741.91 oz., valued at $23,500, an increase of 171.91 oz. over 1914 production. Most of this came from California, the Oregon production being from only one mine. The Rambler mine, in Albany County, Wyoming, produced platinum-bearing copper concentrates. The world's production is estimated as 143,145 oz., of which Russia yielded 124,000 oz., Colombia, 18,000 oz.; United States, 742 oz.; New South Wales and Tasmania (the latter producing osmiridium), 303 oz., and Canada, 100 ounces.

The figures on the recovery of platinum and allied metals by metal refiners are not complete and are probably several hundred ounces below the actual production. They are given as follows: Platinum, 6,495 oz.; iridium, 274; iridosmine-osmiridium, 355; palladium, 1,541; as compared with 3,340, 64, 195 and 2,635 oz. respectively for 1914. Of the 8,665 oz. of refined new metals recovered, 1,587 oz. is believed to be of domestic origin.

An interesting feature of United States Mint practice in 1915 was the melting and spinning of platinum for use in Government laboratories. Since the law does not permit the payment for other than gold and silver contents of bullion, the rare metals derived from the modern electrolytic-refining process might be described colloquially as "velvet." In rare cases, where it is evident that a deposit of bullion contains platinum, the depositor is so informed and is at liberty to withdraw his deposit.

Potash in Salduro Salt Deposit[*]

By Hoyt S. Gale[†]

The salt deposit at Salduro, Utah, is described in the railway pamphlets as one of the scenic wonders of the Western Pacific R.R. route west of Salt Lake City. The name is that given to a small station and sidetrack established by this railroad 112 mi. from Salt Lake City on the main line westward, only a few miles east of the Nevada State line. It lies in the center of a broad, flat plain of glistening white salt, so smooth and hard on its surface that the place has been used as a track for automobile races by people from Salt Lake. The station has been the site of a small salt industry since the Western Pacific R.R. was completed and has lately attracted attention as a possible center of production of potash salts. Wendover, a freight terminal of the railroad, 9 mi. farther west, is a small settlement at which railroad hotel accommodations are available to travelers or visitors and from which the Salduro deposit may be easily reached by wagon.

The Salduro deposit has for some time been of local interest as a remarkable deposit of clean, pure-looking salt, especially as it lies immediately on the route of a main line of railway. The property has been covered by a group of claims owned largely by persons or companies in Salt Lake and Ogden, and the deposit has been more or less exploited by the Montello Salt Co., of Ogden, and later under lease by the Capell Salt Co., of Salt Lake City, as a source of salt.

AREA MORE THAN 100 SQUARE MILES

The deposit consists of a smooth white bed of solid crystalline salt that extends from east to west along both sides of the railroad from a point near milepost 811 (Salduro station is 815) to and considerably beyond milepost 818, a total distance of about 8 mi. According to reports the deposit covers more than 100 sq.mi. The salt forms a surface crust that is from 3 to 5 ft. thick in its thickest part, near the center, and thins off gradually toward the edges.

Naturally this deposit was one of the first to attract attention as a possible source of potash when, in 1911, after wide interest in potash had been created, the West was explored generally for deposits of potash salts.

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[*] Published by permission of the Director of the United States Geological Survey.

[†] Geologist, United States Geological Survey, Washington, D. C.

Reports of tests for potash made on the Salduro salt and associated brines were considered unfavorable, however, and interest in the deposit was confined to visits and sampling by private parties, who apparently all reached the same conclusion. I visited the deposit for the United States Geological Survey in the course of my regular field work in October, 1914, when I bored three shallow holes with a hand auger and took the samples here described. The analyses were made by R. K. Bailey in the Survey laboratory at Washington in November and December, 1914.

SAMPLES FROM HOLE NO. 1

[Site: ¼ mi. due south of Salduro (railroad signboard), on Western Pacific R.R.]

	Depth in Feet
Salt, hard (total thickness of the salt stratum here)	0 – 3.3
Clay, sticky saline (= sample No. 1 at top) somewhat mixed with broken salt crystals from overlying stratum (= sample 4 at depth 8.9 ft. and sample 5 at depth 12 to 12.2 ft.)	3.3–12.2

Brine from a depth of about three feet was collected from this hole after five minutes' pumping with a small hand pump and saved as samples 2 and 3 (duplicates).

SAMPLES FROM HOLE NO. 2

[Site: 1 mi. by measurement S 39° E from hole No. 1.]

	Depth in Feet
Salt, white crystalline, with some gray, muddy (= sample 6)	0 – 0.8
Salt, including muddy portions, to base of surface, salt stratum here (sample 7 is of cuttings from 0.8- to 3.2-ft. depths)	0.8– 3.2
Clay, gray, sticky, somewhat mixed with broken salt fragments from above	3.2– 4.2
Clay, as above (= sample 8)	4.2– 7.7
Clay, white to gray, but including hard, knotty portions of tufa-like material (= sample 9)	7.7–10.2
Clay, white, plastic	10.2–12.0

Brine from a depth of about three feet was collected from this hole after pumping and was saved as samples 10 and 11 (duplicates).

The brine in hole No. 2 stood 3½ in. below the surface level and, as in hole No. 1, flowed freely on pumping. In the course of the pumping a clean sand-like deposit came up with the solution and settled out in considerable quantity. It appears to consist of small, clearly defined crystals of gypsum.

At hole No. 3, near the old salt camp, just east of a small gasoline storage house which stood south of the set of three houses of the salt camp, the crust was very hard to drill, and the hole was not completed. Sample 12, taken here, was brine that flowed into this hole when it was 37 in. deep, before the salt crust had been entirely penetrated.

THICKNESS OF SALT DEPOSIT THREE TO FIVE FEET

The borings show that the crust near the center of the deposit is a surface layer of salt that reaches in places a thickness of 3.2 ft. Test borings at other places are reported to have shown a thickness of 5 ft. or more. The crust is underlain by a smooth white clay, and both salt and clay are permeated by a saturated brine, which in certain places flows freely.

Tests of the weight of the salt crust had been made by E. G. Rogers, who was for a time in charge of the work of extracting and shipping the crude salt from this deposit. By actually weighing a block measuring a cubic foot he found that 90 lb. might be taken as an average from which to estimate the quantity of salt available.

The analyses of the samples already described are given in the following tables:

The composition of the salt crust is shown by samples 6 and 7. Sample 6 was taken from the purer surface layer, 10 in. thick, and sample 7 was somewhat muddy salt taken from depths of 10 to 38 in.

Sample 6 is therefore a comparatively pure sodium chloride containing 95.39% NaCl, apparently no Na_2SO_4 and 4.08% $CaSO_4$ in the water-soluble part. Doubtless the insoluble portion was partly gypsum and partly mud

The soluble salts contained in the underlying layers are shown by the following analyses of test samples:

ANALYSES OF SAMPLES OF LOWER LAYERS AT SALDURO SALT MARSH

As Percentages of the Soluble Salts

	Hole No. 1			Hole No. 2	
	Sample 1, at Top of Salt Crust	Sample 4, at Depth of 8 to 9 Ft.	Sample 5, at Depth of of 12 Ft	Sample 8, at Depth of 4 to 8 Ft	Sample 9, at Depth of 8 to 10 Ft
K	2.25	2.64	1.82	2.36	3.48
Na	....	....	....	....	....
Ca	....	....	....	....	....
Mg	....	....	....	....	....
Cl	47.77	55.84	54.27	49.65	56.67
SO_4	13.86	3.65	5.41	13.14	3.55
CO_3	None	None	None	None	None
HCO_3	None	None	None	None	None

ANALYSES OF SAMPLES OF LOWER LAYERS AT SALDURO SALT MARSH

As Percentages of Original Sample

	Sample 1	Sample 4	Sample 5	Sample 8	Sample 9
Total soluble salts ignited	14.55	13.00	13.98	15.36	11.72
H_2O in original sample	6.01	5.79	5.12	5.93	6.75

The content of potassium in the salts in these muds is considerably higher than that in the purer salts, which are free of mud. The analyses therefore show the absorption of potash by clay, which is more clearly shown by detailed work done on the muds of Columbus Marsh,

SOLUBLE PORTION, IN PERCENTAGES, OF SAMPLES 6 AND 7

	Sample 6	Sample 7
K	0.07	0.25
Na	36.85	33.30
Ca	1.20	4.72
Mg	0.10	0.21
Cl	58.90	50.51
SO_4	2.88	11.01
CO_3	None	None
	100.00	100.00
Total soluble salts (ignited)	96.20	52.22

and here, as there, it seems extremely doubtful whether any commercial importance can be attached to the small percentage of potash salts found particularly as they are mixed with a heavy plastic mud which would be extremely difficult to handle.

ANALYSES OF BRINES FROM SALDURO SALT MARSH

As Percentage of the Dissolved Salts

	Hole No. 1, Sample 2	Hole No 2, Sample 11	Hole No 3, Sample 12
K	3.18	4.01	2.85
Na	33.78	Not determined	Not determined
Ca	0.30		
Mg	1.70		
Cl	59.60		
SO_4	1.44		
	100.00		
As Percentage of the Original Sample			
Total soluble salts ignited	26.78	25.68	26.85
Specific gravity	1.211	1.206	1.211

The potassium content of the samples of brine ranges from 2.85% to 4% of the dissolved salts, or 0.76% to 1.03% of potassium in the original solution, which is saturated with this and other salts. This is about one-half the potassium content of the Searles Lake brine (analyses show 2.07 to 2.17% potassium in the original solution at Searles) but double the potash content of the water of Great Salt Lake (0.34% potassium in the sample of October, 1913), which, however, is not usually a saturated solution.

If, as has been reported, potash can be successfully recovered from the waters of Great Salt Lake, either as a byproduct or directly as a principal product under present market conditions, it is of course possible that the Salduro brine and many other brines of the Western desert basin regions might also be worked. Though there is undoubtedly a great quantity of brine in the area it

Salduro, yet it does not, as at Searles Lake, constitute so large a part of the saline deposit, and as the salts at Salduro are so much shallower and the underlying clays so much less permeable to water solutions, the total quantity available must be correspondingly smaller.

Manganese Ores of Bukowina[*]

The author visited the manganese-ore deposits of the Dorna Vatra district of Bukowina province, Austria-Hungary, toward the close of 1913. The orebodies are situated on the slopes of the Carpathian Mountains, near the Roumanian frontier. The principal deposit is that of Arschitza, 3 km. to the southeast of the village of Jacobeni. Others, known as Orata, Oitza, Kilibaba, Putchos and Valaputna, occur to the north of Jacobeni; and Theresa, Rosch and Sara Dorna lie to the south, near the Roumanian frontier.

The district is well wooded and mountainous, and from 800 to 1,300 m. above sea level. Highways are excellent, and the district is connected with the Austrian steel works by a standard-gage railroad to Hatna, where it joins the main line between Lemberg, Czernowitz and Bucharest.

The ore occurs chiefly in silicious mica schists, in lenticular bodies of oxides of manganese and iron up to 100 m. long and 40 m. wide. The general direction of strike is northwest to southeast, and the dip varies from 20° to 50°. At Arschitza and Argestru, near Jacobeni, three principal lenses had been developed. The deposit consists of a mixture of pyrolusite, some hausmannite, brown hematite and quartz. The combination is called *Schwarzeisenstein* (black ironstone.) At Oitza the deposit is built up of beds 0.1 to 2 m. thick of grayish green to flesh-colored rhodonite with interspersed portions of rose-colored manganese spar (rhodochrosite?) and quartz and layers of a yellowish green mica hornblende schist. A piece of mineral from the lower levels at Arschitza and of the type locally known as rhodonite proved on analysis to consist essentially of the carbonate rhodochrosite. Analyses of some samples taken at Arschitza show the manganese to vary from 33 to 39%; iron, 8 to 14%; silica, 12 to 22%; phosphorus, 0.3 to 0.5%. After deduction for mineral already excavated and assuming that only 25% of what remains may be merchantable ore, it is calculated that over 150,000 tons of mineral could be mined above the 100-m. level in the Arschitza deposit; giving an output of 50,000 tons per annum for three years without taking into account the quantities of oxide and carbonate which could be proved at lower levels.

Early mining operations were conducted by opencut. Then crosscuts were run from the surface to the orebody, and the mineral was extracted without any prearranged plan or regular filling. Later, overhand stoping was introduced and was in use at Arschitza in 1913. Crosscuts were driven into the mountain side at vertical intervals of 30 m. or less, and ore extracted by making rooms to a height of 2.5 m. in parts of the orebody containing merchantable ore. Low-grade ore was used for filling, through which timbered raises were carried and successive slices of the mineral were extracted. The average cost of mining for seven years had been about $1.90 per ton.

The ore-dressing plant, 1¼ km. north of Jacobeni station, was operated by power from the river Bistritz. The equipment consisted of rolls, trommels and jigs, one section operating on fines and the other on lumpy material. The average cost of washing the ore, from 1906 to 1912 inclusive, appeared to be 1.5 kr. (about 30c.) per ton of run of mine.

The average of official analyses of mine product showed dry ore to contain 30.30% Mn and 0.34% P. Two principal grades of washed product were obtained, carrying 44.8% and 41.90% Mn respectively; the average of analyses showing 42.90% Mn, 12.06% Fe, 7.20% SiO_2, and 0.41% P. The daily output of these two grades was 42 tons, or 35% of the total rock handled, and the balance consisted of 45 tons of "manganese waste" carrying about 27.90% Mn, 23 tons of "manganese mud" carrying about 28.2% Mn and 10 tons of discarded waste; everything but the latter was sold. In 1913 the average cost of product was $2.62 per ton. The average selling price was $2.21, showing a loss of 41c. per ton.

The deposits, while perhaps of no great importance in normal times, are believed to have been of great value to Austrian steel works from the time the Russian troops were forced out of the Bukowina until June, 1916, when that province was again occupied by the Russians.

Safety-First Medals Plus Cash Bonuses

The Joseph A. Holmes Safety Association, organized to perpetuate the memory of the late director of the United States Bureau of Mines, has evolved a plan that should yield some quick and valuable results. It has resolved:

1. That annually there be awarded one or more medals, with honorariums, to be known as the Holmes Award for the encouragement of those originating, developing and installing the most efficient safety-first devices, appliances or methods in the mineral industry during the previous year. These awards to be the result of reports and investigations by the secretary and the representatives of the association.

2. That once a year a meeting will be held in the City of Washington at which these awards will be made and to which the recipients will be invited, the awards being announced publicly at a dinner or meeting which may be held at the time of the annual meeting of the representatives of the societies making up this association.

3. That the executive committee, at its discretion, may make awards of suitable medals for personal heroism or distinguished service or the saving of life in any branch of the mineral industry, such medals being of small intrinsic value, but suitably inscribed with the name of the recipient and the nature of his service. These medals to be presented publicly, with appropriate ceremonies, through the medium of the field representatives of the Bureau of Mines or other suitable agency at the mining camp, town, village or city nearest the mine, smeltery or other establishment in which the act of heroism or service was performed.

Like all good works that require the expenditure of money, this movement will be limited only by the extent of the generosity of the public. More than 20 national societies, labor organizations and Government bureaus are represented in this association; but subscription blanks may be obtained from the secretary of the Joseph A. Holmes Safety Association at Washington.

* * *

Sheet Mica Production in 1915, according to the U. S. Geological Survey, was less in quantity than in any of the 12 preceding years, but the value is the highest recorded. The average price per lb. was 68c., as compared with 50c. in 1914, 21c. in 1913, and 11c. in 1910. The total value of all mica, sheet and scrap, produced in the United States in 1915 was $428,769; exceeded only in 1913, when the value was $436,060. Of the 553,821 lb. of rough-trimmed and cut mica produced, North Carolina supplied 281,074 lb. or about 51%; and of the 3,959 tons of scrap mica, 2,840 tons, or about 72% came from North Carolina. The remainder of the production was from New Hampshire and eight states of less importance.

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[*] Abstract of paper by Herbert K. Scott, Iron and Steel Institute, London, Sept. 21-22, 1916.

Rich Gold Ore Found in Idaho

By Robert N. Bell*

SYNOPSIS—The finding of bonanza gold ore in the working of the Boise-Rochester company and the solution of the metallurgical difficulties of the Altanta Mines Co. have brought Idaho gold mining into greater prominence. The metallurgical accomplishments, while not so sensational, are more conducive to the permanence of the district as a gold producer. Amalgamation recovers 25% of the gold. Concentration, roasting and leaching bring the final recovery to 92%, which gives a good profit on the ore available. Of the silver content, 70% is recovered.

The recent gold-ore discoveries made on the property of the Boise-Rochester Mining Co., in the Atlanta district, 80 mi. east of Boise City on the middle fork of the Boise River, are of unusual interest by reason of the high contents of the ore disclosed and the environments in which it has been found.

Other developments and advancements of the past year in the Atlanta Mining district, however, especially in the matter of ore treatment, are of more real importance than the bonanza ore, which, while of a sensational nature and fully confirming the romantic stories of the early-day production of rich ore from this district, as far as is now known may only be of transitory interest; but the milling-ore development and the ore-treatment demonstrations recently made practically insure that an old gold camp can come back, and in this instance, I believe, remain as an important gold producer of considerable capacity.

The geology of the Atlanta district is covered in an old bulletin entitled "A Geological Reconnaissance Across Idaho," by George H. Eldridge, which was published in the Sixteenth Annual Report of the United States Geological Survey. As stated, this district is 80 mi. east of Boise and about the same distance northeast of Mountainhome, both on the Oregon Short Line Ry., and is connected with both points by good wagon roads over which daily auto stages and light motor trucks serve the district. This road, via the noted old gold camp of Rocky Bar, crosses a high divide at an elevation of 8,000 ft. and is closed to vehicular travel for nearly six months of the year. The Boise River road from Boise City by way of Arrow Rock Dam, is only passable for light rigs, but is on a water grade all the way and would make the camp much more accessible with improved wagon road construction.

Developments on the Atlanta Lode

Atlanta is situated well within the great eruptive granite batholith of central Idaho, 40 or 50 mi. from its nearest contact lines of overlying ancient sedimentary formation. The entire surrounding region is siliceous gray granite or quartz monzonite extensively intruded by dikes of igenous rocks up to 200 ft. in width, including fine to coarsely crystalline quartz porphyry and quartz-bearing syenite porphyry, together with some smaller dikes of greenish-black diabase rock. The central feature of the district's mineralization is the great Atlanta lode, which has been compared in power and persistency, by some of the older authorities, with the Comstock Lode and other noted ore courses of the west.

This lode starts at what I believe to be a persistent north-south fault marked by the course of Montezuma Gulch and a line of mountain saddles. It strikes S 70° W, is nearly vertical with a dip of 10 to 15° to the southeast. This lode is entirely covered at the surface with disintegrated granite débris except for a segment of about 1,000 ft. on the point of the highest apex. It forms the axis of Atlanta Mountain, a terminal spur of the Sawtooth Range, two miles distant and about 2,000 ft. vertically above the town of Atlanta, which is situated on the middle Boise River at an elevation of 5,500 ft.

From Montezuma Gulch the lode has been opened at short intervals along its course for 2½ mi. to the Yuba River, beyond which its course has not been determined. For ¾ mi. along the course of this great lode it has been extensively stoped, drifted and developed. The deepest point of penetration is on the Monarch mine, which consists of a vertical shaft 600 ft. deep with six well-developed levels, the bottom east level having a face depth of approximately 1,000 ft. under the highest crest of the lode. The lode is a strong fault fissure from 50 to 150 ft. thick between well-defined talc gouge walls, slickensided and deeply grooved in several directions. Its matrix consists of a severely crushed and brecciated granitic gangue and in the limited outcrop exposed shows an irregular stockwork of crystalline quartz seams with wall bands varying from 5 to 20 ft. thick of decidedly shattered bluish quartz. The blue color is due to the presence of finely disseminated ruby silver and mixed sulphide minerals including iron, lead, zinc, copper, antimony, arsenic, argentite and native metals of both gold and silver very finely divided and affording a concentrate representing about 2% of the volume of the ore.

This lode was made famous in the late 60's by the shipment of crude silver-gold ore which the old smelter-return record books show ranged from $800 to $1,000 per ton. These high results were largely due to secondary silver minerals and were principally derived from the shallower levels of the Buffalo and Monarch mines, with smaller shipments from the Pettit, Last Chance, Minerva, Big Lode and Tahoma mines.

The Vein System at Boise-Rochester

Striking across the Atlanta lode with a course N 70° W, there exists a close-set system of steep parallel fissures along which the Big Lode, Tahoma, Last Chance and Minerva mines were the most important producers. This subsidiary system of closely parallel veins at almost 300-ft. intervals contains some good values, but the orebodies are less persistent with two or three exceptions than in the main lode. They give the general appearance of being older than the lode and are probably faulted by it, but that feature is not fully determined.

An extremely interesting phase of the mineralization on the main lode in its deepest workings on the Monarch mine, is the persistent occurrence of a small black dike of diabase accompanying the main ore course, which is built on both walls of the dike and gives the appearance of being later than the black-dike intrusion which may have been the germinating cause of the ore occurrence, as I have pointed out in several other important instances in Idaho mine development. A similar small basic dike has recently been disclosed in the best lower level stopes of the Boise-Rochester company.

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*State mine inspector, Boise, Idaho.

The deepest development on the main-lode ore course still shows occasional patches of high-grade ore. The ore upon which an important tonnage can be figured is of about $10 per ton value and shows a decided increase of gold in proportion to silver as depth is attained, having a present ratio on the Monarch development of about three-fourths gold and one-fourth silver in the total contents. Toward the east end of the lode the ratio of gold to silver on the Boise-Rochester property has always been higher and will average 9 to 1.

The entire length of the main lode as originally outlined is covered by the patented properties of the Boise-Rochester Mining Co., the Atlanta Mines Co. and the Atlanta Gold and Silver Mining Co.

Bonanza Ore Development at Boise-Rochester

The Boise-Rochester Mining Co.'s property extends from the east end line of the old Monarch group for 2,700 ft. to Montezuma Gulch, where the lode is believed to be abruptly terminated on a big fault, as the texture of the granite northeast of this gulch is entirely different and other topographical features indicate a fault at this point. This property represents a reorganization of the Bagdad-Chase company holdings. This latter company was a former extensive operator in San Bernardino County, Calif., and about ten years ago purchased the Pettit group of claims, which at that time had an extensive development of $10 ore aggregating about $1,000,000 in gross value at the extreme western end of the group adjoining the Monarch showings.

The property was equipped with a 40-stamp mill and an aërial tramway one mile long. The ore proved decidedly difficult to treat, as only half of its content was amenable to plate amalgamation and the methods then in vogue, of concentration and cyaniding the concentrates, gave decidedly unsatisfactory results. The enterprise failed to pay a profit and was shut down several years ago and left in the hands of a caretaker. A little over a year ago a privately owned half-interest in the extreme east end claim was combined with the Bagdad-Chase property and a reorganization accomplished under the present name.

As a result of the development by intelligent concentrated annual assessment work on these claims in the lowest adit tunnel at the east end of the group, an entirely new shoot of ore was discovered carrying excellent mineral that varied from $4 to $20 per ton and averaged around $12 per ton. The mill was overhauled, new motors installed, and put in operation to the extent of 20 stamps, and for the past year it has been treating about 100 tons of ore a day from this new shoot, which proved to be 500 ft. long and from 5 to 15 ft. wide. At a distance of 100 ft. above this lower adit, while stoping up on this orebody, a flat fault was encountered which displaced the ore course to the south at a horizon of about 10 ft. below another old crosscut adit higher up the mountain.

After recovering the vein above this fault displacement, it was found to contain some extremely high amounts of gold. It has now been drifted on for 300 ft. to a face depth of about 180 ft. and shows for that distance a practically continuous pay course of bonanza value that varies from a mere seam up to 10 in. thickness containing material of better than $1,000 a ton in gold with selected hand specimens disclosing bands of native metal as much as ½ in. thick. The vein on this level varies up to 15 ft. in width of talcy granitic gangue with irregular black bands of gouge material, a subordinate quantity of crushed quartz and occasional segregations of calcite crystals and siderite crystals, the latter a definite evidence of good gold values, and fortifies the belief of the origin of the minerals in a basic end phase of the granite magma.

The richest specimens are definitely associated at this point on the lode with a soft greasy looking noncrystalline black mineral that was thought to be petzite, a telluride of gold and silver, but the company's assayer found no reaction for tellurium and a more detailed study of this particular mineral by A. G. Van Eman, a Boise chemist, has determined it to be a complex lead mineral, sulphantimonide and sulph-arsenide of lead, containing fully 50% lead. It shows no crystal form, and it is interesting to note that some of the richest specimen ore occurs on a decided movement plane in the vein and is polished like a mirror as it comes out of the vein, the native gold occasionally showing through the polish in the black mineral. It is barely possible that this high-grade ore may be localized to a few feet above the horizontal fault in the vertical vein; however, it ranges along the vein from the portal of the new adit tunnel to a face depth of nearly 200 ft., and a narrow diagonal fissure a few inches thick containing $600 per ton is now being drifted on from the foot-wall side of the lode toward the course of this new ore channel at a point 400 ft. farther west on its strike and under the fault. These conditions combine to indicate considerable lineal extent and depth to this high-grade mineral, and from present appearances the discovery should result in the shipment of several carloads of bonanza ore besides affording a continuation to the surface of the large milling-ore shoot shown and of much better grade than previously handled.

The old Bagdad-Chase company had entirely lost faith in the enterprise, and the new developments and operations are to be credited to the faith of local operators and local capital and particularly to the present manager of the property, Leo J. Falk, a young business man of Boise, who was personally concerned in the original transfer of the property. The present company has carried on extensive experiments in an effort for better recovery of values by fine-grinding and cyaniding the concentrates raw at the milling operations, has made considerable progress along this line and is now experimenting with flotation under the direction of George J. Wyman, Jr.

The Atlanta Mines Co.

The most important advancement of the year in this district, exceeding in permanent value the rich ore disclosure on the Boise-Rochester property, has been made by the manager of the Atlanta Mines Co. This property embraces 2,200 ft. of the main lode to the west of the Boise-Rochester and includes the most important area of the old-time development and production of the district, when it was extensively mined under the separate enterprises known as the Monarch, Last Chance and Buffalo mining companies.

These properties were acquired and consolidated by T. N. Barnsdale, of Pittsburgh, Penn., during the Thunder Mountain boom of 14 years ago and have since been lavishly supplied with capital for mining, development and milling equipment. During these years the enterprise has been in charge of Daniel Kirby, an experienced Colorado mining operator who has developed a large amount of primary milling ore, estimated at fully 500,000 tons of about $10 a ton ore.

While developing the old mines to greater depth, Mr. Kirby has employed some of the best metallurgical talent available in several specific attempts to treat the ore on the ground, but has been unsuccessful beyond an extraction of 40 to 50% of the contents. These milling efforts embrace amalgamation, fine concentration and cyaniding, succeeding the old pan-process methods employed in the early days, which proved too expensive on the primary ores available. These efforts have resulted in the accumulation of a milling plant of 150 tons daily capacity which, within the past year, has been turned to excellent account by a local metallurgist, Marcus White, of Silver City, Idaho, who in conjunction with Mr. Kirby is now operating the property under lease on dump ores and making a big success in extracting the low-grade contents available.

Metallurgical Difficulties Overcome

On the various old shaft and tunnel dumps that represent the accumulation of low-grade ore from which the high-grade shipping and milling ore has been carefully picked, this property carries at the surface 200,000 tons of mineral which, on elaborate sampling tests, shows an average of between $4.50 and $5 per ton in gold and silver in a ratio of about ¾ gold to ¼ silver. This extensive resource of mined mineral is now being treated at the rate of 130 tons a day. It is taken from the various dumps by a system of gravity and dragline haulage to the main aërial tramway head, which connects with the mill on the Boise River two miles below and affords an average mill-feed value of $4.50 per ton.

The method employed is grinding the ore in four 5-ft. Huntington mills with a combined capacity of 120 tons a day. The pulp is discharged through 30-mesh screens onto copper-plate amalgamation tables which recover 25% of the contents as free gold. The mixed sulphides are then recovered on Johnson vanners at a ratio of about 60 tons into one and assay from $120 to $150 per ton in gold and silver. These concentrates are then roasted in an Edwards mechanical-rabble furnace 90 ft. long with a 7-ft. hearth. 3% salt is added for chloridizing the silver, and after a dead roast with cordwood fuel, the sulphur and arsenic contents are reduced to a small fraction of 1% and the roasted concentrates leached in an 8-lb. cyanide solution, resulting in an extraction of 92% of the gold and 70% of the silver in the concentrates, at a total cost, for this separate treatment, of $7 per ton of concentrates, or 11½c. per ton on the original mill feed. This is the most complete recovery of values that has ever been attained in the Atlanta district and at a lower cost and is a great credit to Mr. White's metallurgical ability in solving a serious problem of ore treatment that has stood as a bar to the profitable utilization of the extensive ore resources that the Atlanta lode mines have been known to contain for years. Given a modern crushing plant at the head of this mill, of the Hardinge or Marathon type, for fine grinding and flotation cells for closer concentrating work, which could be installed at a moderate cost, Mr. White believes he can increase the capacity of this plant to 300 tons per day and make a recovery of metal on the deep-level ore resources of the property similar to what is now being made on the low-grade dump material available, which is being handled at a handsome margin of profit at this time; and it seems likely, from present demonstrated results, that the Atlanta Mines Co. may be shortly transformed into one of the important gold producers of the west and that Mr. Kirby's and Mr. Barnsdale's faith in the deposits of the district will be amply justified with profit-sharing results.

The recent mining development on this property has been intelligently handled, with an elaborate system of daily sampling, mapped, disclosing bodies of mineral up to 40 ft. in thickness of $8 to $10 ore that gives manifest evidences of the basis of a big gold-producing operation of lasting character.

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Secondary Metals in 1915

The quantities of metals recovered in 1915 from scrap metal, sweepings, skimmings and drosses have recently been reported upon by J. P. Dunlop, of the United States Geological Survey. His report gives the estimated production of secondary copper, zinc, lead, tin, antimony and aluminum, the total value of the recovery amounting to more than $114,000,000, exclusive of the value of old iron, steel, platinum, nickel, gold, silver and other metals. According to this report, it is not the large manufacturer, but the individual housekeeper and the small tradesman who are responsible for the opinion that the inhabitants of the United States are the most wasteful in the world. As an example of metal waste which appears small and unimportant, it is stated that probably not one-tenth of the tin or other foil made is ever re-used, though such foil can be made only from the purest metal.

In 1915 dealers, smelters and refiners handling waste metals were more prosperous than ever before. Many consumers, who formerly had always used virgin metals, found it necessary or advisable to buy scrap material. The result was an increased demand for the latter and also some improvement in methods of handling so as to obtain a higher grade of product.

Assuming that remelted brass had an average content of 70% copper, the total recovery of secondary copper was 196,187 tons, of which 29,787 tons was recovered by plants refining primary metals and the balance by plants treating only secondary materials.

The reports show that the railways utilized in their own shops and foundries more than 13,000 tons of brass, in addition to 850 tons of copper and 4,750 tons of copper in alloys other than brass.

Secondary lead recovered in 1915 amounted to 78,900 tons. The total increase over 1914 was about 17,800 tons, and that of lead in alloys more than 10,700 tons, the increase being ascribed to expansion in railroad traffic and manufacturing.

Secondary zinc, including that in brass, amounted to 92,575 tons in 1915, being equal to 19% of the prod[illegible] of primary spelter in the United States.

Secondary-antimony production increased from [illegible] short tons in 1914 to 3,102 tons in 1915, all [illegible] being recovered in alloys.

Secondary tin recovered in 1915 was equal to about 24% of imports as metal or oxide, being 13,650 tons as compared with 12,447 tons in 1914. The metal recovered as tin was 5,250 tons and that in alloys and chemical compounds, 8,400 tons. The latter includes the tin content of products made from clean tinplate scrap, consisting mainly of tin chloride with some oxide, etc.

Secondary-aluminum recovery in 1915 amounted to 8,500 tons, as compared with 4,522 tons in 1914. Of this 2,800 tons was recovered in alloys, mainly of 92% aluminum and 8% copper. The increase in quantity of secondary aluminum in 1915 is said to be due to the use of old castings in automobile manufacture.

Recent Labor Legislation

Walker D. Hines, chairman and general counsel of the Atchison, Topeka & Santa Fe Railroad Co., addressed the annual convention of the Investment Bankers' Association of America, Oct. 4, on "The Needs and the Opportunity of the Railroad Situation." In this address he gave an excellent and concise summary of recent events and legislation that have led up to the present dangerous situation in the economics of the United States. Mr. Hines said:

> In July, 1914, the locomotive engineers in the territory west of Chicago and the Mississippi River made demands for increased wages and more favorable working conditions. The railroad companies made counter demands for the modification of various working conditions which they regarded as unreasonably favorable to the engineers. The railroad companies offered to submit both sets of demands to arbitration under an act of Congress which had been passed the year before with the approval of the railroad brotherhoods. The engineers refused to arbitrate the demands made by the railroad companies and said they would strike unless the arbitration was confined to their own demands. President Wilson intervened and urged the railroad companies to avert a strike by confining the arbitration to the points which the engineers were willing to arbitrate. The railroad companies, out of deference to the President, yielded to this unreasonable position. Here the country was face to face with a railroad strike which threatened to tie up transportation throughout the West; the arbitrary position of the railroad brotherhood was clearly disclosed; and the support which that position received paved the way for still more arbitrary action in the future.
>
> But despite this impressive warning as to the arbitrary methods of the brotherhoods and as to the resulting public menace, Congress took no action to protect the public. On the contrary, about two months later legislation was adopted which seemed designed to remove the lid entirely and to give railroad unions and other unions still more power and to make the nation still more defenseless. This legislation was the Clayton act, which was approved by the President on Oct. 15, 1914. Sections 6 and 20 of that act were inserted by way of compliance with the demands of the labor unions. Section 6 may be construed to provide that the existence and operation of labor unions and the action of their individual members shall not be deemed restraints of trade under the Anti-Trust act. Section 20 may be construed to provide that strikes shall be regarded as lawful no matter how unreasonable their purpose or their method. The prevailing opinion seems to be that these sections deprive the Government of any means whatever to prevent conspiracy to restrain commerce through a railroad strike, no matter how widespread the strike or how unreasonable the motive which actuates the strike.

Mr. Hines declared these were the things which "emphasized and increased the power of the railroad labor unions and encouraged them to their climax of arrogance, which came last August." Continuing, he said:

> Under the law as it seems to be construed by the Government, the country has no voice whatever in preventing or postponing a railroad strike, no matter how widespread it may be or how arbitrary the leaders of railroad labor may be. The result is that until there shall be some general remedial legislation, the railroads are left in a position which is full of danger to the public and full of discouragement to prospective investors whose capital ought in the public interest to be used in the further development and improvement of the railroads. Since the Government is unable to get the railroad unions to do anything they do not want to do, the whole pressure of the Government is exerted to get the railroads to concede whatever the unions insist upon. When Executive pressure fails, then Congress seeks to grant by hurried legislation what the labor unions demand. If such legislation proves constitutional, the railroads must try to shift the burden to the public, and to do this must get the approval of the Interstate Commerce Commission, and to some extent of state railroad commissions.
>
> The continuance of such a condition is a menace to the soundness of present and future railroad securities, because if railroad revenue is thus put at the mercy of the railroad unions, no one can have confidence in the ability of the railroad companies to continue to earn sufficient net income to pay interest, rentals, and dividends and to provide the annual surplus necessary to protect railroad credit.
>
> Of course there will be and must be consideration of this matter by Congress until some method can be found for the settlement of these controversies in a legal and orderly way in accordance with the rights of all parties concerned. But I wish particularly to emphasize that no such law can be passed except over the opposition of the railroad brotherhoods; for they have declared in the most unqualified manner that they will oppose any law which seeks to provide for an official investigation of the merits of a dispute before a strike can take place and will oppose any other law through which the Government would interfere in any way with the unrestricted freedom of railroad labor to strike whenever it sees fit. When you consider the past record of Governmental compliance with the wishes of union labor, you will realize that it is not going to be an easy thing to get the necessary remedial legislation when that will be violently opposed by union labor. We must expect the labor unions to use in the future all the political power they can command just as they have done in the past.

Foreign Trade in Copper

Exports of copper from the United States in August are reported by the Department of Commerce as below, in pounds:

Ore and concentrates, contents	405,717
Unrefined, blister copper, etc.	28,460
Refined bars, etc.	64,158,773
Plates and sheets	881,649
Wire	1,734,701
Total copper, lb.	67,209,300

The weight of ore exported in August was 5,071 tons; of concentrates, 527 tons.

Imports of copper into the United States in August are reported by the Department of Commerce as below, in pounds:

Ore and concentrates, contents	15,539,695
Matte, contents	973,155
Unrefined, etc., in bars, pigs, etc.	26,651,896
Old, etc., for remanufacture	579,177
Composition metal, copper chief value	146,934
Total copper, lb.	43,890,857

Actual tonnage of copper-bearing material imported in August was 40,916 tons ore, 18,896 tons concentrates and 1,117 tons matte.

Mining in India in 1915

The Chief Inspector of Mines in India has just issued his annual report of 1915. In addition to information regarding persons employed, accidents, health and sanitation, the following figures of output are given: Mica, 24,063 cwt.; manganese, 378,172 long tons; gems, 251,449 carats; gold, 24,320 oz.; copper, 8,010 long tons; wolfram, 39,432 cwt.

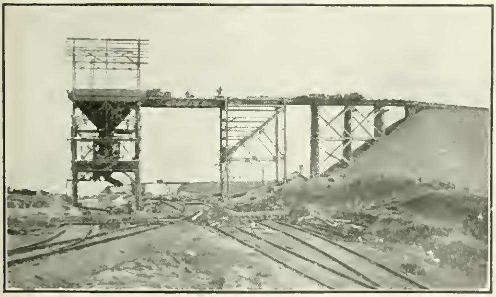
It should be noted that this report does not give a complete review of mining in India, but confines itself to those mines and quarries coming under the scope of the Indian Mines Act of 1901, which excludes workings that are shallower than 20 ft. The complete figures are given in the records of the Indian Geological Survey.

Details of Practical Mining

Screening Rock from Iron Ore

By L. A. Rossman*

One of the problems which confronts the mining operator is the removal of the rock, or taconite, from iron ore. In many of the ore deposits on the Mesabi Range this rock is found in what are called "horses," constituting enormous pillars throughout the whole deposit or forming horizontal or dipping strata of varying thicknesses with ore between. At the Susquehanna mine, an openpit property of the Rogers-Brown company at Hibbing, taconite appears intimately mixed with the ore. If the property were being worked underground, this rock would be picked out and left in the workings. In the openpit method of the Mesabi Range, the elimination process has formerly been to pick out the ore by hand from in front of the shovel, where it is loaded into dump cars and hauled away. This is a very arduous and expensive operation and the Rogers-Brown company has put into use another method—that of passing the ore and taconite, just as it comes from the ore bank, through a screening plant.


SUSQUEHANNA SCREENING PLANT IN COURSE OF CONSTRUCTION

The process used is simple. The plant structure, which was completed this summer, is of steel, the building being 26 ft. wide, 40 ft. long and 51 ft. high. The ore is brought on a trestle, shown in the accompanying illustration, to the top of this building in 12-yd. automatic air-dumped cars. They are pushed in ahead of a locomotive that can handle five of them on the 4½% grade on which the approach is laid. The ore is dumped from these cars onto grizzlies formed by standard 85-lb. rails set on 30-in. centers. The great rock chunks that rest on top of these grizzlies are broken up and fall with the rest of the material into a large steel bin, which will hold six of the dump cars of ore. The ore then passes through the bottom of this bin into the screen, its passage being regulated by means of a gate and feeder. The screen onto which the ore passes is circular, 60 in. in diameter and 24 ft. long. It much resembles the trommel found in concentrating plants, except that its diameter is the same throughout its whole length and the incline is secured by setting the supports at an angle. This screen slopes 1¾ in. per ft. and its perforations are of 2-in. diameter. The ore passes through these perforations into the bin, from which it is drawn into the cars, while the rock oversize discharges into chutes, from which it is fed into dump cars and thence carried to the rock piles. It will thus be seen that the ore that passes the screen is fine and light, though not as fine as that which characterizes the washed product. From the shipping-ore bins the feeding of the ore into cars is controlled by arc gates.

A motor of only 30 hp. supplies all the power required. The machinery is all of Allis-Chalmers manufacture and the structural work was done by the American Bridge Co. This is the first season in which this plant has been operated. At present all of the ore from one steam shovel is being taken care of by this method. Fifty-five 40-ton cars of the product have been handled in 10 hr., together with ten 16-yd. cars of rock and waste. The capacity of the plant is thus large and sufficient for the openpit. While the plant is still considered an experiment, results are said to be very satisfactory. The success of the undertaking means much not only to the individual mining company, but to all those on the Range.

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*Grand Rapids, Minn.

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Three Types of Oil-Fired Boiler Installations in Arizona

Three different types of boiler installations using oil fuel attracted the attention of A.I.M.E. members visiting Arizona in September. The installations, though dissimilar in many respects, gave surprisingly uniform efficiency results. Fig. 1 shows the boiler-house interior at the Sacramento power house of the Copper Queen company at Bisbee. The over-all efficiency of this plant was stated as 81.29%. Economizers were used. Fig. 2 shows a similar installation at the Inspiration power house at Miami, Ariz., where an efficiency of from 7[illegible] to 83% is obtained. Fig. 3 shows the installation at the Junction power house of the Calumet & Arizona com-

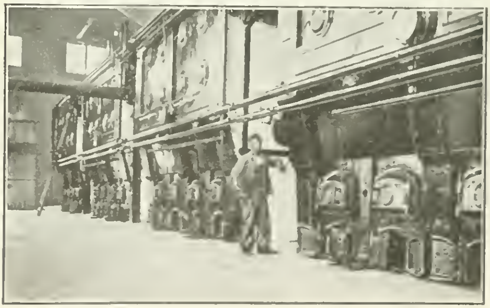


FIG. 1. OIL-FIRED BOILERS AT THE COPPER QUEEN

pany, near Lowell, in the Bisbee district. These are old boilers, Scotch-marine type, and have been moved many times, having the advantage that on such occasions there is no large amount of brickwork to be torn down and replaced. This plant gives an operating efficiency of from 75 normal to 83.5% maximum.

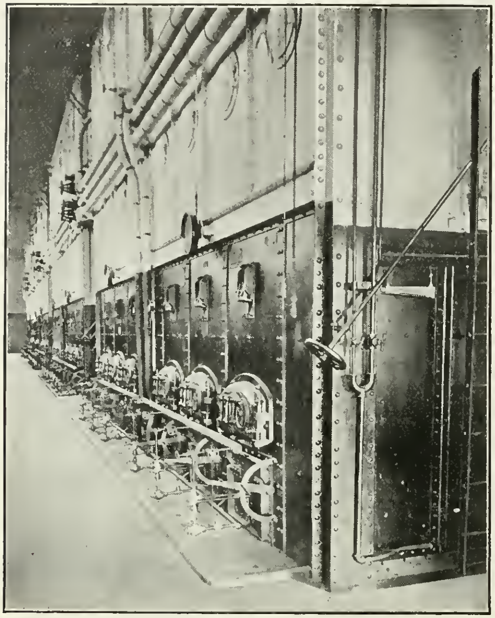


FIG. 2. OIL-FIRED BOILER INSTALLATION AT THE INTERNATIONAL SMELTERY

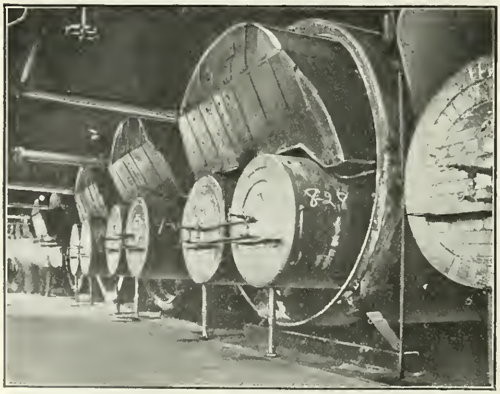


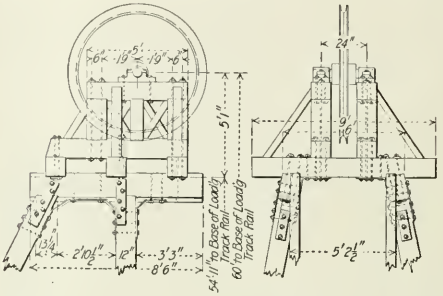
FIG. 3. CALUMET & ARIZONA OIL-FIRED SCOTCH BOILER

⁂

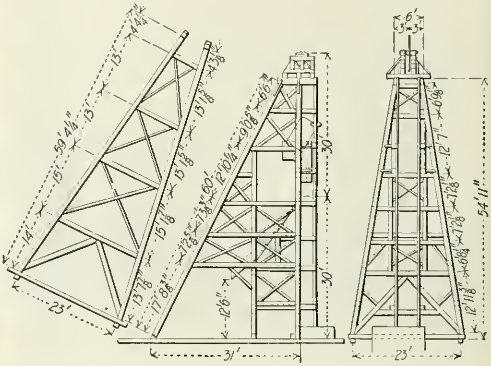
Dust Prevention About Mine Plants or other industrial works is necessary for the health of the workers if for no other reason. The dust losses of ground products is considerable and often of considerable value. The obscuring of lights by dust is another injurious factor. To reduce dust losses in a large steel plant the raw materials entering the plant, iron ore, and limestone are first sprinkled. The cars containing the material are run onto a siding over which a sprinkling system is installed.

The Tioga Headframe

A headframe similar in design to those used by the Oliver Iron Mining Co., but made of timber instead of steel, is in use at Chisholm, Minn., on the property of the Shenango Furnace Co. It is set over a single-skipway shaft and was built from material on hand. Timber to the amount of 25,000 ft. b.m. was used, together with the necessary ironwork and bolts, as shown on the accompanying details. The total cost of this headframe was $2,300.


5'
6"
1'9"
1'9"
6"
5'1"
54'11" to Base of Loadg Track Rail
60' to Base of Loadg Track Rail
13¼"
2'10½"
12"
3'3"
8'6"
24"
9'
1'6"
5'2½"

DETAILS OF THE SHEAVE WHEEL AND BEARINGS

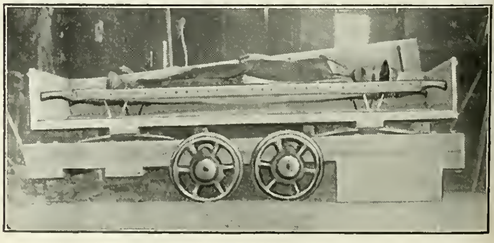


CONSTRUCTION OF THE HEADFRAME

⁂

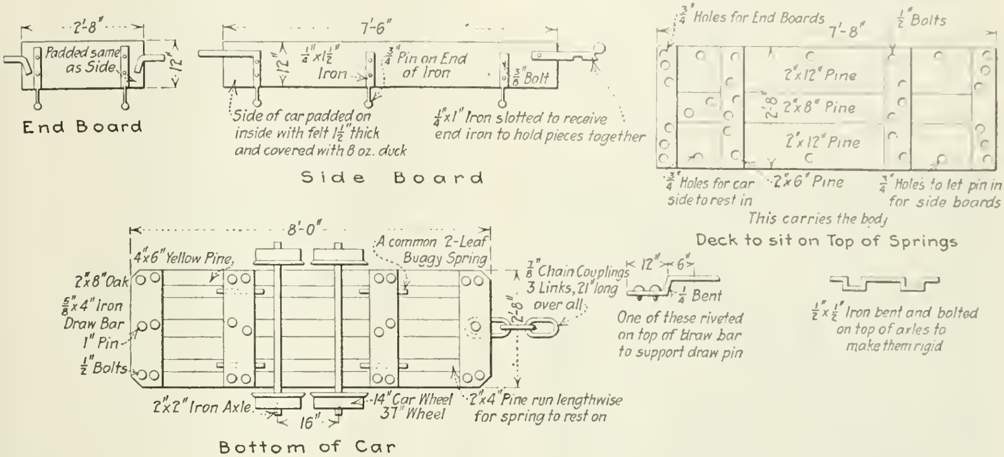
Underground Mine Rescue Car

The Illinois Zinc Co. has done much to provide for the comfort of its employees. One of the latest improvements designed by J. A. Ede, the consulting mining engineer of the company, described by Gaston Libiez in



THE RESCUE CAR COMPLETE

Coal Age, Oct. 14, 1916, is a stretcher car by which injured men may be brought in comfort and without jolting to the surface. The design is quite simple—a skeleton mine truck supporting carriage springs to which a box, in which the stretcher is placed, is secured.


2'-8"
Padded same as Side
12"
End Board
7'-6"
12"
¼"x1½" Iron
¾" Pin on End of Iron
⅜" Bolt
Side of car padded on inside with felt 1½" thick and covered with 8 oz. duck
¼"x1" Iron slotted to receive end iron to hold pieces together
Side Board
¾" Holes for End Boards
7'-8"
½" Bolts
2"x12" Pine
2'-8"
2"x8" Pine
2"x12" Pine
¾" Holes for car side to rest in
2"x6" Pine
¾" Holes to let pin in for side boards
This carries the body
Deck to sit on Top of Springs
8'-0"
4"x6" Yellow Pine,
A common 2-Leaf Buggy Spring
2"x8" Oak
⅝"x4" Iron Draw Bar
1" Pin
½" Bolts
⅞" Chain Couplings 3 Links, 21" long over all
2'-8"
12"
6"
¼ Bent
One of these riveted on top of Draw bar to support draw pin
½"x½" Iron bent and bolted on top of axles to make them rigid
2"x2" Iron Axle
16"
14" Car Wheel 37" Wheel
2"x4" Pine run lengthwise for spring to rest on
Bottom of Car

DETAILS OF CONSTRUCTION OF THE CAR

The first car of this type was constructed at the Deer Park mine, southeast of La Salle. Another will be built at Peru and used at the mines at that place. A box is slung from the truck portion of the car. In this will be kept bandages, salves and stimulants and a lungmotor. The car will be kept in a dry place specially provided for the purpose. This place will be at some point near the face of the workings.

The cost of the car, including all labor and material, was $80; the length over all is 8 ft., the width 2 ft. 8 in., and the height of the box 12 in. The bill of material is as follows:

Lumber:

- 2 pieces 4x6 in. by 8 ft. long, yellow pine.
- 2 pieces 2x12 in. by 7 ft. 8 in. long, yellow pine.
- 1 piece 2x10 in. by 7 ft. 8 in. long, yellow pine.
- 4 pieces 2x6 in. by 2 ft. 8 in. long, yellow pine.
- 4 pieces 2x8 in. by 2 ft. 8 in. long, oak.
- 2 pieces 2x4 in. by 8 ft. long, yellow pine.
- 4 pieces 1x12 in. by 7 ft. 8 in. long, yellow pine.
- 2 pieces 1x12 in. by 2 ft. 8 in. long, yellow pine.
- 1 piece 1x10 in. by 7 ft. 8 in. long, yellow pine.

Iron and Bolts:

- 60 ⅜x1¾-in. carriage bolts.
- 40 ½x4½-in. carriage bolts.
- 35 ½x9-in. carriage bolts.
- 20 ½x3-in. carriage bolts.
- 10 ⅜x3-in. carriage bolts.
- 1 piece ⅝x4-in. iron 8 ft. long.
- 2 pieces ⅝x4-in. iron 20 ft. long.
- 10 pieces ¼x1½-in. iron 14 ft. long.
- 2 pieces ½x2-in. iron 30 ft. long.
- 5 No. ⅜-in. cut washers.
- 10 No. ½-in. cut washers.
- 1 ⅞-in. chain in three links, 21 in. long.
- 1 1-in. pin, 8 in. long, with 12 in. of ¼-in. chain attached, to go with car to couple with 4 common two-leaf buggy springs made out of ¼x1½-in. spring steel; length over all, 3 ft.; distance between springs, 8 in.
- 1 set of 14-in. diameter car wheels.
- 2 2-in. standard axles, 3-ft. 1-in. gage.

⁂

Siberia Is to Have Large Steel Works—The plan, as a result of a recent meeting between representatives of the Russian Government and of the iron industry, is to raise a capital of 20,000,000 rubles, the interest to be guaranteed to the banks subscribing. The government is to lease the district of Kusnezk, where the works are to be located, to the company for 60 years, the company to supply a fixed tonnage of rails and other railroad material yearly at current prices. This district has coal and iron deposits, the iron ore being of high grade.

Utilizing Old Candle Boxes

At a medium-sized copper mine in the West a number of different types of air drills were in constant use, and of two of these types there were three sizes each. Since parts were broken at frequent intervals, it was necessary to keep quite a stock of extras. In addition to the regular stock of mine supplies, such as pipe fittings ranging from ¼ in. up to 4 in. and all the rest of the daily necessities, this made the task of storekeeper no sinecure; especially in consideration of the fact that he was expected simultaneously to fill two other important positions. The various items, from piston-ring springs to saw files, were spread out on shelves in the lower part of the crusher building, the room being narrow and long. In an unused corner a pile of empty candle boxes accumulated in a haphazard fashion, and the dust from the mill-feed bins sifted down as the vibration of the machinery jiggled things out of place. Various employees drifted in now and then, helping themselves to different supplies and seldom leaving any message except when some particular item was exhausted from the stock.

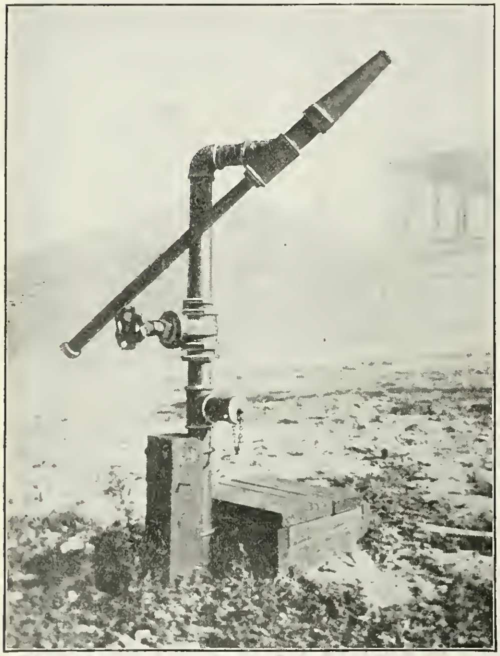
A little ambition and overtime work brought about a slight change. The candle boxes were stripped of superfluous nails and arranged in tiers in a smaller room at one end of the building. Small cleats were nailed here and there to prevent shifting or toppling forward. To each size of each type of drill a vertical tier was assigned, others being selected for pipe fittings and the like; the heavier parts being placed in the lower boxes, while the smallest parts were arranged in cigar boxes set inside the candle boxes. When complete, the general effect was like a set of sectional bookcases in a library. The fact that the small room was ceiled, combined with the protection afforded by the individual recesses, reduced the accumulation of dust to a minimum.

By moving one group of supplies each day a card-index inventory was made. When this was completed, the value of stock actually on hand was found to be only about 60% of the theoretical stock showed by the large stock sheets, which had been made out laboriously each month on the basis of material received and material [illegible] to have been issued.

Details of Milling and Smelting

Fire Hydrant Used at Miami

At the Miami Copper Co., Miami, Ariz., a novel fire hydrant has been devised which obviates many disadvantages of the old-time hydrant with hose and coupling. These hydrants are placed so that any fire will be within range of one or more. The universal joint formed by the elbow being loose on the riser and the nipple carrying the angle nozzle connection being loose in the elbow allows the stream to be turned in any direction. No hose is used. The nozzle is cylindrically bushed so that a solid stream is thrown. These hydrants are cheaply and quickly made and fill the requirements perfectly. They look like young hydraulic giants.


"MONITOR FIRE HYDRANT" AT MIAMI, ARIZ.

⁂

Effect of Tin on Mechanical Properties of Steel has just been reinvestigated by J. E. Stead, and reported on at the autumn meeting of the Iron and Steel Institute. His results apparently show that 0.1% Sn produces an increase in maximum stress of 1.4 tons and a decrease in elongation of 0.8%. Doctor Stead thinks it doubtful whether 0.05% Sn would have any material effect on the properties of structural steel, or that the use of 10 to 15% of detinned scrap in steel for forgings, rails or plates, but they show that tin in sensible quantity must be avoided, as it tends to make steel difficult to roll and hard and stiff when in the heated state. Research is urgently required to determine the effect of small quantities of tin owing to the large quantities of detinned scrap which will soon be available for steel making.

Use of Porous Bottoms in Flotation Cells

In a description of the history of the flotation process at Inspiration, Ariz., read at the Arizona meeting of the American Institute of Mining Engineers, Dr. Rudolph Gahl described the experiments made on porous bottoms for pneumatic-flotation cells. Dr. Gahl points out that the porous bottom is one of the most essential parts of the bubble-column type of flotation machine. The experiments made at Inspiration indicated that one of the principal difficulties was the tendency of the pores of the filtering medium to contract gradually under use and therefore to retard the passage of air through them. This tendency appeared to be more pronounced in the solid bottoms used with the Flinn-Towne type of machine than with those using the textile bottoms, although the tendency was apparent even there. It was at first supposed that the choking was due to the dust that might be carried by the air admitted below the bottoms, which might settle in the pores and reduce their area. A canvas blanket will, after a certain length of service as a porous medium, show rings and spots of dark color opposite the air inlets, indicating a deposition of dust particles.

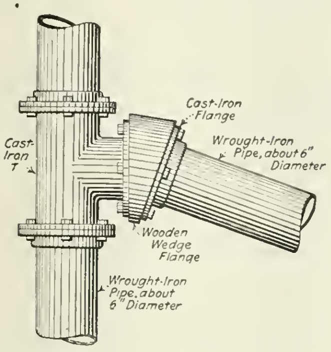
In order to investigate the influence of such spots on the air passage, round disks were cut from a Callow blanket that had been used for some time, and their character was investigated by using them as porous bottoms in a glass tube standing in a vertical position. Air under pressure could be applied to an air chamber under the disks and the air passing through the material could be measured by a gas meter. The air discharged through the material gives a measure of its porosity. It was found, through these tests, that the darkest spots were not the points of lowest porosity—those farthest away from the air inlet showing the greatest tendency to choke. An explanation of this surprising behavior seems to be in the fact that the blanket is more thoroughly agitated near the air inlet, while the more distant parts are comparatively quiet. Incrustations, due to the presence of soluble salts in the water, in conjunction with fine slimes, always form to a greater or less extent in the top layer of the blanket. Agitation opposes this formation, thus allowing the quieter parts to be more completely covered.

Through this reasoning it was concluded that a solid porous material is not as suitable for a diaphragm as the textile material if a bottom of long life is required. This conclusion seems to agree with the experience of everyone who has experimented in the matter. Carborundum tubes and stones have been tried and abandoned, most operators returning to the textiles.

It appears to be a necessary condition for serviceable flotation-cell bottoms that they be of a flexible nature. The 4-ply canvas, stitched every half-inch or so, with which Callow's first cells were equipped, seems to answer the purpose well. To keep it in good condition and free from incrustations it has to be cleaned frequently. This is done by dipping an iron pipe, connected with the water hose, into the compartments and sweeping the canvas bottom with the jet of water discharging from the lower end of the pipe.

A Wooden Angle Flange

In the concentrating mill of the Old Dominion at Globe, Ariz., an ingenious method of making a pipe connection at an angle without the use of special fittings, which cost money and require time, was devised as shown in the sketch. By simply cutting a wooden wedge to fit snugly between the flanges, drilling, boring and trimming the outside and using the customary bolts and gaskets, a perfectly tight and satisfactory job was secured.

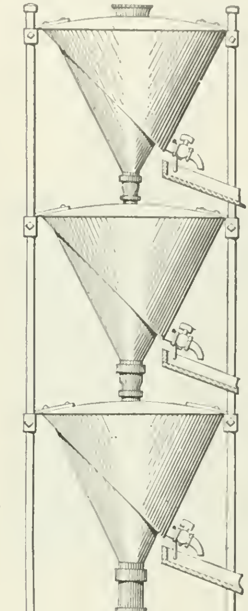

Cast-Iron Flange
Cast-Iron T
Wrought-Iron Pipe, about 6" Diameter
Wooden Wedge Flange
Wrought-Iron Pipe, about 6" Diameter

A WOODEN ODD-ANGLE PIPE FITTING

Wagner Hydraulic Classifier

Frank F. Wagner, of Denver, has invented an improvement in hydraulic concentrators or classifiers, which was granted patent No. 1,193,953 on Aug. 8, 1916. The object of the invention is to provide a concentrator in which the metallic minerals may be separated from the gangue by the action alone of an upwardly directed current of water or oil and to separate the metallic minerals into different grades, varying in specific gravity. This is accomplished by the employment of a number of tanks, preferably cone-shaped, having their smaller extremities lowermost. Each of these tanks is provided with a trough at the top to receive an overflow, which carries gangue or uncleaned minerals, as may be required and according to the adjustment of the apparatus.

Referring to the illustration, the apparatus consists of a bottom tank, preferably cylindrical in shape, and a series of cone-shaped tanks forming a superstructure, the lowermost cone-shaped tank being in communication with the cylindrical tank at the top, the next higher tank having its lower extremity in communication with the top of one below, and so on depending on the number of tanks employed, the lower extremity of any tank being in communication with the upper extremity of the one next below. The diameters of the pipe connections between the lowermost cone-shaped tank and the cylindrical tank, and between the various cone-shaped tanks, diminish in an upward direction. The reason of this variation in size of the various pipe connections is that the water, which is introduced from below and is carried upward through all the tanks under pressure, diminishes in volume, so that while the entire volume of water enters the lowermost tank, a portion is drawn off with the material taken from this tank, so that a less quantity of water enters the tank next above and so on. By diminishing these pipe connections on this principle, the construction is made to harmonize with the existing conditions and better results are obtained than would be the case if these pipe connections were all of the same size. In the construction shown in the illustration there are four tanks, the lowermost being cylindrical and the others cone-shaped. With this apparatus the gangue is caused to overflow at the top of the uppermost tank into a trough, and is drawn off by means of a faucet or other suitable valve-controlled device. The tank next below is similarly equipped with an overflow trough, from which is drawn off a heavier grade than the silica, which may be termed middlings and which will contain some metallic minerals but of relatively low specific gravity. The third tank from the top is also equipped with an overflow trough into which will be carried a grade of practically pure mineral, but of greater specific gravity than that included in the middlings. Finally the metallic minerals of greatest specific gravity will be caught in the lowermost or cylindrical tank, and may be drawn off into a trough or other receptacle arranged at the bottom of this tank. From this it will be understood that as many different grades of material, separated according to their varying specific gravities, may be made as desired and according to the particular material under treatment. While the apparatus has been designated a concentrator, it is equally well adapted for use as a sizer or classifier, and whether it is used for the one purpose or the other depends on the character of the material under treatment as regards the size of the grains or particles.

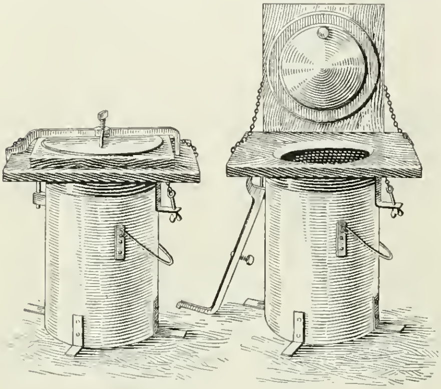


WAGNER CLASSIFIER

Mining & Metallurgical Machinery

A Sanitary Mine Latrine

The accompanying illustration shows a type of mine latrine manufactured by E. D. Bullard, of San Francisco.



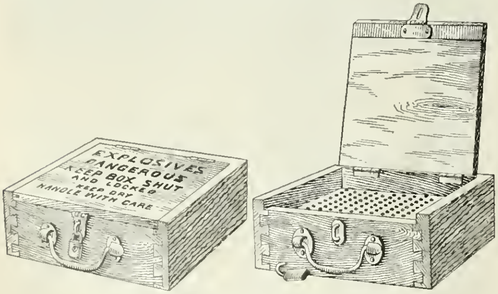
A SANITARY LATRINE

This type recommends itself because of its simplicity and sanitary properties. It can be taken apart and cleaned when necessary.

⁂

A Convenient Safety Cap Box

Although it is a dangerous practice to carry dynamite and caps in the same vehicle on account of the sensitiveness of the caps to shock and the probability that their explosion would fire the dynamite, there are times when separate loading or two trips are very inconvenient and expensive. To provide for such cases and also to care for caps in the field, a safety box has been designed that makes it feasible to transport caps and dynamite in the same vehicle without extraordinary risk, and greatly decreases the risk from flying fragments in field blasting.



A SAFE BOX TO CARRY CAPS IN

This box as illustrated, from the *Du Pont Magazine*, September, 1916, is made of oak ⅞ in. thick, dovetailed at corners and with rabbeted bottom of oak. The top is of ½-in. pine with blind hinges and staple. The loaded box cannot be opened without destroying the cover. Even the most enterprising pryer will hesitate to use force on a caseful of sensitive explosives.

The box is lined inside with ½-in. felt, obtainable at harness shops. The cap board is removable, but should fit snugly on and between the felts. The space between the bottom of the cover and the top of the bottom felt should be jest right to hold caps firmly without undue pressure. The holes in the cap board, 100 in number, should be large enough to permit easy entrance of caps, but not large enough to let them fall out.

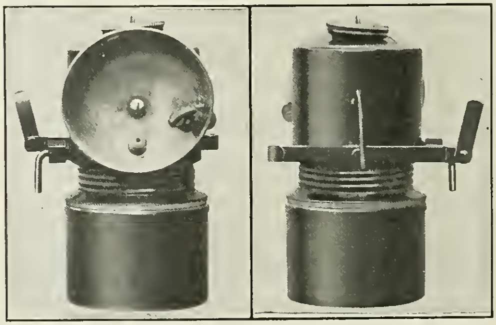
The fact that a box made this way was filled with 100 caps and thrown over a 50-ft. embankment into a quarry, where it bounded around on the rocks and no explosion resulted shows that it should fulfill its requirements.

⁂

Acetylene-Lamp Improvements

The use of acetylene lamps in metal mines has greatly increased in the last three years. Mine managers have been quick to appreciate the considerable saving possible by replacing candle illumination with that of carbide. Many mines now use carbide lamps in at least a portion of the underground works, while a considerable and increasing number have abandoned candles altogether in their favor.

With the increased use of carbide lamps has come a demand for improved construction to meet underground-illumination requirements. Among those manufacturers who have responded to this demand is the Harker Manufacturing Co., whose improvements are shown in the accompany illustrations.

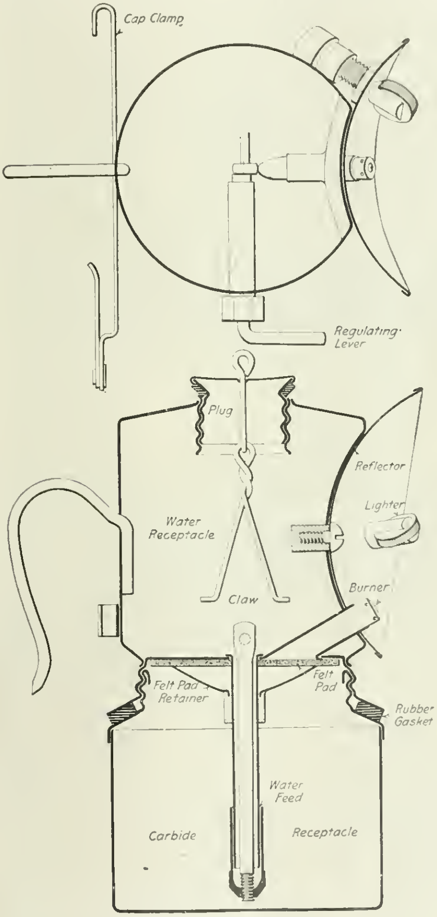


FRONT AND REAR VIEW OF THE LAMP

Perhaps the most important improvement from an illumination standpoint is the changed position of the burner. Instead of its former position in the center of the reflector, it is now placed near the reflector base, as best shown in the sectional view, and inclined upward. As a result, the flame reflects from a maximum of reflector area without impinging upon and burning it.

Engineers who in the past have experienced difficulty in vernier reading will be quick to appreciate the improvement.

Another improvement is the water-feed regulator. This is the lever seen at the side of the lamp. Turned to its most upward position, the water is shut off, and turned to the other extreme, the feed is wide open. After lighting the lamp with the regulator at wide-open position, in about half a minute the regulator can be adjusted to half-open position, or some other, according to the degree of illumination desired. Charged with 2 oz. of ¼-in. carbide, in accordance with the manufacturer's directions, the lamp should burn for about four hours.



DETAILED SECTIONAL VIEWS OF LAMP

The lamp has a dark enamel finish and is equipped with a crossbar seen at the back, which, by means of a pivoted hook, firmly attaches the lamp to the tin front of the miner's headgear so that it cannot jolt with the wearer's stride.

When empty, the lamp weighs 6 oz. It is known as the Hoppe "Brite-Lite" miner's carbide lamp and is made by the Harker Manufacturing Co., 410 East Pearl St., Cincinnati, Ohio.

A General-Utility Jack

Templeton Kenly & Co., Ltd., of Chicago, Ill., have recently placed on the market Simplex jack No. 310 as a general-utility device. This jack is of strong and rugged construction and embodies features that render it available for a multiplicity of purposes at the mine, either above or below ground. It is described as follows in *Coal Age* of Oct. 11, 1916:

The chief advantage of this jack lies in its tilting base. This base is attached to the body of the jack by a hinge joint and may be locked in a position at right angles to the center line of the body; or, upon releasing the catch, the base may be tilted through an angle of almost 90°. The hinge pin passes through an elliptical hole in the hinge joint so that the thrust of the jack is taken directly by the foot and does not put a shearing stress upon the pin. The bottom of the foot is provided with suitable calks to prevent slipping when the tool is placed in an inclined position.

ONE OF THE USES OF THE SIMPLEX JACK

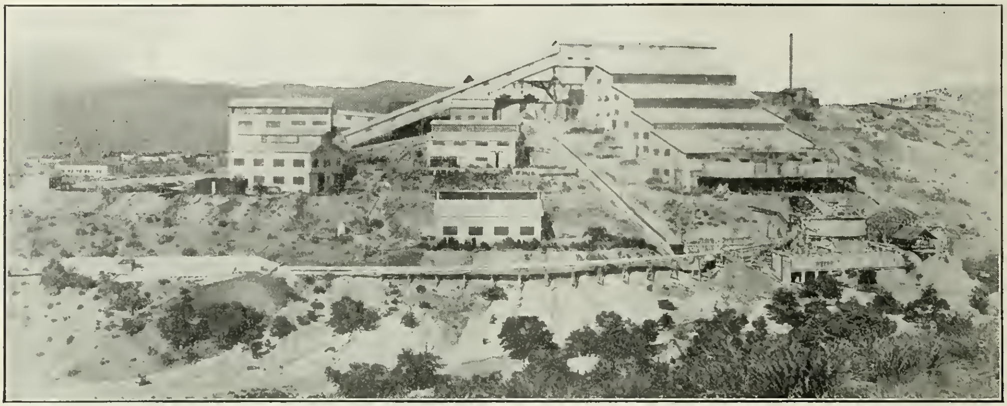
The adaptability of this jack to the general run of work encountered in and about a mine is extreme. The tilting base makes it unnecessary to provide a level footing when a vertical lift is necessary, or an inclined footing when an inclined lift is to be made. This is a great time saver when quick work, such as the replacing of a locomotive or car that has jumped the track and is blocking the entire transportation system, is to be performed.

Besides its applicability for emergency work on locomotives, etc., this tool may be used as an ordinary track jack, being provided with a suitable lifting foot, for the forcing to place of heavy mine timbers, or for other purposes.

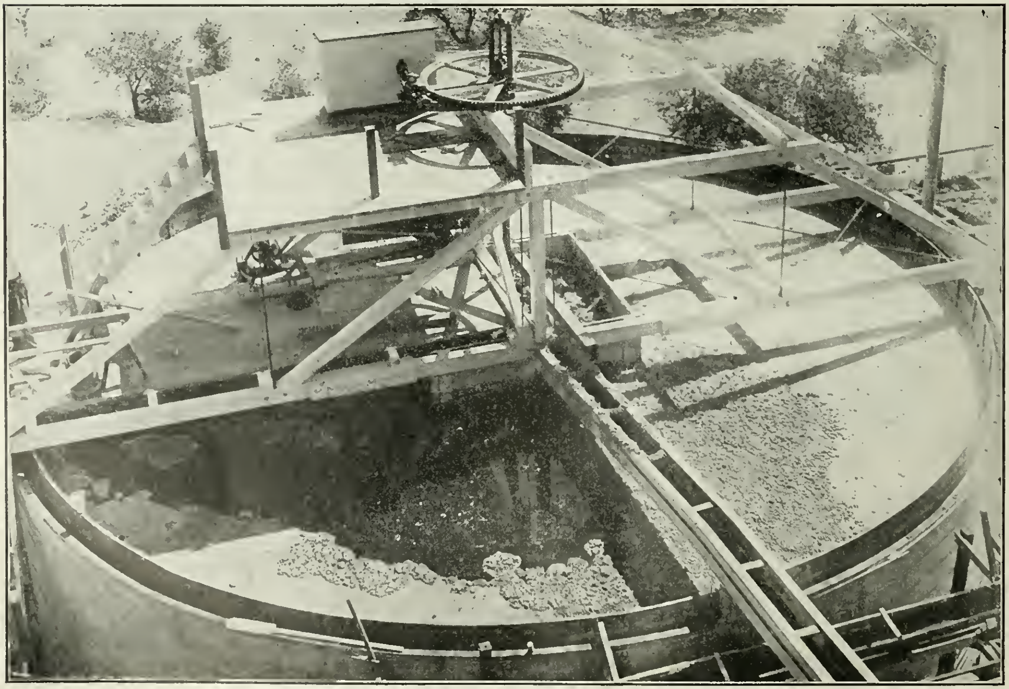
⁂

A New Iron and Steel Plant in China is being erected for the Han-Yeh-Ping Iron and Coal Co., Ltd., of Hanyang. It is to be at Tayeh, about 20 mi. from its iron-ore mines. The site consists of about 670 acres. The new plant will start with two blast furnaces of 400 tons daily capacity each, with necessary equipment, and will eventually be extended to complete eight blast furnaces with sufficient openhearth steel furnaces and rolling mills to convert the blast-furnace production into finished products. The contract for the first two blast furnaces was last year awarded to the Riter-Conley Manufacturing Co., Pittsburgh, but some delay ensued owing to a misunderstanding between that company and the [illegible] of the Chinese company. Matters have now been [illegible] and it is expected that the material for the furnaces will be delivered by the end of this year.

Photographs from the Field

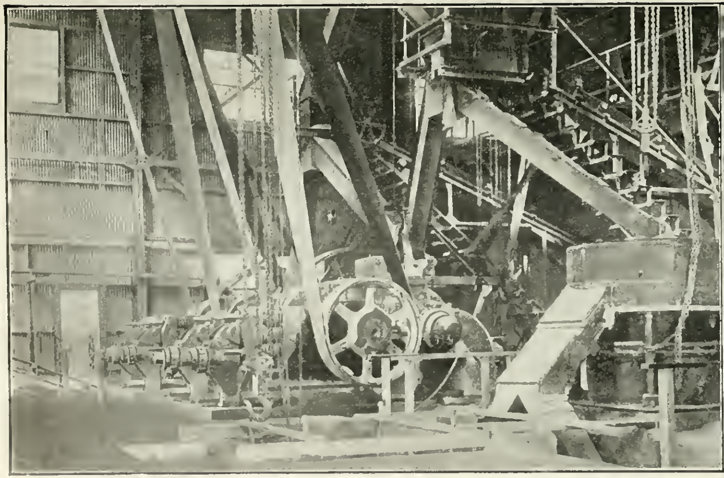


General view of the concentrating plant, showing from left to right the assay office, the coarse crushing plant, beneath which is the machine shop, conveyors, coarse-ore bins, below which are successively the transformers, supply house and carpenter shop. The Dorr slime thickener is below the concentrator. The tailings launder is shown across the bottom of the view

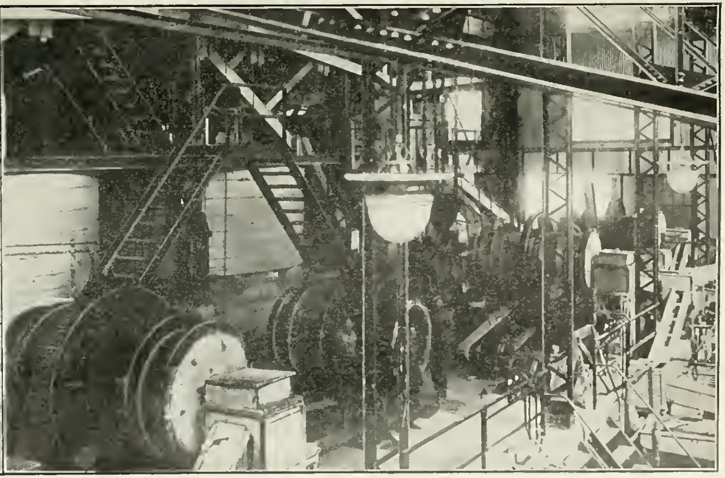


The large Dorr thickener for handling the flotation concentrates

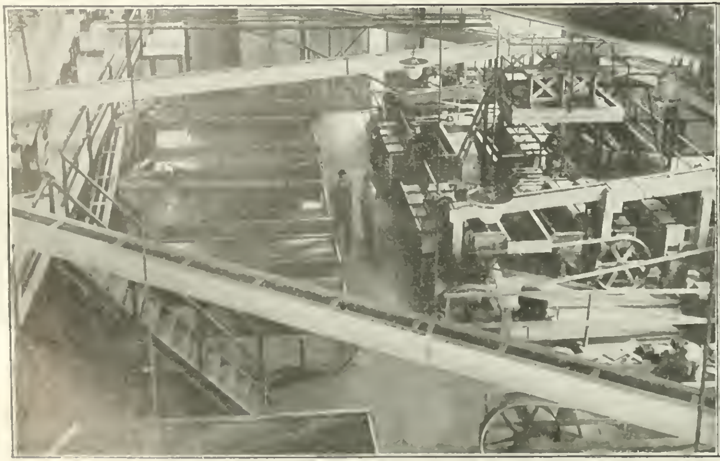
VIEWS OF THE PLANT OF THE BURRO MOUNTAIN COPPER CO., TYRONE, N. M.



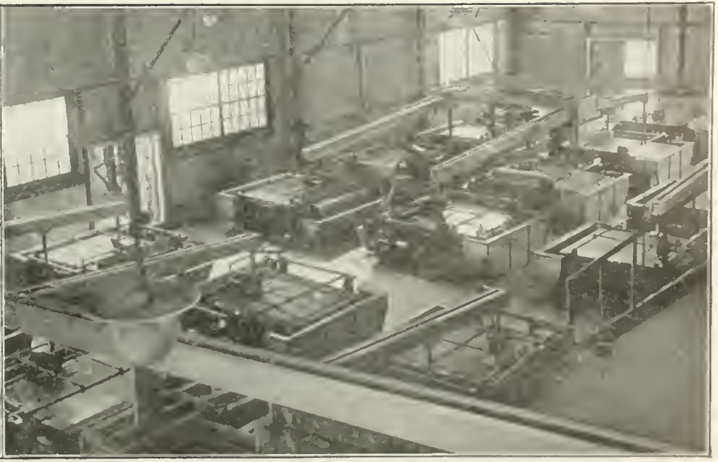
Allis-Chalmers rolls in crushing plant



Marathon mills for regrinding



The Butchart tables and Rork-Kraut flotation machines



Senn pan-concentrating tables

INTERIOR VIEWS OF THE BURRO MOUNTAIN CONCENTRATOR

Correspondence and Discussion

The Attempted Tyranny of Labor Unions

After reading several *Journal* editorials concerning the recent transportation strikes, etc., I cannot restrain expression of my profound disgust with them. Their sneering one-sidedness must be obvious to the most prejudiced. Why do you, with such persistent hypocrisy and affected horror, charge that a concession to the labor unions is a victory of the minority, a holdup of the public, a defeat of democracy? For example, in the case of the threatened railroad strike, why do you insist on seeing it as a contest between the interests of 100,000,000 and the interests of 400,000 (the brotherhoods) instead of between the interests of the 400,000 and the interests of several thousand (?) railroad stockholders? You employ the old editorial trick of "seeing" the public as a neutral element whose "rights" you so nobly champion and over which you shed crocodile tears.

By subdividing the labor element into its striking and nonstriking parts, you create a third "neutral element" (the public) into the contest, from the standpoint of whose interests you view the contest and use this neutral element as a fine weapon with which to combat the success of the strikers. The public, on the contrary, is a party to the quarrel, of necessity very much concerned—unfortunately, more so than it knows—through sympathies and interests, for the public is largely that part of labor which happens to be passive while its complement is striking.

Again, when you refer to the traction strike in New York, you grossly misrepresent facts known to every wide-awake New Yorker. The companies, not the men, broke the agreement, as was borne out by the facts learned by the investigating commission and embodied in their statements. The companies forced the strike. When the same strike first threatened some time previously, the companies quickly settled to the men's satisfaction. Then, while making adequate and systematic provision for a strike (having secured through agencies, strikebreakers from different parts of the country and accommodations for these) it began to make individual proposals (individual contracts) contrary to the agreement, leaving the men to choose between disintegrating their union or going out on strike to preserve it. Hence the companies' action could be interpreted only as a stragetic (*sic*) lockout, intended to destroy organizations among its men, against which it frankly declared itself. It thus caught the men unprepared, yet despite this there was greater interruption to traffic than your editorial would indicate. You mention nothing of the demoralized surface-car systems or the terror of the public at the innumerable fatal and serious accidents due to inexperienced hands. Furthermore, as any observant person will attest, the public demonstrated its sympathies with the strikers on all occasions afforded it (at many benefits held and street collections made and changed mode of travel). The private machines, Fifth Avenue busses and the New York Central R.R., all charging several times the companies' rates, carried and still carry great crowds, all of which indicates the loss of trade by the "struck" lines and the sympathies of the public and emphasizes that the strike did have effects. I cannot believe that you do not know these facts.

Incidentally, you admit the dependence of the many on the "bounty" of the few—that is the real "tyranny," autocracy, you will not see. This is the minority—the class control, which labor through organization is beginning to challenge, and their victory is a victory of the interests of the many, a democratic victory.

How long will editors think they can boldly lead the readers' thoughts with utter confidence and credulity—that by making frequent reference to history in glowing terms, by raising cries of "tyranny" and "democracy" and sounding warnings, by using catchy phrases and labored eloquence, they can affect sincerity and all will be accepted as given. I wonder how many other readers feel as I do. I hope you will have the fairness to publish this letter.

New York, Oct. 11, 1916. WILLIAM CULLICOVER.

Mining in Huelva, Spain

You probably know that the iron-copper district here is one whose production is practically monopolized in the province of Huelva. Now almost all of the mines are in the hands of English and French houses, but there is still an area from which may be formed business that may rival Rio Tinto or Tharsis in importance. Because of the war, at its end there will be strong competition among the nations to secure the best of this opportunity. I have thought of addressing you to know if you consider it possible to take any steps to start and carry to a conclusion such a business. I am an engineer, practicing my profession here, and have 18 years' experience in the district.

Such a business would require a very large capital. For less money a more modest development might be started, but not taking in all the possibilities.

I would be glad to have you advise me what you think the possibilities are in this direction.

JUAN HEREZA.

Plaza de Monjas, 8, Huelva, Spain, Aug. 17, 1916.

Refractory Manganese Ores

In the *Journal* of Oct. 7 Henry O. Marcy states: "I believe that to Mr. Rowe belongs the credit of first reducing the refractory silicate ores of manganese, iron and copper, and producing commercial quantities of metal in the electric furnace," etc.

In California, to my knowledge, silicate ores of manganese have been smelted for over a two-year period. From April, 1915, to October, 1915, rhodonite ores from Mendocino County, Calif., and also from Alameda County were smelted in an electric furnace into 80% commercial ferromanganese and on a 15-ton per day production. During the rest of the time pyrolusite and psilomelone ores were smelted into 80% alloy and on a 14- and 16-ton per day production. I mention this for the general information of *Journal* readers. R. C. GOSROW.

1304 W. 51 Place, Los Angeles, Calif., Oct. 16, 1916.

Oxygen Mine-Rescue Apparatus*

By E. Steidle†

SYNOPSIS—The United States Bureau of Mines now uses three types of apparatus. Tests have been made since 1908. Eight rescue cars, five rescue stations and three emergency automobiles are now operated. More than 10,000 miners have been trained to use apparatus. Helmets have been discarded for rescue purposes, only mouth-breathing apparatus being now used, but specifications require bypass to permit drawing on oxygen supply in emergencies.

Various kinds of apparatus are used for entering irrespirable or poisonous gases, following explosions or during fires in mines. These have been popularly termed "oxygen helmets" or "artificial breathing apparatus," "smoke helmets" or simply "helmets." The terms applied are often inappropriate, particularly "helmet," because in the approved self-contained mine-rescue apparatus helmets are no longer employed. On the other hand, for fire fighting at close range smoke helmets employing compressed air or connected to an air pump have been used in certain mining districts. For rescue purposes, however, which require the movement of the wearer for a long distance from the base, only self-contained apparatus should be employed. The oxygen-using apparatus is the kind that is receiving the greatest development and the bureau has termed this "oxygen mine-rescue apparatus."

European Rescue Apparatus Still Used

The United States Bureau of Mines at present uses three European types of apparatus—two German and one English—in mine-rescue, mine-fire and mine-recovery operations. However, they are still on probation and consequently do not bear the official approval of the bureau, as do permissible explosives and various types of miners' lamps. No American type of apparatus is used by the bureau in actual field work.

The first oxygen mine-rescue apparatus was invented many years ago in Europe, but the first apparatus was brought into this country by a German agent only in 1908, at which time the Bureau of Mines (then the Technologic Branch of the United States Geological Survey) began to use the apparatus in investigating mine-explosion disasters, and later to demonstrate its use and systematize methods of training miners in mine-rescue work. The Bureau of Mines has also been largely instrumental in introducing to mining companies the best type of apparatus, and today there are thousands used throughout the different coal- and metal-mining districts of this country. Several states have passed laws that compel the mining companies to install oxygen mine-rescue apparatus at their mines and maintain a rescue crew properly trained in its use. Furthermore, the mining companies that have properly equipped crews have in consequence received reductions in their insurance rates. Some of the larger interests have even provided emergency-rescue and fire-fighting cars.

The Bureau of Mines operates eight fully equipped mine-rescue cars, five rescue stations and three emergency-rescue automobile trucks in different mining centers of the United States. The first mine-rescue cars used by the bureau were remodeled Pullmans, but the new cars are to be of modern all-steel construction.

Coal and Metal Miners Trained to Use Apparatus

The principle of increased mine safety has been urged in nearly every section of this country through the medium of these rescue cars and stations, and more than 10,000 coal and metal miners in the United States have been trained in the use of oxygen mine-rescue apparatus by employees of the Bureau of Mines during the last eight years. Furthermore, during this same period the bureau rescue men have attended 283 mine disasters. Rescue apparatus was worn by 699 men at these disasters, 92 miners were saved by apparatus men in the service of the bureau, and 768 were saved by other rescuers wearing apparatus. Very few mine explosions or mine fires occur that do not require the services of properly equipped mine-rescue crews.

The primary purpose of oxygen mine-rescue apparatus was to furnish protection to those who ventured into mines filled in whole or in part with poisonous gases, in an effort to rescue those imprisoned. However, the apparatus is now widely used in fighting mine fires and in mine-recovery work, particularly where the ventilation has been affected.

Oxygen mine-rescue apparatus may be likened to any device that is used to insure protection: it is necessary that it be on hand when needed, it is essential that men who use it be properly trained in its use, and it is of great importance that the apparatus be kept in proper working order and in a sanitary condition at all times. The humanitarian viewpoint is, of course, foremost in our minds, but at the same time the actual saving of money through compensation, as well as the preservation of property must not be lost sight of. The latter item alone greatly exceeds that of the initial cost of the apparatus together with the cost of upkeep and training.

Experiments and field tests of oxygen mine-rescue apparatus by the Bureau of Mines have, however, demonstrated that all types of apparatus are, from a physiological standpoint, limited in use; in other words, none of the apparatus will entirely accommodate the physical requirements of a wearer. Thus, as an instance of only one of several defects in the apparatus now used, the manufacturers have usually directed that the oxygen supply should be set at a rate sufficient only for moderate exertion on the part of the wearer. A natural circulation depending upon the respiratory movements of the wearer is altogether preferable.

The oxygen in the air is immediately more essential to the life and activity of a human being than food and water. A self-contained oxygen-breathing apparatus must, therefore, provide the wearer with air that is in every respect similar to normal air and should entirely meet his physiological requirements. The three types of apparatus used by the Bureau of Mines are identical in their most important features. Improvements in details are especially necessary in all of them in order to insure greater safety in their use.

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*A paper read before the 44th annual meeting of the International Association of Fire Engineers, Providence, R. I., Aug. 29-31 and Sept. 1, 1916; by permission of the director, U. S. Bureau of Mines.

†Mining engineer, U. S. Bureau of Mines, Pittsburgh, Penn.

The principal features of the present self-contained oxygen mine-rescue apparatus consist of: (1) A rubber bag or bags into and from which the wearer breathes; (2) a steel cylinder or cylinders containing compressed oxygen which is fed automotically into the breathing bag through a reducing valve at a fixed volume per minute; and (3) a regenerating charge carried either loose in the rubber breathing bag or in a specially prepared metal cartridge connected to the bag. In other words, every time the wearer of the apparatus inhales, a small part of the oxygen in that breath is absorbed by the blood and in its stead a small proportion of carbon dioxide is thrown off. The exhaled air containing this carbon dioxide passes through the charge of alkali, which absorbs the impurities; the requisite quantity of oxygen is then automatically supplied in order to bring the next inhalation up to normal condition. In mine-rescue work where a rescue crew is frequently called upon to go a half-mile or so into a poisonous atmosphere, it is necessary that the apparatus have a two-hour capacity, and a self-contained oxygen mine-rescue apparatus is practically the only possible means of supplying regenerated air for such a period.

Designing a New Apparatus

The physicists and engineers of the Bureau of Mines have been engaged in designing a new apparatus that will more fully meet one's physical requirements, and encouraging results have already been obtained. The rate of oxygen supply in the newly designed apparatus will be controlled automatically by the breathing of the wearer, and it will adjust itself with equal readiness during vigorous exertion or while at rest. The United States may be relied upon eventually to manufacture an apparatus that will be superior to those of foreign design now in use.

So far, men in laboratory tests and also in the field have worn oxygen mine-rescue apparatus at intervals from four to six hours a day for periods of several weeks and have not suffered any serious disorders. Of course, every man who is to take part in mine-rescue work should have received a thorough physical examination, particularly of his heart, arteries and kidneys; he should be of fair muscular development, under 40 years of age, not over the average weight for his height, and his arterial pressure when resting should not be more than 135 to 140 mm. of mercury.

The consumption of oxygen by the body is sometimes compared to that of a fire. The analogy, however, can be carried too far. When oxygen is supplied to a flame, the combustion proceeds at a more rapid rate. This is not true when pure oxygen is supplied to the lungs, because one does not consume any more oxygen when breathing air highly enriched in oxygen than when breathing normal air. The quantity that the body demands is wholly determined by physical exertion. The ordinary open flame is extinguished when oxygen in the atmosphere falls below 16½%. The blood of a normal man at sea level is not able to absorb enough oxygen properly to sustain life when the oxygen percentage drops below 13%, and unconsciousness is likely to occur at about 9%. Furthermore, burning and breathing differ in that the former depends mainly on the percentage of available oxygen in relation to other gases present; whereas, in the latter, the lungs depend almost solely upon the oxygen contents of air by weight regardless of other inert gases present.

One notable and important change that the Bureau of Mines has made in several of the types of oxygen mine-rescue apparatus now in use was the discarding of the so-called "helmet" or headpiece. In the case of all of the reported deaths, except one, in this country while using rescue apparatus, helmets were worn. The helmet contains considerable dead space in which foul air is likely to accumulate; it is also cumbersome, obscures the vision and is likely at all times to be jarred free from the face if it accidentally comes in contact with an obstruction. The mouth-breathing form of apparatus is the only type now used by the bureau. Of course this does not refer to a supplementary headgear for protection from heat. Perhaps the next step taken by the bureau in order to increase the safety of the apparatus was to require that all types contain a bypass valve in addition to the reducing valve, in order that the wearer may draw on his oxygen supply at will in case of emergency. In fact, the specifications for the bureau's new apparatus stipulate that there be a bypass attachment, also that in the injector type the injector be placed on the intake side of the regenerating cartridge so as to reduce the course of circulation which is under a negative pressure.

The purpose of this paper is to give merely an elementary discussion of the oxygen mine-rescue apparatus used in this country. It would take pages to discuss in detail all the mechanical and physical features of the apparatus and the numerous tests and experiments that have been carried on by the Bureau of Mines.

Attention is called to the bureau's Technical Paper No. 82, "Oxygen Mine-Rescue Apparatus and Its Physiological Effects on Users." This publication will soon be out of the press and is probably the last word on this particular subject.

The most essential points to be remembered in connection with the apparatus now used by the Bureau of Mines are as follows:

1. The apparatus should be of the one- or two-hour type. Apparatus of smaller capacity can be used only for inspection purposes with the necessary degree of safety. The Bureau of Mines does not use the so-called "half-hour" types of apparatus unless they are equipped with the regulation reducing valve and finimeter.

2. The "helmet" with a seal to cut off the outside gases should be discarded; it should be replaced by a simple mouth-breathing device.

3. A bypass valve should be a part of every apparatus, as it can be used to draw on the oxygen supply at will in case the reducing valve should fail or in other emergencies.

4. In the injector type of apparatus the injector should be placed on the intake side of the regenerating cartridge.

5. No one should be allowed to wear the apparatus until he has passed a severe physical examination and has been thoroughly trained in its use. The manual of training of the Bureau of Mines requires that the apparatus be worn for five 2-hr. periods.

6. The apparatus should be tested weekly to gurantee that it is absolutely air-tight and that the reducing valve is supplying the requisite amount of oxygen per minute.

Extra precautions should be taken in connection with apparatus in which there is a negative pressure circulation; that is, an injector employed to operate the circulatory system artificially.

7. The apparatus should be kept in a sanitary condition.

8. The apparatus should be thoroughly tested immediately prior to its use in an irrespirable atmosphere.

9. The regenerating charge, whether loose in the breathing bag or contained in a specially prepared cartridge, should be inspected carefully before being introduced into the apparatus. Do not expose the regenerating charge to a freezing temperature.

10. No one wearing the apparatus should be allowed to enter alone into an irrespirable atmosphere; the bureau recommends that a rescue crew should consist of five men.

* * *

Schools To Train Foremen for Our Chemical Industries*

Within the last 25 years there has been created a growing demand, from industries, for young men with chemical training. As a result of this demand many excellent chemical courses have been established in our universities and technical schools, the graduates from which have found a ready welcome in nearly every line of manufacturing. These young men, for the most part, have been employed as analytical chemists and through hard work and untiring effort have risen to positions of responsibility and trust. The demand for such men has been gradually increasing until at the present time there is hardly a sufficient number available to meet the demands. As our manufacturing processes have become more complicated within recent years, there is another problem that confronts us: that is, the ability to handle these complicated processes in an intelligent manner in the works. In other words, we have come to realize that we must have not only research chemists to work out new processes and technically trained men in our laboratories to test the materials purchased and the products manufactured, but likewise men in our plants who are also technically trained to make these products. That is to say, we must make provision for the training of our foremen. Many a process has been pronounced a failure and many a product ruined, because unintelligent supervision was exercised during the preliminary trials.

That such a condition exists was felt by the trustees of Pratt Institute, and in 1905 a course in applied chemistry was established, which has for its aim the training of young men for foremanship positions in our growing chemical industries. In organizing the work Dr. Allen Rogers[1] attacked the problem from an entirely novel standpoint, as he believed that to train men for factory work required that they be given factory experience. It being impossible to put the student into actual factories, the next best method was adopted—that of building model factories at the school, where the student might handle materials on a scale sufficiently large to approach commercial conditions.

In the original plan five model plants were selected: A soap factory, paint factory, chemical works, dyeing equipment and tannery. Since the inauguration of the course, however, the scope of the work has been greatly enlarged, the equipment in all of the original plants has been materially increased, and several new plants have been installed, including a dry-color and ink works, varnish equipment and an intermediate and dyestuff plant. In working in these model plants the students are assigned in groups, one of the members being foreman. The equipment is of such a character that marketable products can be produced, and being of a high standard, they find a ready sale. The returns from the sale of manufactured articles are sufficient to offset the cost of raw material. During the last year the sales from these manufacturing plants, not counting the material used in the manufacture of other products or sold to other departments of the institute, amounted to over $2,500. By working in the model plant, the student becomes familiar with the handling of machinery, gains experience in the control of men and acquires confidence in his own ability to work with materials that have a money value. He also learns that to spoil a batch of goods means money lost and to make an inferior article lowers the efficiency of his plant. In carrying on this work, the foreman must keep a record of all operations, the cost of raw material, take into account the item of labor, wear and tear of machinery, cost of container and interest on the investment.

The object of the course, as already stated, is to train foremen, and so the instruction is not treated as an engineering problem, the idea being simply to fit young men to handle practically every piece of apparatus or machine found in any chemical manufacturing plant. Since the inauguration of the course the number of applicants for admission has increased from 8 for the first year to over 140 in the last three years. As the number admitted is limited to 35, more than 100 bright young men have to be disappointed each year. Of the 300-odd graduates there are: Managers, 11; assistant managers, 3; superintendents, 18; assistant superintendents, 31; foremen, 66; chief chemists, 16; chemists, 98; in other lines, 6; out of employment, 1; the remainder are employed as inspectors, salesmen or other workers connected with the chemical industry.

Progress in Leather Trades

As an outgrowth of the course in applied chemistry and largely as a result of the efforts of Dr. Rogers, who is considered an authority on leather, courses in tanning and applied leather chemistry were opened at Pratt Institute in 1911. In conducting these courses, the institute has the financial and moral support of the National Association of Tanners and the allied industries, as well as the hearty coöperation of all the leather-trade journals. The majority of students enrolled in these tanning courses come directly from the trades and, on completion of their course, usually return to the plant from which they came. Many plants even send their men and not only meet the expenses of the course, but keep them on the payroll during the time. The tanners of the country realized that the future of their industry depended upon having young men with technical training occupy the positions of responsibility in the [illegible] and so they appointed a committee and raised the necessary funds to meet the needs. They now [illegible] [illegible] in order to place the industry on a still [illegible] [illegible] it will require the unhampered attention of the research chemist; and another fund is being raised, which will insure the establishment of a very complete research laboratory. This research work will be carried out in conjunction with the tanning course, where the facilities of the best-equipped tanning-school plant in the world will be at the disposal of the research chemist and his staff. The National Association of Tanners, therefore, has done the wise thing by first seeing to it that they had technically trained men in their plants before starting a line of investigation that would eventually find its application in the tannery.

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*Extracts from material supplied by the American Chemical Society.

[1] Research chemist, Pratt Institute, Brooklyn, N. Y.

Foreign Trade in Lead and Zinc

Imports of lead during July and August, 1916, are reported by the Department of Commerce, as follows:

Articles and Countries	Contents (Pounds) July	August
Lead ore:		
Canada	58,000	33,800
Mexico	320,686	2,385,663
Chile	731,618	188,160
Colombia	7,697	
Peru	171,067	53,694
China	134	
Salvador		225
	1,289,202	2,661,542
Lead in base bullion and bullion:		
Peru	16,163	12,723
Mexico		287,993
	16,163	300,716
Lead, pigs, bars and old:		
France		56,160
Canada		12,000
Mexico	446,600	245,424
Barbados	662	1,045
Brazil		142,282
Costa Rica	72	
Panama	1,510	
Cuba	203	
Haiti	1,500	
	450,547	456,911

The actual tonnage of lead ore imported in July was 4,062 and in August, 10,093.

The imports of zinc ore amounted to 23,539 tons in July and 36,366 tons in August. The countries of origin and the metal contents (in pounds) were as follows:

Countries	July	August
Italy		5,000,000
Spain	4,088,000	4,981,514
Canada	1,493,000	1,105,600
Guatemala		32,000
Mexico	7,447,053	11,441,549
Colombia	8,744	2,205
China	42,795	
Peru	13.546	19,400
Australia	3,765,000	
Hong Kong		4,480,860
New Zealand		1,888,051
	16,858,138	28,951,179

Zinc in blocks, pigs, etc., was imported as follows (in pounds):

Countries	July	August
Costa Rica and other British West Indies	10,264	3,938
Cuba	41,183	33.833
Brazil	13,732	
Colombia		108,760
	65,179	147,145

Imports of zinc dust in July amounted to 85,408 lb. and in August to 92,948 lb., all from France and Japan. Zinc dust of foreign origin amounting to 52,553 lb. was exported in July and to 62,400 lb. in August.

Exports of lead and zinc during the two months under review were as follows:

	July	August
Lead, pigs, bars, etc.:		
Produced from domestic ore	18,016,865	15,084,104
Produced from foreign ore	3,119,550	896,000
Zinc, pigs, bars, etc.:		
Produced from domestic ore	23,491,422	32,344,106
Produced from foreign ore	9,015,755	9,359,643
Zinc plates and sheets	1,925,392	4,978,592

Precious Stones in 1915

In the chapter on Precious Stones, written for Vol. XXIV of the *Mineral Industry* by Dr. George F. Kunz, the effect of the war is noted, with particular reference to diamonds; the stringent British regulations to prevent industrial stones from getting into German hands; the closing of the mines at the beginning of the war; the gradual increase of American demand with the corresponding increase of price in three jumps totaling over 20% in about three months; and finally the French war measure of May 16, 1916, prohibiting the importation of precious stones, pearls excepted, as a means of limiting the indulgence in luxuries. Paris being a distributing center for pearls, the export trade represents an economic gain. A curious effect of the war is the phenomenal demand in London for cheap diamond rings, with a falling off in the demand for large diamonds.

Official returns from the Mines Department place the total diamond production in the Union of South Africa for 1915 at 103,385.7 carats having a value of £399,810; while in 1913 the production was valued at £11,389,807. Most of the mines ceased operations shortly after the outbreak of the war. Many employees served in the campaign in German Southwest Africa, and the companies cared for the families of such volunteers. Prospecting in Rhodesia disclosed some fissures of kimberlite, and the diamantiferous beds in the Somabula forest have been traced for about 70 mi. northeast from Willoughby's Halt. They contain many gem stones besides diamonds, including chrysoberyl and topaz.

In Brazil diamonds are now reported to have been found in the matrix, the discovery being credited to Dr. Eberhard Rimann, the chief mineralogist and petrographer of the National Geological Institute in Rio de Janeiro since 1912. The states of greatest present importance, as regards diamonds, are Minas Geraes, Bahia, Goyaz and Matto Grosso. In the districts that have been worked, the stream gravels have in some cases been gone over several times and the higher terrace gravels now furnish most of the stones. Dredging operations are not yet successful, but the outlook is good.

Imports of precious stones into the United States in 1915 amounted to $26,521,330, nearly one-half of which value was represented by diamonds, cut but not set.

The American diamond field of Pike County, Arkansas, was practically idle; the watchman of the Arkansas Diamond Co. retrieving 32 stones with a total weight of 17.9 carats. Montana furnished good sapphires, now popular as a gem stone, to the extent of 36,863 carats, and 506,700 carats of culls for industrial use. Turquoise and the less precious stones were not extensively mined, though the pink and red tourmalines of southern California are finding a good market in China.

Appraisement of Zinc

Appraisement of zinc at customs houses has been ordered modified. The Treasury Department has issued this statement in that connection:

"The plan for the appraisement of zinc in ore, published in T. D. 36,446, is hereby modified, to provide that the method therein set forth shall not apply to sulphide ores assaying 40% or less of zinc. The zinc in such ores should be appraised at not less than the contract or purchase price."

Editorials

Copper Smelting and Refining Capacity

We have previously called attention to the similarity of conditions now existing in the copper industry to those that prevailed in the zinc industry about a year ago, when there was a plethora of ore and a scarcity of smelting capacity, conditions that gave the smelters the benefit of extraordinarily large margins, and indeed sometimes rendered it difficult for the producers to dispose of their ore at all. In the zinc industry that situation has been to a large extent corrected by the building of new smelting capacity.

The production of copper at the present time is throttled chiefly by deficiency of refining capacity, to a less extent by deficiency in smelting capacity. There is, thus, a congestion of crude copper that cannot be refined and of ore that cannot be smelted. Some new producers are finding it difficult to dispose of their output. Anbody who has refining or smelting capacity to sell can get for it almost anything that he chooses to ask. We have heard of smelting contracts recently made at a discount of 5c. per lb. of copper.

The smelter who makes such a contract is sure of winning a huge profit. The ore producer is called upon to make a huge sacrifice and may resent it unless he understand the conditions. If he does understand the conditions, he figures that it is much better for him to sell his copper at 22c. per lb. than not to sell it at all. If anybody does not choose to accept such terms, there are lots who are glad to, and the producer who holds out stands the chance of missing the market altogether. The law of demand and supply prevails in the smelting business just as in everything else.

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The Metallurgical Advance

The advance of metallurgy during the last few years points more and more decidedly to selective treatment of ores; that is, the segregation of the principal metal-bearing constituents of an ore into a bulk much less than that of the original material by the use of a process costing little to operate. Such a process should logically be called concentration, which is what it really is, but that word has had such a long and honorable use in connection with gravity-water separation that, to avert confusion, it is advisable to avoid its use in another sense. Concentration, then, may be held to be one form of selective ore treatment, in which the bulk of the ore is treated by a cheap process, a residue thrown away and a selected smaller portion further beneficiated by a more costly method. Close examination of former systems of treatment will show that most of them make use of selection in some form, varying from the natural high-grade ores, selected by nature, and progressing through hand-sorting and concentration processes, down to the highly refined fine-concentrating and flotation processes. Consequently it is not surprising that the latest steps have served to reveal more clearly the tendency of modern ore treatment.

To put the statement in another form, it might be said that elimination of portions of the ore should begin as soon as possible after treatment begins. Thus, at the sorting table, manifestly worthless rock is extracted and thrown away. And similarly in jigging, table concentration and other systems, valueless portions of the rock may be selected for rejection, leaving more concentrated portions to be acted upon by the costlier processes of regrinding, concentrating, amalgamating, floating or whatever other method may seem applicable. Of course the extremes of total absence of value and total absence of everything but value can hardly be reached. Even the most barren-looking rock probably contains some metal, and even the bullion bar contains foreign material that must be removed later by refining processes. But the desired conditions can be approximated, and residues of no immediate commercial value can be rejected at appropriate stages in the process. Flotation has done much to clarify the ideas of the desiderata of metallurgy. Certainly it seems now to be generally conceded that the treatment of the large bulk of ore by an inexpensive, not highly efficient method to produce a small, selected portion that can be further treated by a more expensive and efficient method constituting the final step is the procedure that will, all things considered, be most satisfactory.

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Selling Custom Ore

A Colorado local paper told recently of the experience of a small ore producer in Gilpin County, who shipped a carload (about 25 tons) of ore to the American Smelting and Refining Co. at Denver. The consignment was refused as worthless by the smelting company, owing to its high content of zinc, the assay of the ore being 1.175 oz. gold, 11.7 oz. silver and 23.2% zinc. The ore having been refused by the smelter, a public sampling and ore-buying concern was asked to make a bid. It offered $1 per ton. The consigner of the ore then ordered it shipped back to Black Hawk. Upon arrival there, the Colorado & Southern Ry. rendered a freight bill of $196.10. The local Mine Operators' Association then came to the assistance of the unfortunate producer and secured from the railway a large reduction of its charges, after which the ore was sold to a local ore-buying concern for the net sum of $386.72.

The local paper from which we derive the above facts characterized the affair as "a raw deal." In so far as the railway company was concerned, it certainly was, a charge of $4 per ton from Black Hawk to Denver being exorbitant. The smelter was, of course, perfectly within its rights in refusing to buy the ore if it did not want it. In shipping the ore without previously finding out where it was marketable, the consignor took chances. Nevertheless those are chances that the small producer takes habitually, and often to his disadvantage, for the ore once delivered to the smelter, a loss—perhaps large—is involved in taking it away, and the consignor is therefore generally constrained to accept unfavorable terms.

The remedy for such unfortunate occurrences is greater publicity respecting the ore market. The producer who makes a consignment ought, of course, previously to find out by inquiry respecting the probable terms, but many will neglect to do that. The current terms, however, of various kinds could be published in a general way so that producers might have some idea of the market, just as does the farmer when he ships potatoes or pigs to a commission merchant.

A New Brood of Wildcats

The great interest at the present time in the production of ores and metals naturally stimulates interest in the development of prospects, which inspire hope of the uncovering of a new bonanza. Such a story as that of United Verde Extension kindles imagination and makes easy the promotion of "prospects" in the vicinity. So it is in other mining districts. And so it is also that fraudulent promoters quickly and naturally take advantage of their new opportunities.

An esteemed correspondent in Arizona, which is one of the livest of mining states, writes us on the subject as follows: "Incidentally I am wondering what the United States Post Office authorities are doing respecting the prosecution of persons who are using the mails for fraudulent purposes. We have, in our immediate vicinity, several companies that are issuing literature which certainly should be brought to the attention of prosecuting attorneys; yet so far as I know, nothing is being done toward putting the 'soft pedal' on these people. It is a great pity that the present high prices of metal and the general boom in the mining industry are assisting the operations of some of the worst swindlers that I have ever come across. I wish there was some way of stirring the Post Office authorities into activity. I have tried to do this, personally, in one instance, but did not get any results at all. I wonder if the time be not ripe for some strenuous efforts to be made by responsible mining men and the journals that represent them, so as to curb the activities of persons who are stock swindlers, pure and simple, and whose present activities will certainly be to the damage and detriment of all legitimate mining."

We hope that the daily press will take notice. If the daily papers will refuse to prostitute their advertising pages, the swindlers will not get very far. However, they will catch thousands of the unwary by means of their circulars and other representations. For these the Post Office authorities should be on the lookout. It is the duty of every good citizen who knows the facts to apprise the authorities of wildcats emanating from their district. Otherwise the Post Office authorities will not know that action is necessary. If, after receiving such information, they neglect to act, the blame will be theirs.

Production of Spelter Abroad

Bits of evidence showing how the production of zinc is increasing in many parts of the world are constantly appearing. Thus, the official report of the production of ores and metals in Sweden shows that the electrothermic smeltery at Trolhättan produced 8,588 metric tons of spelter in 1915, compared with 2,300 tons in 1914. The electrothermic smeltery at Sarpsborg, in Norway, also made a largely increased production, but to the major extent (if not wholly) its output consisted of refined spelter produced from common spelter shipped thither from Great Britain.

Outside of the United States the most spectacular increase in spelter production is occurring in Japan, whose smelters are now supplying the major part of the Japanese consumption. Inasmuch as only a few years ago Japan imported all her spelter, the obtaining of her own supply releases, of course, capacity in other parts of the world.

China has been exporting a small tonnage of spelter—probably the output of native smelters—and Canada is now making a small production of electrolytic spelter. The new, large zinc smeltery at Ekibastus, in Siberia, is probably in operation by this time. The zinc smelters of both France and Great Britain have increased their output. While these additions to the world's production are occurring in driblets, as compared with what happened in the United States, nevertheless their aggregate is considerable. The swelling foreign supply is undoubtedly playing an important part in the spelter market.

The new conditions are helping to relieve the zinc situation in Australia, where, upon the outbreak of the war, an annual output of about 400,000 tons of concentrates, the great bulk of which formerly went to Germany and Belgium, was cut off from their market. Later, a relatively small proportion thereof was sold in the United States, shipments of which have been received by American smelters during the last year. Later still, an additional market was found in Japan. Finally, the British government agreed to purchase 100,000 tons per annum during the war and the same quantity yearly for 10 years after the war.

In the meanwhile important plans to increase the spelter production in Australia have been instituted—especially through the erection of a large electrolytic plant in Tasmania—and the British government has agreed to purchase for 10 years 45,000 tons per annum of spelter produced in Australia. However, the production of electrolytic spelter in Tasmania can hardly begin before the latter part of 1917, and it will probably be a long time before that plant, together with the smeltery at Port Pirie, will be able to produce 45,000 tons of spelter per annum.

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The reports from the lead refineries of diminishing output owing to increasing inefficiency of labor are but another sign of the times. Prosperity—which means high wages and continuous work—generally breeds slackness and indifference to control. This comes soonest in evidence in the metallurgical industry in those branches of work wherein the human factor is highest; for example, in zinc smelting and lead refining. In copper smelting, wherein the machine and the furnace are preëminent, it is of least effect. The greatest menace to American welfare is the growing lack of thrift, or what is the same thing—the growing tendency to waste, whether it be of material or time.

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How long are citizens enlisted in the National Guard to be kept on the Mexican border while their patriotic and generous employers pay their wages and salaries?

BY THE WAY

The report of the Bureau of Statistics of the State Department of Labor that wages in the factories of New York have advanced on the average by 15% during the two years of the war indicates that labor is participating with capital in the great prosperity of the United States.

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A Butte miner who had a job in the New York subway was met on Broadway by a Western friend, who asked him what he was doing there. He replied: "Working in a sort of a parlor. I put in a shot and a dago comes in and mucks it out, and when I feel like it I go back and put in another. They call it working, but you could eat it. Talk about blasting! It sounds like a Fourth of July firecracker."

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There happened to be in San Francisco recently seven of the technical staff of the Pueblo Smelting and Refining Co. of 30 years ago, and appropriately, they got together at dinner. They were Baron von der Ropp and E. N. Englehart, formerly at the old lower works in Anaconda; H. H. Schlapp of Broken Hill fame, now a resident of Melbourne, Australia; Philip S. Morse, formerly of Cockle Creek, Australia; August Raht, who built the East Helena smeltery; George Westcott, who has abandoned assaying for fruit raising, and E. P. Mathewson.

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According to the report of the Werchisset Mining Co., it appears that the copper industry of the Ural has been compelled to reduce its production on account of shortage of labor, of difficulties of transport, and owing to the impossibility of obtaining sufficient coke from the Donetz district, says *Engineering*, London, Aug. 18, 1916. The cost of production has increased, but prices were fixed by a long-running contract with the Copper Syndicate, Medj. The Russian banks appear to be much interested in the Ural mining and metallurgical undertakings, and are by degrees acquiring a number of shares in these concerns. Thus the Union Bank of Moscow has acquired the majority of the shares in the Alepajew Metallurgical Works, which has a capital of 5,880,000 roubles. This is one of the oldest concerns in the Ural and manufactures pig iron and half-finished products.

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The Jerome boom gathers momentum as it progresses. "There seems to be no limit to the spots," writes an Arizona correspondent, "upon which a million-dollar corporation can be formed overnight. And they are being as quickly formed. Of course the 'home folks' take the first 100,000 shares at 10c., while the outside world hungrily awaits the issuance of the second 100,000 shares at $1 a share. Thus it goes. Nearly every man, woman and child in Jerome has an armful of stocks and is accumulating more hourly. The preachers put their savings behind their faith and fill their coffers with the filthy lucre between Sabbaths. Stenographers vie with their employers for prestige on the 'Change, and schoolteachers keep one eye on the stock ticker and one on the blackboard. One cannot distinguish between common street loafers and malefactors of great wealth, and the swamper is a financier of much renown. Verily it is a jolly good camp —and profiting."

The following letter from a young engineer who is doing good work for himself and for his community with very small means is of peculiar interest: "I was glad to get the information about the ——— ———. I do not believe that you can work that hard rock by hand. I also think that small air installations can be put in cheaply. I have been waiting to see how the ——— was going to turn out. The installaton is more than a success. It is some layout. We bought an old Oakland auto engine supposed to be 35 hp. We paid $150 for engine and transmission. We set this on a frame of 8x8 and connected a piece of $2\frac{3}{16}$-in. shaft directly to the end of the transmission. Off this shaft we drive a 72-cu.ft. compressor and a pump to cool the engine. On the end of the shaft is a pinion that drives the hoist. The hoist pulls out of the mine about 1,200 ft., and then we attach another cable to pull up the hill. The hill is 1,300 ft. long. The maximum grade is 50%. We have a bin at the top where the self-dumping skip unloads. We put a new carburetor and magneto on the engine and then it went fine. We are going to try kerosene after we run awhile. I believe that we can take the 72-ft. compressor that we have and put it on a truck. This truck could carry the Shaw sharpener, jackhamer, etc. I planned on getting an 8-16 Mogul tractor made by the International Harvester Co. to drive the same, using the tractor as a stationary engine and also to haul ore. With a layout like this, I believe that you can make a profit out of lots of places where old timers had to quit." To a young fellow who is showing such ingenuity and resourcefulness, we say, "More power to his elbow."

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The Anaconda *Standard* remarked fittingly that the announcement of E. P. Mathewson that he is to leave Anaconda was received with deep regret, not only in the city for which he has done so much in all civic lines, but throughout the state, where he has taken a foremost interest in every coöperative effort for the common good. His personality is stamped upon institutions of which Anaconda is most proud—the whole movement centering in playground activities, the sports on the common, the Christmas celebrations and other holiday observances; the library; the good-roads system, and many another undertaking that is significant of progress. In his official capacity he has had the confidence of the entire community as well as of the company he has represented here. Throughout the state he was recognized as a tireless worker for the upbuilding of the best in Montana. He was chairman of the state fish and game commission, and from the first has been at the head of the good-roads and automobile organization of the state. The attractiveness which Montana has for tourists is the result largely of his activity in these two capacities. He has been an enthusiastic worker for the state fair and other organizations of the kind, and his presence will be sorely missed in every aggregation of loyal boosters. He leaves Montana with the best wishes of every citizen for his prosperity in his new field of usefulness, and the assurance that he will always be welcomed back, whether it be for a temporary visit or to make the state his permanent home if he finds the longing for return irresistible. The *Journal* adds to this that Mr. Mathewson in Montana has been not only a distinguished metallurgist and a great administrator, but also a good citizen.

Personals

John Seward has returned to Nutley, N. J., from Ontario.

L. W. Kemp, lately at Grass Valley, Calif., is now at the Chuquicamata mine in Chile.

A. P. Rogers has just returned to New York from a professional trip in Dutch Guiana.

Mill Superintendent Eames, of the Hollinger Mine in Ontario was in New York last week.

C. H. Macnutt has obtained a commission in the Royal Canadian Engineers, Canadian Expeditionary Force.

John F. Boyle has been elected president of the Arkansas & Arizona Copper Co. He succeeds C. W. Clark, resigned.

Richard A. Parker has been elected chairman of the mining bureau of the Denver Civic and Commercial Association.

Charles W. Newton, manager of the Consolidated Interstate Callahan mines at Wallace, Idaho, was in Boise on business recently.

J. Reddington, who has been in charge of development work at the Moose mine, Gold Lake, Manitoba, has returned to New York.

Robert McGarraugh, formerly mine superintendent of the Aguacate mines in Costa Rica, has been appointed general superintendent in charge of operations at the mines.

Persifor G. Spilsbury, general manager of the Aguacate mines, Costa Rica, has been transferred to New York and will have his offices at 55 Liberty St., New York.

G. A. White, formerly metallurgist of the American Sheet and Tin Plate Co., is now associated with the Titanium Alloy Manufacturing Co., of Niagara Falls, in the same capacity.

Frederick Laist, formerly metallurgical manager for the Anaconda Copper Mining Co., has been appointed the successor of E. P. Mathewson, who has just left the Anaconda company.

J. N. Bulkley, 120 Broadway, New York, has been appointed consulting engineer to the Kaolin Products Corporation, and will design and supervise the erection of the new plant.

J. L. McAllen has resigned his position as superintendent of the Gold Bullion mine at Knik in the Willow Creek District, Alaska, and will engage in private practice in Portland, Ore.

W. H. Wright, of the Malm-Wolf Co., Denver, Colo., sailed from Nome on Oct. 7 for Seattle. During the past month Mr. Wright has been making placer investigations in Alaska for New York parties.

John V. N. Dorr and **Carl E. Akeley** have been awarded the John Scott Legacy Medals and premiums by the Franklin Institute of Philadelphia; Mr. Dorr for his hydrometallurgical apparatus, and Mr. Akeley for his cement gun.

W. F. Ridley, superintendent of the Allouez and Centennial copper mines in Michigan, was seriously injured while at work underground recently, losing three toes on his left foot and receiving serious injuries about the head and face.

Edward Ray Weidlein has been appointed associate director of the Mellon Institute of Industrial Research of the University of Pittsburgh. Mr. Weidlein has held an industrial fellowship since 1910, and during the past four years has been in active charge of the hydrometallurgical investigations of the institute.

Will L. Clark, manager of the United Verde Copper Co. since 1904, has resigned that position. He is succeeded by Robert E. Tally, who for the last eight years has been superintendent of mines for the United Verde company, and is now to have the title of assistant general manager. For the present he will continue also to act as superintendent of mines.

L. P. Yandell has been elected a director in the Stanton copper companies—Mohawk, Wolverine, White Pine Extension and Michigan. Mr. Yandell is the manager of the estate of the late Joseph E. Gay, for many years heavily interested with the Stantons in all their properties. He has visited the Michigan and has a close working knowledge of the conditions at the various mines.

F. N. Flynn, for the past seven years connected with the Arizona Copper Co., Ltd., at Clifton, Ariz., has resigned his position as superintendent of the smelting department, effective Oct. 31. **Roger H. Hatchett**, who has been Mr. Flynn's assistant for six years past, has been appointed acting superintendent of the smelting department. Mr. Flynn will sail from New York early in November, for Chuquicamata, Chile, where he will enter the employ of the Chile Exploration Co.

Obituary

Lyman B. Brainard, president Hartford Steam Boil Inspection and Insurance Co., Hartford, Conn., died suddenly Oct. 11 of apoplexy, aged 60 years. He was also a director in a number of large corporations.

Levi Leonard Conant, professor of mathematics at Worcester Polytechnic Institute, Worcester, Mass., was killed Oct. 11 by an automobile truck which ran over him. He was born in Middletown, Mass., in 1857, and was graduated from Dartmouth in 1879. He was professor of mathematics in the South Dakota School of Mines 1887-90, removing to Worcester in 1891. From 1911 to 1913 he was acting president of Worcester Polytechnic Institute.

Lewis F. Jones, a mining engineer, sent to Barrackville, W. Va., in charge of a crew from the Pittsburgh station of the Bureau of Mines, to rescue the entombed men at the Jamison mine, was asphyxiated in the workings Oct. 21. Jones, with seven other men, had reached the bottom of the shaft when he was overcome. His companions, advancing to the rescue, felt the force of the gas, and one by one dropped in their tracks. When they did not return to the surface another party entered the mine and brought them out. All quickly recovered except Jones, who had apparently died in the mine. He is the fourth Government expert to lose his life in an attempt to save entombed miners. His death was a great loss, as he was regarded as one of the most able men in directing rescue work. Mr. Jones had charge of the experimental mine of the bureau at Bruceton, Penn., and in this capacity developed many safeguards for the protection of life in mines.

Ranks of Colorado's pioneer mining men have been thinned by the recent deaths of **Col. George G. Vivian, A. R. Gumaer, Charles W. Marshall** and **Fred W. Cammann.** Vivian was the last survivor of the so-called "Swansea Group" of men who were instrumental in establishing several early smelting plants in the state. He was born in Cornwall 61 years ago and came to this country with Pierce, Dumont, and others. At times he managed the Champion, Koohinor and Donaldson mines at Idaho Springs, the smeltery at Golden and the Hidalgo mine near Mexico City. For the past three years he managed the East Butte Copper Co. at Butte, Mont. Gumaer was president of the Florence Oil and Refining Co. and always held numerous mining interests. His death was due to pneumonia. Marshall was stricken with apoplexy while driving to his mining property in Bummer's Gulch, Boulder County. Cammann held properties, at various periods, in the Leadville, Gunnison, Silverton and Central City districts. Heart failure attacked him while visiting his son in Cleveland, Ohio.

Societies

University of Illinois—The number of students registered in the College of Engineering at Urbana, Ill., is 1,143 this term.

University of Arizona—This institution at Tucson will give this winter a number of short courses intended for men working in the mine or smelting plant. These courses include Prospecting; Field Geology; Assaying; Metallurgy; Flotation; Mine Management.

Mining and Metallurgical Society of America—A meeting of the New York Section was held at the Engineers' Club on Oct. 19. W. R. Ingalls having declined to accept the chairmanship of the section to which he was elected at a previous meeting, Morril B. Spaulding was elected to fill that office. Prof. Benjamin Leroy Miller addressed the meting on the subject of "Iron and Manganese Deposits of Brazil."

Haileybury School of Mines—The new mining and milling laboratory at Haileybury, Ont., is nearing completion and the school is now getting the machinery and equipment. The laboratory will comprise a complete small size concentrator, cyanide mill, flotation plant, assay office, blacksmith shop, machine shop and carpenter shop and will contain most of the machines usually met with in these lines. The school has the coöperation of the mines of the Cobalt district and of manufacturers of mining machinery.

Industrial News

H. W. Dow has been appointed sales manager of the Nordberg Manufacturing Co., of Milwaukee, Wis Mr. Dow has been associated with the company in the engineering and sales departments for 12 years.

Trade Catalogs

Erie Volute Centrifugal Pumps. Erie Pump and Equipment Co., Erie, Penn. Catalog No. 32. Pp. 32. 6x9 in. Illustrated.

Roller Bearings. Hyatt Roller Bearing Co., Newark, N. J. Bulletin No. 307. Pp. 24; 7x10 in Illustrated. This covers the application of roller bearings to mine cars.

Encyclopedia of Goodyear Mechanical Rubber Goods. The Goodyear Tire and Rubber Co., Akron, Ohio. Pp. 40. 7½x10½ in.

This is the title of a set of bound bulletins containing tabulations of the mechanical rubber goods made by this company and information as to their use.

New Patents

United States patent specifications listed below may be obtained from "The Engineering and Mining Journal" at 25c. each. British patents are supplied at 40c. each.

CONCENTRATING—Ore-Concentrating Apparatus. Thomas A. Janney, Garfield, Utah. (U. S. No. 1,201,053; Oct. 10, 1916.)

CRUCIBLE FURNACES—Improvements Relating to Crucible Furnaces. E. Hall, Birmingham, Eng. (Brit. No. 4,991 of 1915.)

CRUSHER—Ore Crusher and Concentrator. Charles O. Haskell, Los Angeles, Calif., assignor to Centrifugal Machinery Co., Los Angeles, Calif. (U. S. No. 1,200,104; Oct. 3, 1916.)

CRUSHING—Improvements in Crushing, Grinding and Pulverizing Machines. W. H. Coward, Somerset, Eng. (Brit. No. 735 of 1915.)

CONCENTRATOR—Ore Concentrator. George T. Cooley, Joplin, Mo., assignor of one-half to James Athel Brent, San Francisco, Calif. (U. S. No 1,201,151; Oct. 10, 1916.)

DRILL—Rock Drill. August Gerdes, Gretna, La. (U. S. No. 1,200,935; Oct. 10, 1916.)

ELECTRIC FURNACE. Horace W. Gillett and James M. Lohr, Ithaca, N. Y. (U. S. Nos. 1,201,224 and 1,201,225; Oct. 10, 1916.)

ELECTRIC FURNACES—Improvements in or Relating to Electric Furnaces. E. K. Scott, Kent, Eng., and F. Howles, Manchester, Eng. (Brit. No 3,953 of 1915.)

ELECTROLYSIS—Process of Recovering Metals. Charles J. Reed, Glenside, Penn. (U. S. No. 1,200,025; Oct. 3, 1916.)

FUEL—Process of Burning Powdered Coal and Analogous Fuel. Edward P. Roberts, Cleveland, Ohio. (U. S. No. 1,200,028; Oct. 3, 1916.)

FURNACES—Improvements in and Relating to Furnaces for Melting, Oxidizing and Volatilizing Metals. W. H. Boorne and J. Sackett, London, Eng. Brit. No. 7,072 of 1915.)

FURNACES—Improvements in or in Connection with Rotary Furnaces. F. W. Stevenson, Coventry, England. (Brit. No. 6,433 of 1915.)

RETORT DISCHARGING—Improved Means for Discharging Retorts. Gibbons Bros., Ltd., Stafford, Eng. (Brit. No. 10,058 of 1915.)

RETORT-DISCHARGING MACHINES. Simmonds Engineering Co., Iola, Kan. (Brit. No. 3,147 of 1915.)

ROASTING—Improvements in Securing Rabble Arms to Shafts of Metallurgical Furnaces. Furnace Patent Co., Philadelphia, Penn. (Brit. No. 16,939 of 1915.)

SIGNALING—Improvements in Mine and Other Electric Signaling Systems. Sterling Telephone and Electric Co., London, Eng. (Brit. No. 4,675 of 1915.)

Assessments

Company	Delinq.	Sale	Amt.
Alpha, Nev.	Oct. 25	Nov. 15	$0.03
Andes, Nev.	Oct. 11	Nov. 1	0.02
Big Cottonwood, Utah	Nov. 6	Nov. 24	0.01
Blue Bell, Ida.	Oct. 9	Nov. 9	0.002
Blue Bull, Nev.	Oct. 16	Nov. 20	0 01
Blue Star, Ida.	Sept. 25	Nov. 21	0.02
Cedar Creek, Ida.	Oct. 23	Nov. 23	0.01
Chief Coos Ext., Utah	Oct. 10	Nov. 1	0 002
Columbus-Rexall, Utah	Oct. 27	Nov. 17	0 02
Confidence Silver, Nev	Nov. 8	Nov. 29	0 10
Cornet, Ida.	Oct. 20	Nov. 20	0 00075
Consolidated Imperial, Nev	Oct. 25	Nov. 15	0 01
Demijohn, Utah	Oct. 21	Nov. 10	0 005
Diam. Blk., Butte, Nev.	Oct. 12	Nov. 18	0 01
Diamondfield Bl'k B'tte, Nev.	Oct. 12	Nov. 18	0 01
Duluth, Ida.	Oct. 18	Nov. 18	0 001
Eagle Mountain, Ida.	Oct. 2	Nov. 4	0 001
Emerald, Utah	Oct. 16	Nov. 18	0 00¼
Emerald, Utah	Nov. 15	Dec. 9	0 00¼
Enterprise, Ida.	Oct. 19	Nov. 20	0 002
Four Timber, Ida.	Oct. 1	Nov. 1	0 002
Friend, Ida	Oct. 21	Nov. 24	0 002
Giant, Ida	Oct. 5	Nov. 9	0 003
Hale and Norcross, Nev.	Nov. 8	Nov. 20	0 03
Idaho & L. A., Ida	Oct. 16	Nov. 17	0 005
Idaho Mont, Ida.	Oct. 30	Nov. 18	0 002
Independent, Ida	Oct. 7	Nov. 7	0 005
Lehi Tintic, Utah	Nov. 8	Dec. 2	0.0025
Manhattan Cons., Nev.	Oct. 9	Nov. 8	0 01
Military, Ida	Oct. 25	Nov. 25	0 00025
Mineral Range Gold, Utah	Oct. 16	Nov. 8	0.005
Monarch-Pgh., Nev	Oct. 23	Nov. 27	0 01
Murray Copper, Utah	Oct. 9	Nov. 8	0 001
Naildriver, Utah	Nov. 4	Dec. 4	0 01
Native Silver, Mont.	Oct. 2	Nov. 4	0 005
Ninemile, Ida	Nov. 2	Nov. 17	0 0015
Nonpareil, Ida.	Oct. 23	Nov. 23	0.001
North Clift, Utah	Oct. 10	Nov 3	0.01
North Franklin, Ida.	June 19	Nov. 23	0.005
North Tintic, Utah	Oct. 10	Nov. 1	0 002
Ophir, Nev.	Oct. 25	Nov. 15	0 05
Raven, Ida.	Oct. 23	Nov. 20	0 001
Seg. Belcher & Midas, Nev.	Oct. 30	Nov. 24	0 02
Selma, Utah.	Nov. 4	Nov. 23	0 005
Sierra Nevada, Nev	Oct. 12	Nov. 2	0.10
Silver Mt., Ida.	Oct. 21	Nov. 24	0 002
Spearhead, Nev.	Oct. 2	Nov. 2	0.01
Tobar, Utah	Nov. 2	Nov. 23	0.002
Tyler, Ida.	Oct. 12	Nov. 13	0 0015
Utah Arizona, Ariz.	Oct. 31	Nov. 25	0 005
Utah Metals, Utah	Oct. 23	Nov. 18	0 002
Wasatch Marble, Utah	Sept. 26	Nov. 11	0 03
Zuma, Utah	Oct. 30	Nov. 30	0 005

Editorial Correspondence

SAN FRANCISCO—Oct. 20

Lawson Adit Construction has been started by mining students of the University of California. This pierces the hillside just east of the Hearst Memorial Mining Building on the campus at Berkeley, and will be driven by the students 1,800 ft. into the Berkeley Hills. The primary purpose of Frank H. Probert, recently appointed Professor of Mining in the University of California, in this work is to give every mining student thorough acquaintance with all the mechanical processes of drilling, blasting, timbering, mine surveying, etc., without the great waste of time involved in learning such things by working as a laborer in a mine. Different types of mine timbering and different underground procedures will be illustrated in this Lawson adit. Many sessions of classes of mining students will be held there underground, in addition to the practical work which will be carried on.

Death of a Striker in Amador County resulted from an effort of the strikers to halt a motor car driven by an engineer going to his work as watchman at the South Eureka mine. The engineer is said to have tried to avoid the men who tried to stop his car, but one of the strikers is reported to have deliberately jumped in front of the moving car and was fatally injured. The South Eureka and Central Eureka, which adjoin, are being kept clear of water and the impression obtained is that these mines are preparing to resume operation. Possibly they are, provided the former employees are ready to return at the old wage and without regard to any demands of the union. Very likely all of the mines will resume if their men will go back to work on the same conditions. It is quite evident they will never go back under any other conditions. It is up to the men who are desirous of returning to work. There are about 1,000 of them, and among the 300 strikers there are possibly 100 ready to make trouble. They have taken on a little more bravado since the State Federation of Labor has endorsed the strike. Early in the strike the sheriff appointed deputies among the strikers who were informed they would be expected to maintain order among themselves. It was nice of the sheriff to do this, though he was no doubt aware that he was putting a club in their hands. The secretary of the union says he cannot control the men. That was evident in the beginning, when he claimed that the major part of the union members did not wish to strike, but the Austrians and the Spaniards and some other foreign members had their way. About 250 of them seemed to have controlled the situation, and, as Sheriff Lucot expressed it, the law-abiding element, which is anxious to be at work and does not approve the strike, got discouraged when it came to the pinch of protecting themselves against the lawless ones. Then the sheriff asked the governor to send help. The governor sent the labor commissioner to investigate, and his investigation consisted chiefly in trying to persuade the mine managers to take the men back on three months' probation with the promise that those who were good and worthy should receive the extra two-bits a day. The suggestion was declined, of course. The engineers and the pumpmen, who in the beginning were not called upon to remain away from work, were called out during the past week but had returned to work about the time the accident occurred resulting in the death of one of the strikers. The union, which is a branch of the Western Federation (not the United or Union Federation, as erroneously stated), seems to base its hope of winning the strike upon the exodus of a number of miners who were satisfied with the wage and the conditions, but who were not willing to remain idle while a useless strike was being carried on. The strike will be settled when the miners who claim to have no part in it are ready to go to work in a body and ignore the strikers and their demands.

BUTTE—Oct. 21

Butte and London Cavein that stopped work in the south crosscut has been cleaned up and work resumed. In drifting on the ledge encountered just before the cavein took place, good copper ore was encountered. The ore shows copper pyrites and is the best sample yet encountered. The extent of ore cannot be determined until further drifting is done, but every indication is now that a good orebody has been encountered that will assay high in both copper and silver and will develop commercial ore. This is the first of the seven veins encountered in the crosscutting on the 1,600-ft. level of the Butte and London that has given the company a feeling of certainty of success.

North Butte Quarterly Report for the period ending Sept. 30, 1916, shows a production of 124,488 tons of ore from which were recovered 5,953,685 lb. of copper, 247,833 oz. of silver and 402 oz. of gold. This shows a considerable decrease from the record established in the quarter ending June 30, 1916 when from 116,190 tons of ore were recovered 6,071,742 lb. of copper, 264,400 oz. silver and 442 oz. gold, but an approximation to the normal output for the period ending Sept. 30, 1915, when from 123,500 tons mined were recovered 5,672,890 lb. copper, 265,855 oz. of silver and 305 oz. of gold.

Boston & Corbin Recent Mill Changes and flotation addition are responsible for greatly increased recoveries as shown by the following figures: August ore tonnage, 2,808, recovery, 19,815 lb. of copper and 2,723 oz. of silver. September ore tonnage 2,695, recovery, 53,622 lb. of copper and 3,570 oz. of silver. For the first two weeks of October the tonnage was 1,129, mill recovery, 32,000 lb. of copper and 2,117 oz. of silver. On the assumption that the grade of ore mined in October was about the same as that in August the apparent increased recoveries effected in October were 28.5% of copper and 55.5% of silver over those of August before the mill changes were made.

Butte Millionaire Will Give Two Millions to benefit war orphans and destitute families in France. According to close friends of W. A. Clark, Jr., of Butte, son of former Senator W. A. Clark, Mr. Clark is to give the total profits of his sale of war materials and receipts from investments in "war babies" or bonds from the European governments involved in the present stupendous struggle. According to the present plans the funds will not pour into France until peace is declared. It is understood a fund will be established which will be handled under the supervision of the American ambassador to France. Mr. Clark's Butte interests are largely comprised in the Elm Orlu zinc mine, and the concentrator of the Timber Butte Milling Co., of which he is president and general manager, and which, due to the high price of spelter, have netted profits far exceeding the earnings under normal conditions. Owing to Mr. Clark's absence from the city, the report of his generous intentions, announced by his friends, could not be verified.

Davis-Daly Copper and Butte-Detroit have arranged for the use of the latter's mill for the treatment of the zinc ores in the Colorado mine of the Davis-Daly company. While it was not generally known that the Davis-Daly had zinc deposits of value, the statement is made that there is quite a large quantity of it in the upper levels of the Colorado. The concentrator of the Butte-Detroit has been remodeled for operations. An oil flotation system has been installed similar to that employed by the Butte & Superior and Timber Butte. It is stated that the Davis-Daly company is expected to furnish from 100 to 150 tons of ore for the Butte-Detroit concentrator daily. The ore has been tested both in Butte and Salt Lake oil flotation plants, and it is said that a very high percentage of recovery is made. Aside from reconstructing the concentrator, the Butte-Detroit has not been pushing work at its property. The mine was unwatered several months ago and since then has been kept unwatered preparatory to a campaign of shaft sinking and development.

DENVER—Oct. 20

At the Harvard Shaft, recently drained by the U. S. Exploration, Mining and Reduction Co. (this particular branch of this company's activities being known as the Leadville Unit), the permanent underground pump station is completed and the machinery installed, this including two Krogh pumps of 600 gal. capacity each and one Byron Jackson pump for emergency.

Grasselli Chemical vs. Western Zinc is a case just filed in the Federal District Court for Colorado. Plaintiff alleges that defendant failed to live up to contract to deliver 200 tons monthly of zinc oxide when prices of zinc began to soar, and as a result the Grasselli company was obliged to spend $13,560 more for its necessary raw material than its contract price with the Leadville company.

Radium Mining that has been practically at a standstill since the beginning of the European War, is being resumed by the Standard Chemical Co., which will immediately start new operations in its Paradox Valley properties, Montrose County. The carnotite ore will be produced from perhaps 8 or 10 mines and the ore, after concentration in the company's new mill, will be shipped to Pittsburgh for final reduction.

Tungsten Mining in Boulder County is not to cease simply because the market has dropped considerably. Tungsten Mountain Mines Co., in which H. L. Barber, of Chicago, is the heaviest owner, held its annual stockholders' meeting last week in Boulder and plans were laid for continued operations, including the pushing of the long development adit. New officers are J. G. Clark, president and manager; L. R. Means, vice-president; S. A. Greenwood, secretary and treasurer.

Downtown Mines Co. has installed its permanent station pumps at the foot of the Penrose shaft, Leadville. The Wolftone mine is now drained to the bottom of the shaft, unwatering having recently been done in cooperation with pumping in the neighboring Greenback shaft. With the new mining depth created by this drainage, extensive development of virgin ground is planned for the Wolftone, Greenback, Pyrenees, Emmet and McCormick mines.

Colorado Fuel and Iron Co. held its annual meeting in Denver recently. Officers' reports showed gross earnings for the past year to have been $25,626,605, an increase over the previous year of about 51%. Operating expenses showed a gain of 13.7%. Net earnings were $1,316,086, but income from other sources brought the profits up to $1,971,076. During the year dividends amounting to 30% on the preferred stock were distributed. A byproduct coking plant of 120 ovens was authorized to be erected at the Minnequa steel works, Pueblo, the estimated costs of this and numerous other proposed improvements being $3,300,000.

Kokomo Is Forging to the Front Again. The formations there are similar to those at Leadville and the variety of metals found is nearly as great. Zinc-sulphide is being mined in quantities from mines that were closed down years ago because of the penalties exacted for zinc in the gold-silver ores. Interest has lately centered in the production of good silver ore from a claim being worked by a group of Denver men, who style themselves the Mutual Corporation, and of which Hugh Steele, one of Denver's pioneers, is president. The company's ground adjoins the Queen of the West that was famous in the early '60's.

Recognition of the Union is topic for discussion among Leadville mining men and merchants. For some time grumbling has emanated from union sources, evidently paving the way for an exaction of an increase in wages and the restoration of unionism in the district. The substantial men in the district remember too well the expensive and bloody task that eliminated the unions years ago and they do not propose any return to former labor conditions. A short time ago the superintendents of two prominent mines dismissed a number of miners who were openly working for the union. The State Industrial Commission has, in consequence, been requested by union officials to investigate this discrimination. As yet there have been no threats of any sort. Managers of mines will probably not oppose any reasonable request for an increase in wages if such a request does not accompany a demand for union recognition. Two well-attended meetings of merchants and professional men have been held and a committee is investigating matters with the intention of soon reporting.

Changing Mt. Massive's Name has been resented. Leadville was quick to express its disapproval of the prerogative assumed by the U. S. Geological Survey in arbitrarily changing the name of Mt. Massive to Mt. Gannett. This mountain, long considered the highest in the state, is Leadville's favorite landmark. It was given its name by the very man whose name is now given to it. With all respect to this eminent geologist and topographer, residents of this city will refuse to adopt the new name, and endless confusion is certain to follow if the Federal Survey declines to rescind its action. The old name is peculiarly appropriate to this great mountain that is directly west of Leadville as a spur of the Sawatch Range. The city council passed resolutions of disapproval at the change. Sentimental resolutions have been passed by clubs and lodges and sent to the offi[illegible] at Washington—the Leadville Pioneers Ass[illegible] document concluding: "Mount Massive [illegible] endeared to us by old associations and [illegible] tage bequeathed to after-generations [illegible] dred. Therefore we plead for the r[illegible] the ancient name."

SALT LAKE CITY—Oct. 25

Utah Power and Light Co.'s ne[illegible] mission line from Provo to [illegible] Carbon County, which has been [illegible] tion for several months, has b[illegible] United States Fuel Co.'s mines [illegible] Black Hawk are now using electr[illegible]

New Copper Leaching Plant in course of construction by the Utah Copper Co. is making good progress. The plant is near the Magna mill at Garfield, and at a slightly greater elevation. The grading has been completed, and the crushing equipment and conveyor system is largely installed. The tanks are now being built. These are of reinforced concrete, approximately 50x100x 18 ft., and work on them is being done as rapidly as possible, so that they may be completed before freezing weather. The initial capacity will be about 4,000 tons of ore daily.

Local Ohio Copper Stockholders held a meeting recently at the offices of Moore, Mitchell and Maginnis, attorneys, to discuss plans for the reorganization of the company. Two plans have been presented, one by the International Mining and Refining Co., which has the Central Trust Co. as depository; the other by the North American Liquidation Co., with the Columbia Trust Co. of this city as depository. Further information concerning the proposed plans for reorganization was desired and telegrams were sent to William E. Rogers, of the North American Co. and to W. J. Brown, of the International, as follows: "Local stockholders at meeting here tonight, 31,000 shares represented, instruct us to advise both protective committees, and through them the court that they are very familiar with condition of property, Ohio Copper Mining Co., and its present potential value. They value highly their equity in the property, and desire and intend to do their full share by payment of suitable assessment or subscription for preservation of their equity and are anxious for definite action along this line. Other stock not represented at this meeting will join any reasonable plan organization. Plans only submitted tonight for first time. They find it impossible, without more mature thought and consideration, to analyze and choose between plans of the respective committees, both of which were presented at meeting. Signed, George Baglin, Fred Kuster, W. M. Havenor, local committee." Royalties amounting to $450,000 have been paid the Ohio Copper Co. by the General Exploration Co. since its lease started in June, 1915.

SPOKANE, WASH.—Oct. 20

Wood River District of Southern Idaho, 12 mi. north of Hailey, has recently come into prominence through the purchase of the Nay Aug and the Silver-Lead mines, the former by Raymond Guyer, general manager of the Rex Consolidated, and the latter by Darwin Utter, former surveyor general of Idaho. The Nay Aug has been worked intermittently for the last 30 years, and is credited with a gross production of $750,000. It is reported that the property will probably be transferred to the Idaho Exploration Co., a corporation in the process of formation for the purpose of developing Wood River holdings. The property contains two orebodies assaying at picked places as high as 40% zinc and it is estimated that 40,000 tons are available in the old workings for rapid extraction. In the Silver-Lead mine, it is thought, are similar orebodies, continuations of those of the Nay Aug The property is virgin ground now being prospected by a tunnel 450 ft. long and lacking 150 ft. to reach ore.

JOPLIN, MO.—Oct. 21

Emma Gordon Mining Co. elected new officials at the ninth annual meeting, held recently in Miami. G. W. Bigham was reëlected president. This company has first lease on 200 acres of land, near Commerce, Okla., from which an average of $500,000 worth of ore has been produced annually for nine years. The land is owned by Mrs. Hiram McBee, whose maiden name was Emma Gordon, who has received royalties of from $2,000 to $4,000 monthly ever since operations were begun. There are now seven concentrating plants on the lease.

Possession of a Valuable Lease on Indian land in Oklahoma is given P. A. Ewert, of Joplin, by a decision of the Circuit Federal Court. The lease is on 100 acres of land near Picher. Several years ago before there was thought of ore on the tract, Ewert had an agent procure the lease and when ore was discovered near by the agent refused to turn over the lease because the contract with Ewert had not been in writing. Local courts decided against Ewert but the higher court sustained him, declaring the statute of frauds, which requires contracts in writing in such cases, was not intended to protect dishonest men.

Recovery of $174,000, Paid for a Mine, is asked by Roland R. Conklin, of New York, in a suit filed in the District Court here this week. He alleges that fraud was used in getting him to pay the amount named for two leases at Porto Rico, north of Duenweg, last March. The defendants are J. W. Ground, of Kansas City, and the Barnett Mining Co., with G. A. Barnett, of Joplin, as president. Conklin alleges that he was induced to pay $175,000 for the leases through misrepresentations as to the condition of the ground from a mineral standpoint. He further charges that an engineer he employed to investigate the property was bought off by representatives of the mining companies. Conklin is chairman of the board of directors of the Lincoln Zinc and Smelting Corporation, which has purchased four mines in this district since last fall, including, besides the one at Porto Rico, formerly known as the Barnett No. 1, the Bradley at Joplin and the Tom C. and Seneca at Prosperity.

TORONTO—Oct. 21

Consolidated Mining and Smelting Co.'s new issue of stock to the amount of $2,106,835 brings the total capital up to $10,534,375. In this connection it should be noted that the company has secured further zinc contracts, which will necessitate a considerable amount of new construction. The company is also going more extensively into the production of copper and has increased the capacity of its copper refinery, having secured an option on a copper property in the north end of Vancouver Island close to the water. The directors will shortly issue a statement pointing out that, for an enterprise producing on a fairly large scale no less than five metals, the capital is small as compared with that of many companies operating on a more restricted scale. The zinc plant is now making regular shipments which are expected to largely increase in volume.

Interest in the Nickel Question has been revived by the statement of Lord Robert Cecil, of the Imperial Government, to the effect that there is reason to believe that the nickel cargo of the "Deutschland" was a "part of the small stock mined in allied territory," and that precautions should be taken to prevent allied property getting into hostile hands. From the wording of his remarks it is not clear that he referred to Canadian nickel, and it is contended by the government press that he had New Caledonia rather than Sudbury in his mind as the original source of the "Deutschland's" cargo. Nevertheless his utterances, coupled with the report that another German submarine is on her way across the Atlantic looking for further supplies, have been eagerly seized upon by the scare-mongers to keep alive the agitation. In view of another general election, which is likely to take place within a few months, liberal campaigners are giving the question considerable prominence in their speeches.

The Mining News

ARIZONA

Cochise County

SHATTUCK-ARIZONA (Bisbee) — September production, 1,566,446 lb. copper, 26,928 oz. silver, 419 oz. gold and 805 tons lead ore shipped El Paso smeltery. Company earnings for nine months, $2,213,994, equivalent to $8.43 a share per annum.

Gila County

OLD DOMINION (Globe)—September smeltery output, 3,011,000 lb., compared with 3,600,000 lb. in August and 3,852,000 lb. in July. Smaller September output due to discontinuance of treatment of United Verde Extension ores averaging from 600,000 to 800,000 lb. copper monthly.

Mohave County

OATMAN UNITED (Oatman)—Resumed sinking three-compartment shaft recently.

SUNNYSIDE (Oatman)—Stockholders recently ratified sale of control to owners of United Eastern for $86,500.

BIG JIM (Oatman)—Rumored will soon start erection of mill larger than one now building by United Eastern.

SAN FRANCISCO (Oatman) — Recently incorporated for 1,250,000 shares, par value 10c. each, nonassessable. Will develop 40 acres adjoining United Eastern, lying between Fessenden and Oatman United.

Yavapai County

BRODY (Kirkland)—Small scale operations developed good sized oreshoot $8 per ton gold ore.

BLACK BEAUTY (Kirkland)—Good tonnage low-grade gold ore reported developed at shallow depth.

CALUMET & JEROME (Jerome)—Financed for several months developments. Shaft will be sunk to 1,100-ft. level where Daisy vein expected.

PIONEER (Kirkland)—Small force sinking shaft on Big Four. Recent carload shipment assayed high in lead with some gold and silver.

VESUVIUS (Kirkland)—Recent development rewarded by rich pockets at depth from which several shipments returned 6 to 7 oz. gold per ton.

BIG LEDGE DEVELOPMENT (Mayer)—Purchased old Treadwell smelter at Mayer and dismantling. Contemplate erecting complete modern smelter of 150 tons daily capacity.

CALIFORNIA

Amador County

REWARD (Pine Grove)—Crosscut disclosed 8-ft. ledge. Pine Grove mill now in commission.

BUNKER HILL (Amador City)—Collar of shaft concreted to depth of 225 ft. and concrete orebins on surface constructed. Regular monthly dividend withheld this month owing to conditions resulting from labor strike. E. Hampton, superintendent.

CONSOLIDATED AMADOR (Jackson)—New two-reel hoist in course of installation; capacity for lifting 15,600 lb. a distance of 2,000 ft. Rapid progress being made with construction work on surface, unwatering and repairing shaft; water at point just above 800 station. Last work in mine 30 years ago all on and above 800 level. Shaft has inclined depth of 2,100 ft.

Butte County

SOUTHERN CROSS (Forbestown)—Flotation plant installed will be tested in last half October.

CARLISLE (Forbestown)—Mine being unwatered to give opportunity to proposed investors to make examination.

FORBESTOWN CONSOLIDATED (Forbestown) —Gold Bank-Golden Queen properties being operated with prospect of disposal to Eastern investors. Group of 12 claims adjoining reported sold to Italian investors. The Fred Beik property reported sold to Mr. Hall, of Los Angeles. Extensive work in progress at Solano Wonder, situated southwest of New York placer ground.

Eldorado County

PYRAMID (Placerville)—High-grade ore reported disclosed in drift south of 500-ft. station. Shaft being deepened to 700 ft. Mine employs 24 men.

Inyo County

TUNGSTEN MINES (Bishop)—Shipment of concentrates valued at $20,000 reported recently. Mill now operating 11 concentrators working three shifts. Top of Little Sister hill being broken down and ore sent to mill; underground development also progressing. Howard Moore succeeded Cooper Shapley as superintendent.

Kern County

STRINGER DISTRICT developing new tungsten and gold deposits. Charles Hellmer and George Swarthouse encountered placer deposit showing $8 gold and 10 lb. sheelite per ton. A. M. Carter, operating dry washing plant, has several tons good dirt ready for jigging.

KING SOLOMON (Randsburg)—Last cleanup Sept. 29 at new 5-stamp mill netted $4,700. Mill installed about five months ago and produced about $50,000 since.

BUTTE LEASE (Randsburg)—New screening mill in operation. Stamp mill will be installed. Large amount low-grade ore blocked out and high-grade ore being developed. John M. Taylor, manager.

Mariposa County

BONDURANT (Coulterville)—Hazel Belle and other properties situated 12 mi. east reported sold by A. L. Adams, of Bridgeport, Conn., to Eastern men, represented by George R. Stone, of Bridgeport.

Nevada County

CALIFORNIA (Grass Valley)—Water being lowered rapidly. The 280-ft. shaft will be deepened and drifts will be driven in course of development. Property recently purchased by King C. Gilette, the safety-razor man. Robert D. Adams, manager.

Shasta County

McKEEN (Callahan)—Oil flotation contemplated by James McKinney, of Los Angeles. Development in progress for six months past; 50-ton per day tube mill installed.

MAMMOTH (Kennett)—Friday-Lowden tunnel now in 3,300 ft.; 700 ft. remains to be driven to strike orebodies. Another tunnel being driven at Sutro mine, now in 600 ft. and will be extended to about 3,000-ft. point.

MIDAS (Knob)—Diesel 250-hp. engine now en route from Pennsylvania will be installed for unwatering mine flooded to the 1,300-ft. level when mine was on fire three years ago. Substitution of oil for other fuel will reduce fuel bill about 50%.

Tuolumne County

NYMAN MINES (Jamestown)—Reported purchased old Santa Ysabel property. Mine situated between towns of Stent and Quartz, immediately adjoining the App on south. Property long idle; developed several years ago by 1,000-ft. shaft and several drifts; equipped with hoist and other machinery and stamp mill. Company developed for about year and purchase resulted.

COLORADO

Boulder County

LITTLE FRED (Salina)—New process treating tungsten ore will be installed. Property recently sold Kansas men for $25,000.

FERROALLOYS (Utah Junction) Plant for manufacture ferrotungsten from tungsten concentrates nearing completion. Company subsidiary of Rare Metals Co. owning tungsten concentrating mill near Rollinsville, Gilpin County. Plant will be operated early in 1917; process will include electric smelting. Power line being built from substation of Colorado Power Co. near Lakewood.

Clear Creek County

LAMARTINE (Idaho Springs)—Broderick Mining Co. acquired control.

COLORADO CENTRAL (Georgetown)—Dumps sampled recently estimated to contain 460,000 tons ore averaging $7 a ton.

IMPERIAL (Georgetown)—Being developed and operated under lease by Lindall & Eckberg. Payable ore opened and trial shipment made.

BRODERICK (Freeland)—Developing Lamartine property with 25 men. Mine being carefully sampled and assays made by W. G. Arkills, of Idaho Springs. Force at mine will be increased rapidly as possible. Extensive exploration planned.

CONSOLIDATED MINES DEVELOPMENT CO. (Alice)—Newly incorporated with capital of $1,500,000 by W. G. Harper, W. C. Bickford and W. G. Luckenga to acquire lode and placer mining property in Clear Creek County. Development now in progress on one of the company's properties near Alice.

CAPITAL (Georgetown)—Rich strike made last month developing favorably. Slab of rich gold ore stripped for horizontal distance of 25 ft. and about 40 ft. in height. Samples from drillings across 40 in. of vein indicate average value of $3,500 a ton. Slab from 8 to 10 in. wide contains pockets assaying as high as 1,000 oz. gold a ton.

METALS MINING AND LEASING CO. (Idaho Springs)—Newly incorporated with capital of $25,000 to develop and operate mining properties in Clear Creek and Gilpin Counties. Directors are A. H. Roller, J. E. Leet and L. F. Wells. Principal office, Idaho Springs. Development will begin soon on properties now controlled under lease.

Gilpin County

RUNNING LODE (Central City)—Mine machinery being repaired; bailing water will commence at once.

PITTSBURGH (Central City)—Shoot of shipping-grade gold-copper ore opened recently in winze between 1,000- and 1,100-ft. levels, 400 ft. from shaft. Shoot 8 in. wide in places and assays 6 oz. gold, 18% copper and well in iron.

Lake County

NEW MONARCH (Leadville)—Will sink Monarch shaft another 200 ft.

BURGE (Leadville)—Contract let for driving tunnel through porphyry on Red Mountain. Expected oresboot will be opened at porphyry-granite contact.

Park County

OSWEGO MINING AND MILLING CO. (Alma)—Reopening old Magnolia mine and Eddy mill at Montgomery, 6 mi. north of Alma. Mine above timberline on North Star Mountain will be connected with mill by aërial tram having vertical drop of 1,200 ft. in distance of 3,700 ft. In addition to mill's present cyaniding equipment, flotation will be installed. Louis L. Davis, of Denver, manager.

San Juan County

MAYFLOWER (Silverton)—Rich ore opened recently in mine under lease and bond to Mears and Slattery of Silverton.

DORA (Silverton)—Contract for sinking shaft secured by Clay Johnstone. Three shifts to be employed and work rushed to completion.

KLONDYKE (Silverton)—New buildings including boarding and bunk house, compressor building and blacksmith shop under construction. New machinery being installed. Mine development to begin soon.

Summit County

PIONEER CONSOLIDATED (Breckenridge)—Work on boarding and bunk house being pushed so force of 25 men can be increased. Remodeling Extension 25-stamp mill under way. Separate building constructed for crushers, new foundation built under entire mill and power changed from steam to electricity. Power line construction to mill completed.

WELLINGTON (Breckenridge)—Planned to reorganize company, eliminating Wellington Mines Co. of Arizona, holding company of Wellington Mines Co. of Colorado. Former capitalized for $10,000,000 and latter for $50,000. New company to be capitalized for $1,000,000, stockholders in old company to exchange stock pro rata.

Teller County

CRESSON (Cripple Creek)—Reported rich strike made on 12th level. Shoot said to be 16 to 30 ft. wide and assaying $30 gold

IDAHO

Idaho County

MOTHER LODE (Elk City)—Robt. Brownell bought third interest. Development started on main tunnel east of shaft giving depth of 100 ft.

BLACK PINE (Elk City)—Upraise started on lower tunnel at distance of 1,250 ft. from portal uncovered high-grade ore. Free gold plainly visible on face of vein. Mill ready to start operations. S. J. Rieben, manager.

Shoshone County

TAMARACK & CUSTER (Wallace)—Closed down temporarily pending installation of tramway connecting mine with Frisco mill recently purchased, after which production resumed.

GOLDEN CHEST (Murray)—Tests of new mill pronounced satisfactory by superintendent Berlin. Because auriferous and tungsten ores treated nearly same gravity, considerable remodeling necessary at first to save values. Ores dry crushed, screened, jigged and concentrated on Wilfleys.

WEST HECLA (Burke)—Drifting on vein believed extension of main vein of neighboring Hecla mine. Drift starts 1,800 ft. in from portal of crosscut and vein followed for 100 ft. shows promising mineralization; vein has dip and strike of Hecla vein. Morton Webster, of Wallace, president.

LACLEDE (Burke)—Capitalization increased from 1,000,000 to 1,500,000 shares, par value $1. Additional stock issue intended to finance further development and equipment. Present development consists 1,600 ft. of tunnels, 1,200 ft. of drifts, and 300 ft. of shafts opening four mine levels. No commercial ore encountered. Operations suspended till February, when extensive development will be undertaken.

MICHIGAN

Copper

AHMEEK (Ahmeek)—Has installed 40 Denver drills—speed of driving thereby greatly increased.

WHITE PINE (Ontonagon)—Rock from developments on 200-ft. level reported averaging 30 lb. copper per ton.

KEWEENAW (Mandan)—Stamp mill in operation but reported as tuning up. Will handle 250 tons daily with one head.

HANCOCK (Hancock)—Shipping over 700 tons daily. No. 7 lode rich and very narrow—stoping on five levels from 66th to 71st.

CALUMET & HECLA (Calumet)—Subsidiaries increased rock production 15,000 tons in first half October over similar September period.

TAMARACK (Calumet)—Regrinding plant housing completed but no machinery installed. Future uncertain since retirement of Calumet & Hecla management.

WAUKULLA (Matchwood)—New exploration will be undertaken 5 mi. west of the Copper Crown. Shipping in supplies, H. Hillegas, Houghton, manager.

MICHIGAN (Rockland)—Reported paying development costs by sales mass and barrel copper from new workings in Butler Lode. Rock reported averaging 25 lb. per ton.

MAYFLOWER-OLD COLONY (Calumet)—Suspension of diamond drilling reported a preliminary step to sinking shaft to serve both properties operated as one.

MOHAWK (Mohawk)—In September shipped to mill 58,209 tons rock averaging 19.67 lb. yield per ton. Copper production 1,145,762 lb., compared with 1,049,460 lb. in August.

OLD FLINT STEEL (Rockland)—Reopened under management Samuel Brady after idleness since 1875. Property in vicinity of the Michigan; produced less than 1,000,000 lb. copper from fissure opened by three shafts; owned by New York men and present operations financed by New York City option holders.

Iron

LAKE (Ishpeming)—More men added to night shift crew. Production will be increased.

NORTH LAKE (Ishpeming)—Three diamond drills at work west of the Morris-Lloyd shafts.

TRADERS (Iron Mountain)—Ordered to keep mine working all winter. Prospect of higher prices for iron ore next season is incentive.

PABST (Ironwood)—Addition being built to boiler house. New boilers will be added. Change made because of electrification project under way.

VOLUNTEER (Palmer)—Mine abandoned—ore supply exhausted. All machinery removed from underground. Little ore left in stock will be shipped before navigation closes. Shaft sunk in 1906 and property worked most of time until last week. Steel shaft house dismantled.

MINNESOTA

Cuyuna Range

HOCH (Manganese)—Output being shipped to Algoma Steel Corporation, Sault Ste. Marie, Ont. Produces manganiferous iron ore only. Work on new No. 2 shaft progressing rapidly—will be 150 ft. deep when completed.

Mesabi Range

BRAY (Keewatin)—Mine to be reopened by Republic Iron and Steel Co. after idleness since 1913.

NORMAN (Virginia)—Ore supply [illegible] exhausted. Most of ore being [illegible], [illegible] hoisted through shaft—too deep for shovel work now. Was deepest pit property on range.

ELIZABETH (Chisholm)—Will be reopened. Little work ever done and has been idle several years. A 500-gal. electric pump and other machinery ordered. Estimated 200,000 tons ore in sight.

OLIVER (Eveleth)—Contract let for drainage ditch to drain that portion of mining property lying west and southwest of Eveleth. Contract price $125,000. Will be constructed of concrete greater part of distance. Will be 50 ft. deep in spots.

Vermilion Range

SIBLEY (Ely)—Old Sibley No. 1 shaft, vertical, will be abandoned Jan. 1, 1917, by which time new 65° incline shaft will be ready to operate. Headframe from Savoy mine being erected for use at new shaft, after change from 80° to 65°.

MISSOURI-ARKANSAS

Joplin District

CROWN POINT (Duenweg)—This former soft-ground mine opened up rich run sheet ground at 170 ft., in new shaft.

CORNFIELD (Cardin, Okla.)—Drilling on northwest quarter forty-acre lease disclosed good orebody. New shaft started.

NEARBY (Webb City)—Moving Stephenson mill from Porto Rico to lease on Center Creek ground between Webb City and Carterville. Disseminated formation at 175 ft. Mill ready by Jan. 1.

TAR CREEK (Cardin, Okla.)—Sinking shaft to second ore level, having beaten water to 190 ft. Making carload premium lead in upper level weekly. Product 83.5% metallic lead.

GROUND & BARNETT (Joplin)—New mill on Burch land at Duenweg started. Largest mill in district for treatment calamine exclusively. Mining at 130 ft. Four shafts in ore. No trams—surface railway with mule power.

KAHOMA (Commerce, Okla.)—Company took over Merchant's Mining Co.'s lease—consideration, $30,000. Company consists of Muskogee and Salem, Va., men, with W. A. Woods, of Commerce, manager. Shafts will be sunk and new mill erected.

HARTFORD (Joplin)—Moving mill from Galena to site of Old Fort mine at Duenweg. Enlarging and improving plant and adding nine sludge tables. New capacity approximately 500 tons 10-hr. shift. Sheet ground at 235 ft. One of shafts enlarged and concreted down to lime.

ARKANSAS

EDITH (Rush)—Records for production in field broken by company during week, when 31 tons of high-grade calamine was recovered over new mill in 9 hr. New orebody encountered in heading of 300-ft. tunnel week ago and almost carload of concentrate averaged daily since.

MONTANA

Cascade County

GREAT FALLS REDUCTION WORKS (Great Falls)—C. F. Kelley, managing director of Anaconda Copper, announced work started upon foundation of baghouse to collect lead now carried out by fumes from reverberatory furnaces heretofore wasted. Structure to cost $100,000, will be finished by end of year. Building, 50x150 ft., and will contain 1,110 bags. Zinc plant present output 60 tons zinc per day will be increased soon as necessary machinery is received.

Silver Bow County

BUTTE & ZENITH CITY (Butte)—Crosscutting on 1,000 level in property near Nissler, 6 mi. west of Butte, proceeding steadily. Indications in south crosscut of nearing vein cut by shaft between 700 and 800 levels.

BOSTON-BUTTE COPPER AND ZINC CO. (Butte)—Secured patent to Walker claim, located north of Anaconda company's Nettie mine in western Butte district. Company now owns 12 claims in district. Reported that, encouraged by showing made in Nettie, company may soon undertake extensive development.

BUTTE & SUPERIOR (Butte)—At present production rate October output expected to reach 57,000 tons as against 50,150 tons in September, with production of 16,000,000 lb. zinc. In spite of increase, earnings will show decrease, due to spelter price drop. New No. 3 shaft timbered down to 1,500 level used for lowering supplies and men until new hoist is in place—not expected until end of year.

BUTTE DULUTH (Butte)—Preparations for starting operations completed. By end of month new management under Al Frank will begin [illegible]ing and treating 100 tons per day which will be increased gradually to 500 tons, amount [illegible] for under contract by Aug. 1, 1917. Average [illegible] runs 1.6% copper. Expected recover[illegible] with output 500 tons would mean [illegible] copper per month.

NEVADA

Esmeralda County

GRANDMA CONSOLIDATED ([illegible])—[illegible] closed deal for adjoining ground [illegible] doubles present area.

GREAT BEND (Goldfield)—Recent carload shipment asayed $83 per ton. Several small lots milling-grade ore sent out for flotation tests.

SILVER PICK (Goldfield)—Core drill now working from surface near northwestern boundary of property. Management states previous drilling disclosed west dipping veins yielding good assays.

Lincoln County

MEADOW VALLEY LEASE (Pioche)—Have crosscut Yuba dike and drifted to connection with old Yuba workings on 1,200-ft. level. Propose to raise to old 1,100-ft. workings. Some ore being stoped.

Mineral County

SILVER DYKE MINES (Tungsten)—Property will be closed down Nov. 15 owing to impossibility of producing at profit under present market conditions.

OLYMPIA MINES (Mina) Erecting 50-ton cyanide plant on Royal George group about 30 mi. from Mina. Six-mile pipe line supplying water to mill completed.

Nye County

TONOPAH ORE PRODUCTION for week ended Oct. 14 was 8,855 tons valued at $175,330, compared with 8,602 tons for week previous. Producers were: Tonopah Belmont, 2,829 tons; Tonopah Extension, 2,380; Tonopah Mining, 1,200; Jim Butler, 1,150; West End, 627; Halifax, 213; Rescue-Eula, 156; North Star, 53; Miscellaneous leases, 247 tons.

TONOPAH BELMONT (Tonopah)—Has acquired option on control of Panama-Pacific group claims lying in Tonopah eastern section.

MONITOR BELMONT (Belmont)—Work at Highbridge tunnels continues and old Belmont incline will be retimbered to second level. Flotation plant running since last July. Shipping concentrates. About 30 men employed.

TONOPAH EXTENSION (Tonopah)—Has purchased ground of Tonopah Sully Mining Co. embracing about 80 acres adjoining northern boundary of Tonopah Extension. Northerly crosscut being run from 1,540-ft. level of Victor shaft to develop new ground.

TONOPAH MINING (Tonopah)—Heavier equipment placed at Sand Grass shaft which will be deepened additional 150 ft. In quarter ending Aug. 31, gross value ore milled, $336,287; gross value mill products, $310,030; total expenses, $212,982; net earnings, $97,047; miscellaneous income, $40,970; exploration expense, $15,305; net income, $122,712. Cash on hand, $36,172; bonds purchased, $1,019,831; certificates of deposit, $25,000; unchanged silver bullion stored at 50c. per oz., $431,010; total after dividends, $1,362,014.

Storey County

SIERRA NEVADA (Virginia)—Continued reopening old north drift on 2,500 level; north drift from No. 1 stope all in quartz at 75-ft. point.

UNION (Virginia)—Large amount development work and new prospecting drifts started. Ore extracted from 2,500 level averaged $28. Mine worked on five different levels.

UNITED PUMPING ASSOCIATION (Virginia)—One of vertical turbine sinking pumps placed in position at top of Mexican and Ophir winze ready for lowering; to be used for lowering water from 2,700 to 2,900 level.

NEW MEXICO

Grant County

SANTA RITA DEVELOPMENT (Santa Rita)—Bought group 15 claims adjoining Chino, bringing total holdings to about 700 acres. Stock recently listed on New York Curb. W. W. Lawhon, president; H. W. Loomis, general manager.

UTAH

Beaver County

HORN SILVER MINES (Frisco)—Articles of incorporation for this company—successor to Horn Silver Mining—filed recently. Acquires entire holdings of old company. Capitalization $400,000; shares $1 each; stock unassessable.

Juab County

IRON BLOSSOM (Silver City)—Drift to north on 1,700 cut fissure carrying several inches copper. Thought to be near copper oreshoot to north but main body not expected for some distance. Copper ore opened on 600, 1,100, 1,200 and 1,300 levels.

EAGLE & BLUE BELL (Eureka)—Shaft reached 1,950 level, and another 100 ft. of sinking thought possible before reaching water level. Shaft in ore most of distance from 1,832-ft. point; station cut at 1,875 ft., and some development done. Object of work on this level is to get under 100-ft. winze sunk in ore from 1,700—about 125 ft. farther on. Ore being shipped from shaft sinking and development.

Salt Lake County

UTAH APEX (Bingham)—Suit filed recently against company by Utah Lead and Copper, asking for injunction, alleging trespassing on Susquehanna and Venice North Extension lode claims. Order also asked to enter workings and ascertain amount and value of ore alleged taken.

BINGHAM MINES (Lark)—Earnings for past three months reported $15,000 per month, exclusive of Eagle & Blue Bell. Latter mine forced to operate for last five months at one-third normal capacity owing to smeltery failure to handle ore. Output recently increased from 50 to 150 tons daily.

MONTANA-BINGHAM (Bingham)—Tunnel in 4,180 ft., and 100 ft. of 900 ft. recently contracted for completed. Face in quartzite in Bingham Amalgamated ground. Raise being sent up from near face by Congor is up 600 ft.; will connect with surface workings. Karns tunneling machine and machine drills used for tunnel work.

EMMA COPPER (Alta)—New diamond drill hole—known as No. 7—reported cut ore, showing galena in brecciated limestone. No. 7 is 50 ft. from No. 6, and down 260 ft. Slight delay caused by repairs to transmission lines. Old shaft being repaired and pumped out; water now down 100 ft. Pumping to be continued to 250 ft., when work will be started to reach ore. Excavating for new bunk and boarding houses being done to care for winter force.

OHIO COPPER (Bingham Cañon))—Proposed reorganization of foreclosed company will call for what amounts to assessment of only $1 per share on the old stock. New company of 2,500,000 shares capitalization will exchange its stock share for share with old stock on payment of $1 per share. This will raise $1,300,000, there being 1,300,000 shares of old stock, and will leave 1,200,000 shares of new stock available for other corporate purposes. With $1,300,000 thus raised, proposed, with permission of courts, to redeem properties and assets of company sold at foreclosure. New plan financially underwritten and requires only approval of courts. Understood bondholders who bought in property will raise no objection to proposed plan.

Summit County

PARK CITY SHIPMENTS for week ended Oct. 13 amounted to 3,415,470 lb. by nine shippers.

IOWA COPPER (Park City)—At annual meeting L. R. Perry elected president. Company developing claims on Scott Hill near head of Thaynes Cañon, in mineralized zone extending from Park City to Big Cottonwood.

AMERICAN FLAG (Park City)—Shipment being accumulated by Park City Mines Co. lessees, from pay streak 15 in. wide on 1,000 level. Ore assays well in gold, silver and lead. Drifting and raising in ore being done.

JUDGE MINING AND SMELTING (Park City)—On dividend checks recently sent out following notice appended: "This money comes from Utah mines; you and your friends can help us by voting 'No' on tax amendment to constitution, which, if passed, will be a blow to every industry in the state."

VIRGINIA

VIRGINIA SMELTING (Norfolk)—Chloridizing leaching plant partially destroyed by fire Oct. 19. Cause believed defective electric wiring. Adjacent portion of plant leased to Norfolk Smelting Co., though threatened by fire, escaped damage.

WEST VIRGINIA

Kanawha County

ROESSLER & HASSLACHER (St Albans)—Representatives of Perth Amboy, N. J., firm have bought 175 acres 2 mi. west of St. Albans and 14 mi. from Charleston on which to build plant costing about $1,000,000.

WYOMING

Park County

MIDWEST SULPHUR (Cody)—Purchased additional 160 acres adjacent territory doubling holdings. Reported producing 25,000 lb. sulphur every 24 hours and earning 45% annually on $55,000 capitalization. Stock recently listed on Salt Lake Mining Exchange.

CANADA

BRITISH COLUMBIA

SILVER QUEEN (Hazelton)—Bonded to F. H Dakin, of San Francisco, who has taken personal charge—commenced development.

LE ROI NO. 2 (Rossland)—In August shipped 1,507 tons ore; smelter returns on 1,287 tons, $17,380; total revenue, $17,554; total expenses, including diamond drilling, $7,926.

GRANBY CONSOLIDATED (Vancouver)—September production of two smelteries totaled 3,440,035 lb. copper compared with over 4,000,000 lb. each for May, June and July. Discrepancy due to strikes resulting in both coke and laboi shortage.

SILVER STANDARD (Hazelton)—New vein found in tunnel 500 ft. from portal, 150 ft. below surface and 90 ft. beyond where first vein was cut. New vein 12 in. wide of solid zinc blende and grey copper. First vein shows 3½ ft. high-grade ore; drifted on for 50 ft.

HUNTER GROUP (Telkwa)—Property bonded for $35,000 from William Hunter by W. B. Moore and associates of San Francisco. Number of men put at work. Group is oldest location in Hunter Basin, staked in 1903. Ore is bornite and chalcopyrite carrying gold and silver.

COPPER MOUNTAIN (Similkameen)—British Columbia Copper Co.'s main tunnel driven 1,300 ft. since June 15 and proving correct the results given by preliminary diamond drilling showing 5,000,000 tons above this level. Adit when in 2,000 ft. will give maximum depth of 200 ft. and ore above will be mined by glory hole.

DOMINION GOVERNMENT ASSAY OFFICE (Vancouver)—Expects to handle gold to value of $6,000,000 to $7,000,000 per annum. Gold amounting to about $3,000,000, from Trail refinery formerly sent to Tacoma will now go to Vancouver. About $1,000,000 a year expected from Hedley, and balance will be made up from Yukon and other sources.

CONSOLIDATED MINING AND SMELTING (Trail)—Announced new issue of $2,106,835 worth stock offered to stockholders at rate of one of new to four shares of old holdings. Issue will increase total capitalization to $10,534,375. Purpose of new issue is to provide payment for recent building. Shipments to smeltery for September were 42,838 tons. Electrolytic zinc plant turning construction and funds for further extension of out about 20 tons spelter daily.

Manitoba

MOOSE (Gold Lake)—Shaft down about 150 ft. and quantity of high-grade ore taken out.

GOLD PAN (Gold Lake)—T. A. B. Price, of Boston, accompanied by two mining engineers, left to make examination of property and begin active development.

Ontario

LA BELLE KIRKLAND (Goodfish Lake)—Shaft down 350 ft. on vein 11 ft. wide, yielding good milling ore.

PEOPLES (Cobalt)—Crosscut on lower level reached vein crossing property, which is about 8 in. wide and shows some mineralization.

R. A. P. SYNDICATE (Boston Creek)—Operations suspended during repairs and installation of new equipment, including tables for sorting ore.

LAKE SHORE (Kirkland Lake)—Installation of 7-drill compressor and other machinery completed. Development will be resumed with auxiliary steam plant until, electric power available.

McINTYRE (Porcupine)—Report for three months ending Sept. 30: Mill treated 35,810 tons, of which 28,933 tons was McIntyre ore, average grade, $9.08 per ton; operating cost, $4.93 per ton; gross value of product, $262,863; operating profit, $107,844; total profits, including receipts from milling custom ore and subsidiary companies, about $136,000. In stope on 1,000-ft. level of main shaft, orebody from 8 to 30 ft. wide and averages $15 per ton.

CUBA

CUBAN POTASH FIELDS VALUELESS according to report of engineer appointed by Cuban government. Report states 50 analyses made of samples from alleged potash mine showed nonexistence of potash in commercially profitable quantities. Respecting samples obtained by Americans who registered the claim and obtained widespread publicity through "New York Times," report says samples misleading and resulted either from series of natural concentrations impractical on industrial scale—or result of artificial means.

AFRICA

Transvaal

GOLD PRODUCTION IN SEPTEMBER was: Witwatersrand, 744,881 oz.; outside districts, 26,686 oz.; total, 771,567 oz., being 9,583 oz. less than in August. For the nine months ended Sept. 30 the total production was 6,733,917 oz. in 1915, and 6,945,671 oz.—or $343,567,030—in 1916; an increase of 211,754 oz. Native Labor Association reports number of Kafirs at work in September in gold mines, 197,734; coal mines, 10,239; diamond mines, 6,527; totaling 214,500.

PRINCESS ESTATE (Johannesburg)—In September crushed 22,400 tons, yielding £28,445 gold; estimated profit, £1,224.

MAY CONSOLIDATED (Johannesburg)—In September crushed 13,170 tons, yielding £9,680 gold; estimated profit, £686.

GEDULD PROPRIETARY (Johannesburg)—In September crushed 26,800 tons, yielding £40,729 gold; estimated profit, £12,619.

MODDERFONTEIN DEEP (Johannesburg)—In September crushed 40,400 tons, yielding £76,596 gold; estimated profit, £43,768.

ASIA

India-Mysore

KOLAR GOLD FIELD total gold production in September was 45,225 oz., being 106 oz. less than in August and 821 oz. less than in September, 1914. For the nine months ended Sept. 30 the total was 409,284 oz. in 1915, and 402,493 oz. in 1916; a decrease of 6,791 oz. this year.

Chosen

ORIENTAL CONSOLIDATED (Unsan)—Mailed returns for August: 200 stamps ran 29$\frac{9}{10}$ days; crushed 26,895 tons; gross receipts, $132,660; operating costs, $76,721; operating profits, $55,938. Cost development and improvements, $1,439; total net profit, $54,498.

The Market Report

Metal Markets

NEW YORK—Oct. 25

A good business was done last week in all of the metals. Copper and lead were very strong at unchanged prices. Spelter and tin advanced.

Copper, Tin, Lead and Zinc

Copper—The volume of business transacted last week was much larger than in the previous week, the estimated total being about 30,000,000 lb. Nearly all of this was for delivery in the first quarter of 1917, which continues to be the major market, and was done at 27¼c., or the equivalent thereof. Some producers having sold all they wanted to at that price raised their asking price to 27¾c., r. t. on Oct. 25, but copper was easily available from other quarters at the old price. Near-by and December copper is very scarce, but producers regain control of small supplies toward the end of the month, through release of safety reserve, failure of buyers to forward specifications, etc. November copper in relatively small quantity was sold for export at 29@29½c., f.o.b. New York. December copper was quoted at 28@28½c., r. t. January copper sold at 27¾c. r. t. There was some business taken for delivery over the first six months of 1917 at considerably less than current prices. In some quarters there appeared to be considerable desire to negotiate such business.

Transactions last week were chiefly with domestic consumers, especially brass makers. There was some buying from England, especially for early shipment. The British government supplies British manufacturers at the mean quotation for electrolytic on the London Stock Exchange. If they are able to buy elsewhere on better terms they may do so. With the London quotation at £144 this week, that was possible, but the net equivalent here of £144, London, depended much upon freight contracts. There were reports from London of increasing supplies of Japanese copper offered there. France was not a buyer, the French government apparently taking care of consumers on more advantageous terms out of its previous purchases.

Copper Sheets, base price, nominally 37½c. for hot rolled and 38½c. for cold rolled for delivery at mill convenience. Earlier deliveries mainly on toll basis. Wire 32@32½c., nominal.

Copper Exports from Atlantic ports in September are estimated at 29,900 gross tons.

Copper Exports from Baltimore for the week were 4,607,499 lb. bars and ingots to Archangel, Russia; 3,807,301 lb. copper and 92,643 lb. brass tubes to Great Britain.

Tin—Business was active both in spot and futures. At the beginning of the week spot was 41⅛c., and futures, 40⅝c. At the close the quotations were 41½ and 41c., respectively. The trouble over British permits has become more acute and is now a real difficulty in doing business. Evidently the British government desires to increase the stock of tin in England, which has been allowed to run down.

Lead—There were no specially noteworthy features in this market and no material change either in conditions or prices. Demand was somewhat better than in the previous week.

Spelter—A large domestic demand, especially from galvanizers in the Middle West, together with buying by dealers, speculators, etc., caused this market to move sharply upward up to Oct. 23, when a considerable volume of business for early delivery was done at 10c. Interest then died out and the market became more or less nominal. The total volume of business during the week was not large, but this market at present is highly sensitive and responds quickly and sharply to relatively small demand, or conversely, relatively small selling pressure. Considerable business for delivery in the first quarter of 1917 was done at prices not greatly below those for early delivery. Producers seemed desirous of selling all they could for distant delivery at current prices.

Exports from Baltimore for the week included 391,435 lb. spelter to Liverpool.

Zinc Sheets are in good demand and base price remains $15 per 100 lb., f.o.b. Peru, Ill., less 8% discount.

Other Metals

NEW YORK—Oct. 25

Aluminum—Demand good and supplies still scarce. Deliveries mainly on contract. The quotation is unchanged at 65@67c. for No. 1 ingots, New York.

Antimony—Market strong at 13@14c. There is evidently an effort to bull the market, and the trade expects higher prices. There is believed to be justification for an upward movement in the present statistical position. Some of the large foreign producers have no stocks here and are quoting only on shipments from China and Japan.

Quicksilver—Market steady at $80 per flask. San Francisco reports, by telegraph, $77.50, market steady.

Nickel—Market steady and unchanged at 45@50c. per lb. for ordinary forms; with 5c. premium for electrolytic metal.

Gold, Silver and Platinum

NEW YORK—Oct. 25

Gold—There was a cross-current in the gold movement early in the week, $5,000,000 arriving at New York from Ottawa on Oct. 20, while on the same day a shipment of $500,000 was made from New York to Montreal.

Exports of gold and silver coin and bullion from Japan for the six months ended June 30 were $12,869,690 in 1915, and $1,786,921 in 1916. Imports show as great a change, being $1,685,021 in 1915, and $14,944,892 this year.

Gold Exports and Imports in the United States in September are reported as below:

	1915	1916	Changes
Imports...	$42,062,449	$92,562,940	I. $50,500,491
Exports..	2,033,990	6,849,141	I. 4,815,151
Excess, imports.	$40,028,459	$85,713,799	I. $45,685,340

In September, 1914, the gold imports were $2,761,590; exports, $21,887,202; leaving $19,125,612 excess of exports.

Silver—The last advices from London are that the appearance of the market is not so robust as in preceeding weeks, though the undertone continues good. The India Bazaars have not been keen buyers, and as shipments show some increase, there has been some recession in price the past week.

Mexican Dollars in New York were quoted Oct. 19 at 52¼@55¼c.; Oct. 20 and 21 at 52½@55¼c.; Oct. 23 at 52⅛@55⅛c.; Oct. 24 at 51⅞@54⅞c.; Oct. 25, at 51¾@54¾c. Business small.

Platinum—Market steady at $90 per oz. There was a brisk demand, almost entirely from jewelers, who are preparing for the holiday trade.

Palladium—Sales at $80 per ounce.

Zinc and Lead Ore Markets

Platteville, Wis., Oct. 21—Quotations of the district are according to the following figures: Base price per 2,000-lb. ton for material assaying 60% zinc is $63.50 for premium ore down to $58 for medium grade. For material assaying 80% lead the base price per 2,000-lb. ton is $78@80. Shipments for the week were 3,297 tons of zinc ore, 115 tons of lead ore, and 857 tons of sulphur ore. For the year to date the figures are 103,922 tons of zinc ore, 3,578 tons of lead ore, and 25,281 tons of sulphur ore. Shipped during the week to separating plants, 2,587 tons of zinc ore.

Joplin, Mo., Oct. 21—Price quotations per 2,000 lb.; Blende, high, $72.50; 60% zinc, premium ore, $70; medium grades, $70@67; low, $65. Calamine, per ton 40% zinc, $45@38; average selling price, all grades of zinc, $63.37 per ton. Lead, high price, $86.30; base, $87@80. Average selling price, all grades of lead, $80.24 per ton.

Shipments of the week: Blende, 8,082 tons; calamine, 895 tons; lead, 1,172 tons. Value, all ores the week, $664,990; the year to date, $30,087,520.

Blende prices have been higher than now, but seldom is the market of the strenuous nature reached this week, with second and even third rate ore as high as premium ore, and fourth rate ore within $2 of the highest grades. Very little of the week's shipment was purchased under $68 base, merely sufficient to make a low mark of $65. Unsold blende stock is now limited to 1,000 tons Webb City and 8,000 tons Miami, with 5,000 tons calamine over the district.

Butte, Mont., Oct. 20—The Butte & Superior Mining Co. for September reports 48,809 tons of ore milled with recovery of 12,694 tons of concentrates assaying 54% zinc.

Other Ores

Manganese Ore—Sales of two cargoes of manganese ore from Brazil are reported at prices that work out about 70c. per unit of manganese at tidewater.

Imports at Baltimore for the week included 13,200 tons manganese ore from Brazil.

Tungsten Ore—Quotation unchanged at $17 per unit.

Charles Hardy reports under date of Oct. 21, "After the great activity during the first half of the month, a slight lull has been experienced during the past week. I know of only about 150 tons that were disposed of, but the inquiries for the largest quantities possible, especially for European account, continue in the market and negotiations for a contract up to and including the whole year of 1918 are well advanced."

Tungsten ore exports from Burma nine months ended Sept. 30 are reported at 2,136 tons, an increase of 616 tons over last year.

SILVER AND STERLING EXCHANGE

Oct	Sterling Exchange	Silver: New York, Cents	Silver: London, Pence	Oct	Sterling Exchange	Silver: New York, Cents	Silver: London, Pence
19	4 7563	67¾	32 3/16	23	4 7563	67¾	32¼
20	4 7563	67¾	32¼	24	4 7569	67¾	32¼
21	4 7563	67¾	32¼	25	4 7569	67¾	32¼

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine.

DAILY PRICES OF METALS IN NEW YORK

Oct	Copper: Electrolytic	Tin: Spot.	Lead: N Y	Lead: St L.	Zinc: St. L.
19	27 @27¼	41¼	7 00	6 90 @6 92½	9 37½ @9 62½
20	27 @27¼	41¼	7 00	6 90 @6 92½	9 50 @9 75
21	27 @27¼	41¼	7 00	6 90 @6 92½	9 62½ @9 87½
23	27 @27¼	41½	7 00	6 90 @6 92½	9 87½ @10 12½
24	27 @27¼	41½	7.00	6 90 @6 92½	9 87½ @10 12½
25	27 @27¼	41¼	7.00	6 90 @6 92½	9 87½ @10 12½

The quotations herein are our appraisal of the average markets for copper, lead, spelter and tin based on wholesale contracts for the ordinary deliveries of the trade as made by producers and agencies; and represent, to the best of our judgment, the prevailing values of the metals, reduced to basis of New York, cash, except where St. Louis is basing point.

The quotations for electrolytic copper are for cakes, ingots and wirebars. Electrolytic copper is commonly sold at prices including delivery to the consumers and is subject to discounts, etc. The price quoted for copper on "regular terms" (r t) is the gross price including freight to the buyer's works and is subject to a discount for cash. The difference between the price delivered and the New York cash equivalent is at present about 0.25c. on domestic business. The price of electrolytic cathodes is 0.05 to 0.10c. below that of electrolytic. Quotations for lead represent wholesale transactions in the open market for good ordinary brands. Quotations for spelter are for ordinary Prime Western brands. Only St Louis price is given, St. Louis being basing market. We quote New York price at 17c. per 100 lb. above St Louis.

Some current freight rates on metals per 100 lb. are: St. Louis-New York 17c., St Louis-Chicago, 6.3c; St. Louis-Pittsburgh, 13.1 cents.

LONDON

	Copper			Tin		Lead	Zinc
	Standard						
Oct.	Spot	3 Mos.	Electrolytic	Spot	3 Mos.	Spot	Spot
19	124	120	143½	179½	180½	30½	53
20	124	120	143½	179½	180½	30½	54
21							
23	124	120	143½	180	181½	30½	[illegible]
24	124	120	144	179½	181	30½	[illegible]
25	124	119	144	181½	182½	[illegible]	[illegible]

The above table gives the closing qu[illegible] London Metal Exchange. All prices are [illegible] sterling per ton of 2,240 lb. Copper qu[illegible] electrolytic are subject to 3% discount. F[illegible]ience in comparison of London prices, [illegible] sterling per 2,240 lb., with American [illegible] per pound the following approximate r[illegible] reckoning exchange at 4.80. £15 = 3.[illegible] 4.29c.; £30 = 6.43c.; £40 = 8.57c.; £[illegible] = 12.[illegible] Variations, £1 = 0.21½ cents.

Antimony Ore—Market reported a little firmer. High class ore in small quantities was sold at $1.30 per unit.

Molybdenite—Market $1.70@1.80 per unit. Sharp competition among domestic, Canadian and European buyers, both for prompt and forward shipments, advanced price. Supplies of ore small.

Iron Trade Review

NEW YORK—Oct. 25

There is no material change in the iron and steel markets. The demand for export is heavy and insistent. Domestic orders are less active, high prices having operated to discourage construction to some degree.

The pig-iron market is strong with a tendency to advance. Most contracts now placed run well over into next year.

The Navy Department has called for bids on 45,583 tons of armor plate to be submitted Nov. 1. The Department is also calling for many bids on guns of various sizes, shells, and on plate for shipbuilding.

PITTSBURGH—Oct. 24

Some steel mills have been urgently in need of coal because car shortage has cut down shipments on their regular contracts, involving coal at $1.25@1.30 per net ton at Pittsburgh district mine, and they have been buying spot the past week at $4.25@4.50 for steam and $4.75@5 for gas. This has put other buyers largely out of the market, but the steel mills themselves are threatened with a fuel famine. At present, however, steel production is at record rate, October weather being always favorable to large outputs.

The steel mills find themselves oversold despite their very large production and increased reserve is being shown in the acceptance of orders. Open contracts for specification in future have been accepted for about as far ahead as the mills care to commit themselves. Prices show an advancing tendency.

The quotation of 3c. on plates, since the middle of August the official quotation for shipment at mill convenience, has become nominal. Even car plates are at 3.10c. minimum, while ordinary buyers are not quoted below 3.25c. even for delivery second half 1917.

Pig Iron—The market is less active but more excited. Consumers are now well covered through this year and fairly well for the fore part of next year, but there is a question whether furnaces can make full shipments. We quote: Bessemer, $24@25; basic, $20@21; foundry and malleable, $21@22; forge, $20.50@21.50, f.o.b. Valley furnaces, 95c. higher delivered Pittsburgh.

Steel—Billets are not quotably changed but sheet bars are stronger, at $50 minimum. Wire rods are $60@65. Forging billets are $70@75 for deliveries over the next few months. On shell quality billets 4.25c. per lb. has been done in several recent sales and 4.50c. has been bid in one case.

Ferroalloys

Ferrosilicon is higher, the quotation for 50% having been advanced to $100 per ton at furnace.

Spiegeleisen is steady and strong, 20% being quoted at $40@45 per ton at furnace.

Ferrotungsten Exports from the United States were 140 lb. in July; for the seven months to July 31 they were 8,407 lb. These include tungsten metal as well as ferrotungsten.

Ferromanganese—Regular quotations remain at $164 for imported and $165 for domestic on contract but there have been some sales at less and the market is rather irregular.

Iron Ore

The demand for bessemer and low-phosphorus iron for export has caused a corresponding call for iron ores of bessemer grade. Some Old-Range bessemer ores from Lake Superior are reported sold to Pennsylvania furnaces at $5.20 at Lake Erie ports, or 75c. above the season schedule. Some purchasers of Spanish low-phosphorus ores are reported at 13@14c. per unit of iron.

Shipments of Lake Superior ore have been interrupted by a week of hard, stormy weather.

Coke

Connellsville—Still fancier prices have been paid for spot furnace coke, $6.25 being done Friday, $7 on Saturday, $7.50 yesterday morning and $7.25 yesterday afternoon, the market being unchanged and inactive today. It is claimed the high prices have been paid only by brokers, for coke to apply on contracts, furnaces not having paid over $4. Car and labor shortage are holding down production while furnaces are working so well that they are calling for unusually large tonnages. We quote: Spot furnace, $7.25@7.50; contract, nominal, $3.75; spot foundry, $5@6; contract, nominal, $3.75@4.50, per net ton at ovens.

Chemicals

NEW YORK—Oct. 25

The general markets show little change. The tone continues good with a steady business in heavy chemicals.

Arsenic is in fair demand, with prices steady at $6@6.25 per 100 lb., according to quantity.

Copper Sulphate—Sales have been fair and prices firm at $11@12.25 per 100 lb., according to size and terms of order.

STOCK QUOTATIONS

N. Y. EXCH.†	Oct. 24
Alaska Gold M	12¼
Alaska Juneau	7⅜
Am.Sm.&Ref.,com.	110⅛
Am. Sm. & Ref., pf.	118
Am. Sm. Sec., pf. A	96
Am. Sm. Sec., pf. B.	89½
Am. Zinc	46⅞
Am. Zinc, pf.	77
Anaconda	94¾
Batopilas Min	2
Bethlehem Steel	616
Bethlehem Steel, pf.	136½
Butte & Superior	64⅞
Chile Cop	23¼
Chino	58¼
Colo.Fuel & Iron	54⅝
Crucible Steel	89
Dome Mines	24
Federal M. & S	20¾
Federal M. & S., pf.	40¼
Great Nor., ore ctf.	43¾
Greene Cananea	51¾
Homestake	133½
Inspiration Con	65¾
International Nickel	51
Kennecott	53⅞
Lackawanna Steel	86⅝
Miami Copper	39⅝
Nat'l Lead, com	69
National Lead, pf	114¼
Nev. Consol	22⅞
Ontario Min	6¼
Quicksilver	2½
Quicksilver, pf.	3½
Ray Con	26
RepublicI.&S.,com.	78⅞
Republic I. & S. pf.	112½
Sloss-Sheffield	60
Tennessee Copper	23
U. S. Steel, com	119
U. S. Steel, pf.	121⅞
Utah Copper	101
Va. Iron C. & C.	49

N. Y. CURB†	Oct. 24
Buffalo Mines	95
Butte & N. Y	1¼
Butte C. & Z	8
Caledonia	.57
Can. Cop. Corpn	2¼
Cashboy	.05
Cerro de Pasco	38½
Con. Ariz. Sm	2
Con. Coppermines	2⅝
Con. Nev.-Utah	.25
Crystal Cop	.93¾
First Nat. Cop	4⅛
Florence	70
Goldfield Con	.57
Goldfield Merger	.08
Granite	.40
Hecla Min	7¼
Howe Sound	5⅜
Jerome Verde	2
Joplin Ore & Spel	43
Kerr Lake	4¾
Magma	21½
Majestic	.52
McKinley-Dar-Sa	.62
Mother Lode	.38
Nevada Hills	.18
N. Y. & Hond.	14⅝
Nipissing Mines	8½
Oro	‡ 03
Ray Hercules	3⅛
Rochester Mines	.57
St. Joseph Lead	19¼
Standard S. L.	1½
Stewart	3/16
Success	.36
Tonopah	6 1/16
Tonopah Ex	4⅛
Tribullion	.25
United Zinc	4½
White Knob, pf.	1¾
White Oaks	4¾
Yukon Gold	2⅛

SAN FRAN.*	Oct. 24
Alta	.04
Andes	.11
Best & Belcher	.06
Bullion	.02
Caledonia	35
Challenge Con	‡.05
Confidence	.11
Cons. Imperial	.01
Con. Virginia	.12
Gould & Curry	.03
Hale & Norcross	.05
Jacket-Cr. Pt.	.03
Mexican	.14
Occidental	.65
Ophir	.23
Overman	.03
Savage	.11
Seg Belcher	‡ 02
Sierra Nevada	.30
Union Con	.61
Utah Con	.02
Belmont	4 25
Jim Butler	90
MacNamara	.11
Midway	.23
Mont.-Tonopah	‡ 21
North Star	.16
Rescue Eula	.24
West End Con.	.70
Atlanta	.09
Booth	.10
C.O.D. Con	.03
Comb. Frac.	06
D'field B B	05
D'field Daisy	.05
Jumbo Extension	.35
Round Mountain	36
Sandstorm Kendall	‡ 04
Silver Pick	19
Central Eureka	‡ 05
Argo	08
Ariz. Central	.10
Big Jim	1.25
Lazy Boy	.06
Oatman No. Star	‡.14
Tom Reed	2.20
United Eastern	3.75½
United Western	06

BOSTON EXCH.*	Oct. 24
Adventure	3
Ahmeek	104
Algomah	1¼
Allouez	70
Ariz. Com., ctfs	12⅝
Bonanza	.40
Butte-Ballaklava	2
Calumet & Ariz.	78
Calumet & Hecla	570
Centennial	21
Copper Range	71
Daly West	2½
East Butte	16¼
Franklin	9
Granby	90½
Hancock	13¾
Helvetia	.25
Indiana	3
Island Cr'k, com	49
Island Cr'k, pfd	91½
Isle Royale	33
Keweenaw	6⅞
Lake	13¾
La Salle	4½
Mason Valley	4¼
Mass	16½
Mayflower	2¾
Michigan	4⅛
Mohawk	94
New Arcadian	6½
New Idria	14
North Butte	20⅞
North Lake	1⅛
Ojibway	1¼
Old Colony	2¼
Old Dominion	69¾
Osceola	90
Quincy	91
St. Mary's M L.	88
Santa Fe	2½
Shannon	9¼
Shattuck-Ariz	28½
So. Lake	6
So. Utah	.27
Superior	15¾
Superior & Bost.	4¾
Tamarack	45½
Trinity	6¾
Tuolumne	67
U. S. Smelting	72¾
U. S. Smelt'g, pf	51
Utah Apex	3 11/16
Utah Con	14½
Utah Metal	7½
Victoria	5½
Winona	4½
Wolverine	45
Wyandot	1½

BOSTON CURB*	Oct. 24
Bingham Mines	9⅝
Boston Ely	.72
Boston & Mont	.85
Butte & Lon'n Dev	59
Calaveras	5½
Calumet-Corbin	.02½
Chief Con	2
Cortez	.35
Crown Reserve	45
Davis-Daly	3
Eagle & Blue Bell	1⅝
Houghton Copper	1
Iron Cap Cop., pf.	5⅝
Mexican Metals	.42
Mines of America	2¼
Mojave Tungsten	3½
Nat. Zinc & Lead	.55
Nevada-Douglas	1 11/16
New Baltic	2⅞
New Cornelia	17½
Ohio Copper	13
Oneco	80
Raven Copper	‡ 07
Rex Cons.	29
Rilla	11
United Verde Ext	39

SALT LAKE*	Oct. 24
Big Four	1 00
Black Jack	09
Cardiff	7 30
Colorado Mining	19
Crown Point	05½
Daly-Judge	8 00
Emma Cop	2 68⅝
Gold Chain	15
Grand Central	60
Iron Blossom	1 70
Lower Mammoth	05
May Day	13½
Opohongo	01½
Prince Con	1 32½
Seven Troughs	‡ 03
Silver-King Coal'n.	2 75
Silver King Con	3.52½
Sioux Con	16
So. Hecla	2 00
Uncle Sam	06
Wilbert	08½
Yankee	15

TORONTO*	Oct. 24
Bailey	07½
Beaver Con	40
Chambers Ferland	.17
Coniagas	4 75
La Rose	61
Peterson Lake	.20
Right of Way	05
Seneca Superior	09
T. & Hudson Bay	70 00
Temiskaming	61
Wettlaufer-Lor	10
Dome Exten	32½
Dome Lake	61
Foley O'Brien	70
Hollinger	6 70
Jupiter	.28
McIntyre	1.56
Newray	.75
Porcu. Crown	.70
Vipond	.35
West Dome	.34

STOCK QUOTATIONS—Continued

COLO. SPRINGS	Oct. 24
Doctor Jack Pot	09½
Elkton Con	.10
El Paso	.41
Findlay	.03
Gold Sovereign	.05
Golden Cycle	2.40½
Granite	.72
Isabella	.23
Jack Pot	.05
Mary McKinney	.32
Portland	1.90
Vindicator	1.75

LONDON	Oct. 11
Alaska Mexican	£0 15s0d
Alaska Tre'dwell	3 0 0
Burma Corp	4 5 0
Cam & Motor	0 11 0
Camp Bird	0 7 6
El Oro	0 9 6
Esperanza	0 11 6
Mexico Mines	3 17 6
Nechi, pfd	0 13 6
Oroville	0 16 9
Santa Gert'dis	0 11 6
Tomboy	1 1 0

* Bid prices. † Closing prices. ‡ Last Quotations.

MONTHLY AVERAGE PRICES OF METALS

Silver	New York			London		
	1914	1915	1916	1914	1915	16
January	56 572	48.855	56.775	26 553	22.731	26 960
February	57.506	48.477	56.755	26 573	22 753	26.975
March	58.067	50 241	57.935	26.788	23.708	27 597
April	58.519	50 250	64.415	26.958	23 709	30 662
May	58.175	49.915	74.269	26.704	23 570	35.477
June	56 471	49.034	65.024	25 948	23 267	31 060
July	54 678	47.519	62.940	25.219	22 597	30 000
August	54.344	47.163	66.083	25.979	22.780	31 498
September	53 290	48.680	68.515	24 260	23.591	32.584
October	50 654	49.385	......	23.199	23 925	.....
November	49 082	51.714	......	22.703	25 094	.....
Dec.	49 375	54.971	......	22.900	26.373	.....
Year	54.811	49 684	.....	25.314	23 675	..

New York quotations cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

Copper	New York		London			
	Electrolytic		Standard		Electrolytic	
	1915	1916	1915	1916	1915	1916
Jan	13 641	24.008	60 756	88.083	65.719	116.167
Feb	14 394	26.440	63.494	102 667	*	133 167
Mar.	14.787	26.310	66.152	107 714	*	136 000
April	16.811	27.895	75.096	124.319	*	137.389
May	18 506	28.625	77.600	135.457	*	152.522
June	19.477	26.601	82.574	112 432	95.333	137.455
July	18.796	23.865	76.011	95.119	91 409	125 500
Aug	16 941	26.120	68 673	110.283	82.333	126 304
Sept	17 502	26 855	68 915	113.905	85.250	134 071
Oct	17 686	......	72 601	......	88 000	...
Nov	18 627	......	77.744	......	93.273	......
Dec.	20 133	......	80.773	......	100 430	......
Year	17 275	.....	72 532	......	......	......

Tin	New York		London	
	1915	1916	1915	1916
January	34 260	41.825	156.550	175.548
February	37.415	42.717	176.925	181 107
March	48 426	50.741	180 141	193 609
April	47.884	51.230	166.225	199 736
May	38.790	49.125	162.675	196.511
June	40.288	42.231	167.636	179 466
July	37.423	38 510	167.080	168.357
August	34.389	38.565	151 440	169.870
September	33 125	38.830	152.625	171.345
October	33.080	......	151.554	......
November	39.224	......	167.670	......
December	38.779	......	167 000	......
Av. year	38.590	......	163.960	......

Lead	New York		St. Louis		London	
	1915	1916	1915	1916	1915	1916
January	3 729	5 921	3.548	5 826	18 606	31.167
February	3.827	6.246	3.718	6.164	19 122	31 988
March	4 053	7.136	3.997	7.375	21.883	34 440
April	4 221	7.630	4.142	7.655	21.094	34 368
May	4.274	7.463	4.182	7.332	20.347	32 967
June	5.932	6.936	5.836	6.749	25.170	31 011
July	5.659	6.352	5.531	6.185	24.611	28.137
August	4 656	6.244	4 520	6.088	21.946	29.734
September	4 610	6.810	4 490	6.699	23 151	30.786
October	4 600	......	4 499	...	23.994	......
November	5 155	......	5 078		26.278	......
December	5.355	......	5.266	...	28.807	.....
Year	4 673	......	4.567	......	22.917	......

Spelter	New York		St. Louis		London	
	1915	1916	1915	1916	1915	1916
Jan.	6.386	16.915	6.211	16.745	30.844	89 810
Feb.	8 436	18.420	8.255	18.260	39.819	97.762
Mar	8 541	16.846	8 360	16 676	44.141	95 048
April	10 012	16.695	9 837	16.525	49.888	99 056
May	14.781	14.276	14.610	14.106	68 100	94 217
June	21.208	11.752	21.038	11.582	100 614	68.591
July	19 026	8.925	18.856	8.755	97.250	50.750
Aug	12.781	8.730	12.611	8.560	67 786	51.587
Sept	13 440	8.990	13.270	8.820	67 841	52.095
Oct.	12 800	......	12.596	......	66 536	......
Nov.	15.962	......	15.792	......	88 409	......
Dec.	15.391	......	15.221	......	89.400	......
Year	13 230	......	13.054	......	67.553	......

New York and St. Louis quotations, cents per pound, London, pounds sterling per long ton. * Not reported.

Pig Iron, Pitts.	Bessemer‡		Basic‡		No. 2 Foundry	
	1915	1916	1915	1916	1915	1916
January	$14.59	$21.60	$13.45	$18 78	$13.90	$19.70
February	14.55	21.16	13.45	18.93	13.90	19.51
March	14.55	21.81	13.45	19.20	13.95	19.45
April	14.55	21.65	13.45	18.95	13 95	19.45
May	14.61	21.78	13.60	19.11	13 83	19.58
June	14.70	21.95	13.67	18 95	13 77	19.34
July	14.94	21.95	13.91	18.95	13 68	19.20
August	16 01	21 95	15.31	18.95	14 75	19.25
September	16.86	22.88	15 95	19.58	15.70	19.53
October	16.95	.....	15 96	......	15.80	.....
November	17.57	.....	16 47	.....	17 20	......
December	19 97	......	18 44	.....	18.95	......
Year	$15 82	...	$14 76		$14.95	......

‡ As reported by W. P. Snyder & Co.

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Sinking the Wallenberg Shaft

By Lloyd D. Cooper*

SYNOPSIS—The sinking of a 1,200-ft. shaft in Norway by an American contractor is described, together with the equipment used and the progress made. An actual sinking speed of 85 ft. per month was attained. The shaft is situated a mile from the Lökken plant of the Orkla company and will increase the annual production from 150,000 to 1,000,000 tons.

The Orkla Grube-Aktiebolag, which operates the Lökken mine, was organized under the laws of Norway in 1904, the stock control being in the hands of Norwegian and Swedish interests. The mine is connected with Thamshavn, at the head of the Orkedalsfjord, by an electric railway 16 mi. long. At Thamshavn the company owns wharves for passenger and freight traffic and automatic loading equipment. It also owns a fleet of ore boats and a passenger steamer making two round trips daily between Thamshavn and Trondhjem, a distance of about 20 mi.

A GENERAL VIEW IN THE VICINITY OF THE WALLENBERG SHAFT, ONE MILE FROM THE SURFACE PLANT OF THE ORKLA COMPANY

The present production of the mine is in the neighborhood of 150,000 tons of cupriferous pyrite annually. A systematic drilling campaign was carried on which resulted in establishing a large tonnage of ore. The annual production is planned to be increased to 1,000,000 tons. To develop and mine this recently found addition to the ore reserves, it was deemed advisable to sink a shaft 1,200 ft. deep about a mile distant from the present surface plant of the Lökken mine. The work was started by the Orkla company and the shaft sunk 85 ft. As the shaft occupies a hillside position, a tunnel was driven out to surface 65 ft. below the collar. This was used for tramming out the spoil, the shaft collar being used in lieu of a headframe.

The Work Undertaken by Contract

In May, 1915, the E. J. Longyear Co., of Minneapolis, entered into a contract with the Orkla company to finish sinking the shaft to a depth of about 1,200 ft. Under this contract it was agreed to maintain an average rate of 66 ft. (20 m.) per month. The crew for the work was secured on the Marquette and Menominee ranges in Michigan and reached Lökkens Verk early in July, 1915. Shaft sinking, however, was not started until Aug. 5.

The Orkla company had installed a surface plant for the shaft-sinking operations. This consisted of one motor-driven Ingersoll two-stage air compressor, one motor-driven Hammer single-stage air compressor, two motor-driven hoisting engines having a hoisting speed of 200 ft. per min., and a 7½-hp. Sturtevant ventilating fan. This equipment was used by the Longyear company in the consummation of its contract with the addition of a Leyner drill sharpener, which was brought from America. The drilling equipment consisted of [illegible] jackhammers with 30 sets of ⅞-in. form-[illegible]

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*Formerly chief engineer; now manager for E. J. Longyear Co. at Trondhjem, Norway.

The shaft is 12x18 ft. outside of timbers, divided into five compartments which will provide for two skips, two cages and the necessary pipes and ladderways. The rock through which the shaft has been sunk is known as gabbro. It drills easily except through seams of low-grade ore, which occur frequently.

Temporary sheaves are supported on timbers set in the concrete foundations for the shafthouse, which itself will be built of reinforced concrete, as well as the machine shop and engine house which are at present under construction. The spoil is hoisted in two 30-cu.ft. buckets, guided by crossheads and is used for filling a railroad grade about 1,000 ft. from the shaft.

The water encountered is handled by one Eureka 10x4½x10-in. outside-packed plunger pump on the 200-m. level and one 7x3-in. piston pump which is carried down on the timbers as the shaft is sunk. A small pump is used in the bottom, and all pumps are driven by air. A large sump on the 200-m. level was made by building a concrete wall across the drift, and most of the water that comes into the shaft above this level is caught by it. It was planned to pump from the 200-m. level with an electrically driven vertical centrifugal pump capable of handling 135 gal. per min. to a height of 650 ft., but this was found unsuitable and was replaced by an air pump.

The air compressors were of sufficient capacity to maintain 90 lb. pressure, but an unusually early winter caused a serious shortage of water at the power plant just at the time when it became necessary to pump with air, so that from December, 1915, until March, 1916, pressures of from 55 to 80 lb. prevailed. At times only four drills could be used while the pumps were running. As the depth from which the water had to be pumped increased, it was found necessary to run an air line to the compressors at the Lökken mine and use additional compressed air from there. The air line in the shaft is a 4-in. pipe, to which is attached a header with twelve ¾-in. nipples for the machine and pump-hose connections.

The work has been carried on in three 8-hr. shifts with an average for the year of 8.5 men per shift. The personnel is under the supervision of a mining captain and consists of the following men working an 8-hr. shift: 3 foremen, 30 miners, 1 timber foreman and 4 timbermen. The following worked a 10-hr. shift: 2 timber framers, 2 blacksmiths, 2 pipemen and 1 electrician. In addition, the following worked a 12-hr. shift: 2 pumpmen, 3 hoisting engineers, 2 compressor men and 9 landers.

THE METHOD OF WORKING

The first 260 ft. of the shaft was supported with round timbers spaced 7 ft. apart without lining. Soft ground was encountered which made it necessary to change the method of timbering and 7x7-ft. square sets, spaced 6 ft. on center and supported on timber bearings at 100-ft. intervals have been used. The shaft is lined with 3-in. plank, and the skip roads are separated from the rest of the shaft with 3-in. matched lumber. All timbering, with the exception of putting in the stringers, is done without interfering with the sinking operations.

A strong timber stage, having doors through which the buckets pass, is hung below the bottom set, and on this the timbermen work. This stage is supported by four wire cables wound on hand winches in the tunnel and is lowered as the stage is sunk. The skip-roads are covered at the tunnel level by two pairs of doors, balanced with counterweights, which are closed after the bucket is hoisted, preventing any rock from falling back into the shaft.

Under the usual arrangement of drilling, which of course was varied somewhat as the character of the ground changed, 14 sink holes were drilled and with them were blasted the four corner holes from the last round above, using du Pont delay electric exploders. After the rock from this blast had been hoisted, 46 squaring-up holes were drilled, the inside holes being started down in the sink. The holes were found to break deeper when drilled in this way, and it more than compensated for the extra time taken in drilling the round in two parts. On the second blast 15 to 20 holes were shot and the mucking continued until water appeared in the bottom of the shaft. The remaining holes, with the exception of the four corner ones, were then blasted so that the pump was not taken down until after the last blast.

After blasting, the smoke was drawn out through a 10-in. pipe. This method required from 30 to 40 min. to clear the shaft so that work could be resumed.

THE RATE OF PROGRESS

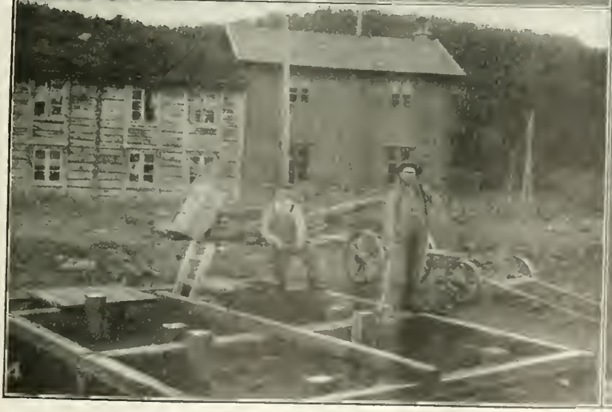
During the year of sinking from Aug. 5, 1915, to Aug. 4, 1916, the cuts averaged 5.7 ft. in depth, breaking 1,231 cu.ft. of rock each with 494 lin.ft. of drilling. The average drilling speed was 4.4 ft. per machine-hour, which includes all the time from the completion of the mucking until starting to charge the holes. The 14 sink holes are frequently drilled by 10 machines in one hour. The holes averaged 7.6 ft. in depth. Of the actual working time in the shaft, 30% was spent in drilling, 59% in mucking and hoisting and 11% in blasting.

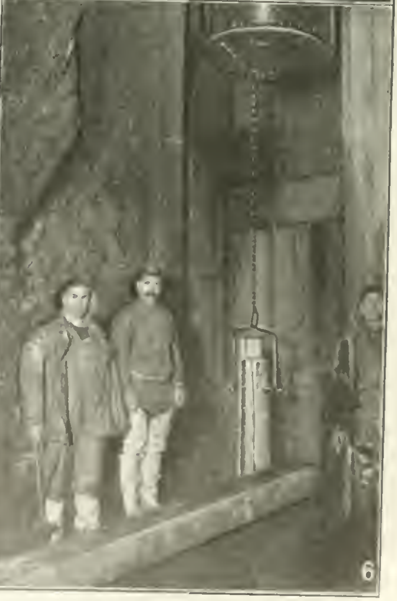
During this period the miners worked 7,217 shifts removing 206,496 cu.ft. of rock, or 28.6 cu.ft. per man per shift. In this time the shaft was sunk 904 ft., or at the rate of 75.3 ft. per month. As the shaft had previously been sunk 85 ft. by the Orkla company, the total depth on Aug. 4, 1916, was 989 ft. In connection with the sinking stations were cut at the 200-m. and 300-m. levels, requiring 49 shifts of 8 hr. each; in October, 1915, the compressor house was destroyed by fire, causing a loss of 38 shifts, while labor troubles in May and June delayed the work 30 shifts. The actual sinking time (making no allowance for delays was therefore 276 days, or a sinking rate of 85.3 ft. per month.

As the Norwegian laws prohibit Sunday work, requiring a suspension of 28 hr., no work was done from 6 p.m. on Saturdays until 10 p.m. on Sundays. In the spring of 1916, however, permission was obtained to work until 11 p.m. Saturdays, thus permitting all the men to work six full shifts a week.

At the date of writing (Aug. 22, 1916) there still remained approximately 210 ft. of shaft to be sunk and two stations to be cut.

The following permanent equipment is to be installed when the shaft is completed: Two 500-hp. hammer air compressors, direct-connected to 300-kw. motors (each compressor will have a capacity of 2,600 cu.ft. per min.); one hoisting engine for men and materials, having a 10-ft. drum with a speed of 1,200 ft. per min. and driven by a 280-hp. motor; one hoisting engine operating two 5-ton skips at a maximum speed of 1,450 ft. per min. and driven by a 700-hp. motor. (Both hoists will have automatic speed-regulating devices attached to the indicators to prevent overwinding or excessive speed at the start); one





DETAILS IN THE WORK OF SINKING THE WALLENBERG SHAFT

Fig. 2—A round of jackhamers used in drilling the holes. Under proper air pressure, 14 sink holes were frequently drilled by 10 machines in an hour. An average drilling speed of 4.4 ft. per machine-hour was maintained. Fig. 3—Tramming out the waste from the mouth of the tunnel. A tunnel 65 ft. below the collar of the shaft serves as an exit for the spoil, which removes the necessity of a headframe, the collar supporting the sheaves. Fig. 4—Framing a set of shaft timbers. The timbers are framed on the surface and then lowered as shown in Fig. 6. A set is made up of 7x7-ft. [illegible] sets spaced 6 ft. apart in soft ground. Fig. 5—The 30-cu.ft. bucket used to hoist the rock to the tunnel level. These are guided by crossheads. Fig. 6—The method of lowering the timber after it is framed. A hole is drilled through the [illegible] of several timbers and these are bolted to a yoke suspended under the bucket

electrically driven plunger pump handling 135 gal. of water per min. to a height of 1,200 ft.; one 30-hp. ventilating fan; two 36x42 Buchanan rock crushers, which will be installed underground.

Austrian Mining in Serbia

On the theory that even one's worst enemies should have their merits recognized, the *Echo des Mines et de la Metallurgie,* Paris, credits the Central Powers with rapidly organizing the underground work in Serbia. Under the general military government of Austria was created a section of mines, which has been prospecting the mountains of Serbia. A laboratory was established at Belgrade. This mining section is headed by a captain, Dr. Kern; its technical manager is Lieutenant Imhoff, director of mines; its working inspector is Lieutenant Franz, mining engineer. The scientific, chemical and metallurgical researches are directed by Lieutenant Brunn.

Prospecting began in November, 1915, in charge of Lieutenants Imhoff and Burkhart, of the Hungarian Finance Department. It is now considered as finished, and seven mines are to be exploited.

In the vicinity of Chabatz the mines of Dorspotok, near Krupanj, property of the Austro-Hungarian railways, are worked for antimony. At Rudnik the military authorities are taking out lead and copper. In the neighborhood of Belgrade the mines of Cavoni Breg (mining district of Ripanj) will soon yield lead, but the most important lead mine worked by the military authorities is that of Babé, whence is derived daily a car of lead and 100 cars of ore which is treated in the works of the interior. To work this mine it has been necessary to build a narrow-gage railway over 5 mi. long, spanning six deep gorges. Considerable labor and expense were required, but the scarcity of lead could thus be relieved.

To obtain copper, the mines of Majdanpeck have been worked. The daily production has been three cars of copper and 200 cars of pyrite.

At Vlaskopolje may be extracted, for supply of Belgrade, 30 cars per day of coal, poor but usable. In the valley of Ibar, near Usce, coal measures have been found. If they are exploitable, they will be used on the military railroads, but it will be necessary to build about 4 mi. of railway to work them.

Strontium in Arizona

That minerals of strontium are found in quantity in Arizona is a fact that is not generally known, according to a bulletin of the Arizona State Bureau of Mines. Fifteen miles south of Gila Bend, in Maricopa County, strontium, as celestite, occurs in the sedimentary series, associated with gypsum, sandstone and conglomerate. The most promising beds are 40 to 50 ft. thick and are most productive in the upper 10 ft. There are undoubtedly other discovered deposits of strontium salts within the state, but they are not recorded.

Strontium is not easily recognized at sight, but is readily identified by the simple tests that are outlined in bulletin No. 35 of the Arizona State Bureau of Mines, entitled "Celestite and Strontianite," which may be secured from Charles F. Willis, director, Arizona State Bureau of Mines, Tucson, Ariz. There are several uses for strontium salts, the principal ones being in the sugar industry and in the manufacture of fireworks.

Diamonds of Smiths Flat

By Burr Evans*

It is not generally known that 47 or more genuine diamonds have been found in the Tertiary gravels that lie embedded in the old channels of the lava-capped buried rivers of the Neocene river system, in and about Smiths Flat, Eldorado County, California. Judge William Pitt Carpender, an old-time miner who arrived at Smiths Flat in 1854, from Akron, Ohio, via the Nicaragua route, operated a deep-gravel mine in the "Deep Blue Channel" on the flat for a number of years.[1] He was justice of the peace at Placerville, the county seat, for 32 years, and being interested in mining matters in general, he kept an accurate record of all the diamonds found in Eldorado County that he happened to hear about, making it a special point to obtain the facts as nearly correct as possible regarding each stone.

Following are Judge Carpender's notes of 33 stones found. First is the name of the person finding the stone, then the name of the mine or locality where found the year when found, the size, color, weight (in Troy grains or carats), etc., and its disposition, when known:

John Bradshaw, Bunchanan Mine, Smiths Flat, 1859, one small white stone.

John Lyford, at Smiths Flat, 1865, one white stone, 3 grains, stolen by a woman and set rough in a ring.

A. Brooks, at Spanish Ravine, 1866, one white stone, 2 grains, flawed.

Ward Bros., near White Rock Cañon, 1867, three small stones, largest one valued at $50 in San Francisco.

Thomas Ward & Co., Live Oak mine, Reservoir Hill, 1868, three stones, two white of medium size, and one yellow; one set in a ring, in possession of Ashcroft, of Oakland, Calif.

Thomas Potts, Sr., near White Rock Cañon, 1868, one light-yellow stone, 2 grains, sold to A. W. Goodyear (first mineralogist of the State of California) when he visited the mines at Smiths Flat in 1871.

J. Jeffry, Webber Hill [no date], one yellow stone, 3 grains.

Mrs. Sam Henderson, Wisconsin Flat mine, 1868, one white, medium size.

Cruson & Olmstead, Wisconsin Flat mine, 1868, four stones.

Henry Olmstead, Wisconsin Flat mine, 1869, one stone, $\frac{9}{32}$ in. maximum diameter, weighed 5 $^{61}/_{100}$ grains, white coating on surface, sold for $280 in San Francisco.

McConnell & Reed, mine south side of Webber Hill and east side of Texas Hill, 1870, one stone, canary color, size of small white bean. (Mrs. Caleb Reed, of Placerville, now has stone set in a ring.)

Nathaniel O. Ames, mine on Webber Hill [no date], one stone of 4 grains, set in ring and worn by Shelly Inch, postmaster of Placerville for many years. (This stone is now in possession of L. P. Inch, city manager of a fire insurance company at 444 California St., San Francisco.)

Charles W. Schafer, Tolkey mine, Texas Hill [no date], one stone of 2½ grains, sold to John Cook.

Fred Bendfeldt, Sr., at Smiths Flat, 1878, one stone of $\frac{7}{16}$ carat, canary color, sold to W. F. Alma, of Boston. (Fred Bendfeldt arrived at Smiths Flat, from Hamburg, Germany, via the Horn, in 1853, and owned and operated the "Bendfeldt" deep-gravel mine at the Flat for thirty-odd years. He "crossed the line" on the Flat Feb. 4, 1916, at the age of 88 years.)

Ed Randall, Wisconson Flat mine, 1879, one white stone of ⅛ carat.

Fred Bendfeldt, Jr., at Smiths Flat, 1894, one white stone of $\frac{15}{16}$ carat, canary color, sold to W. F. Alma.

Bert Carpender (son of William Pitt Carpender), at Smiths Flat, 1896, two white stones of 1⅞ carats, and ¼ carat, and one canary-color stone of 1⅝ carats, sold to W. F. Alma.

Thomas Murdock, at Smiths Flat, 1896, one yellow stone of $1^{3}/_{64}$ carats, sold to W. F. Alma.

Snow Brothers, near Newtown, 1897, one white stone of 1½ carats.

Snow Brothers, near Fairplay, 1897, one canary-color stone of 3 grains, in possession of George Richardson.

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*Box 191, Placerville, Calif.

[1] Deceased Feb. 16, 1916, aged 85. See obituary in the "Journal" of Mar. 4, 1916, p. 450.

Bert Carpender, Stanley mine, Smiths Flat, 1899, one white stone of 2 grains, in possession of W. P. Stanley.

Fred Bosworth, in Cedar Ravine, at Placerville, 1900, one white stone of 4½ grains. (Bosworth still has this stone in the rough and has been offered various prices for it up to $80.)

J. Allen, in Cedar Ravine, at Placerville, 1901, one white stone of $\frac{13}{16}$ carat, sold to W. F. Alma.

Bert Carpender, in Carpender mine, at Prospect Flat, 1912, one white stone of 3 grains.

The majority of the persons named in the foregoing list still reside in the County of Eldorado and will vouch for the correctness of the finds. Besides the persons named, there are a number of others who have personal knowledge of the various finds as stated; among whom can be mentioned Theodore Rupley, miner, who has been at Smiths Flat since 1853; Oliver E. Bailey, C. W. Martin, Louis N. Stricker, James R. Vandegrift and Clarke Howard, justice of the peace, all of Placerville, and a number of others.

In addition to the foregoing list of diamonds found, F. F. Barss, who arrived in Placerville from New York City via Panama in 1852 and started a jewelry store which he has conducted constantly ever since, showed me on Feb. 14, 1916, two diamonds which were found at Smiths Flat about 1874. One of about $\frac{1}{10}$ carat he bought from a Chinaman; and the other, which he bought from a miner, is a good white stone of over $\frac{1}{8}$ carat. Mr. Barss states that in the 70's and 80's he mounted five stones in breastpins and two in rings for different people, all of which were good diamonds and were found in the vicinity of Smiths Flat. One stone he remembers well because of its having a piece of the original blue-matrix attached to it. Another good stone, he states, was found about 1869 by Henry Ashcroft, who is now 85 years of age and is residing at Placerville, Idaho.

N. H. Burger, who arrived in Placerville in 1900 and has conducted a jewelry store there for a number of years past, states that from about 1906 to 1909 he had cut in New York City and set in rings five diamonds that were found by different persons in the gravel of the Neocene river channels between Placerville and Smiths Flat. The stones ranged from $\frac{1}{8}$ to 1 carat, and one was a fine blue stone of about $\frac{3}{8}$ carat; and in 1914 he set in a ring for Frank Jones, a miner, a good white diamond of about $\frac{1}{2}$ carat, which Jones had found in his gravel mine in Chile Ravine, just south of Placerville, and which he still has.

Some day the pipe of blue matrix, from which these diamonds presumably came, may be discovered. This "pipe" undoubtedly has been worn down, eroded and disintegrated in the past ages, thus releasing these diamonds that have been found in the gravel of the buried ancient river channels that pass through Smiths Flat. It is reasonable to suppose that many more of these stones will be found from time to time, as there must have been quite a number more set free from the matrix of the "pipe" in which they were formed. This "pipe," wherever it may be, is evidently overcapped and buried under a mass of volcanic ash and lava which tops off the greatest part of the surrounding region. If this "pipe" is found near Smiths Flat, then the former active mining life, with greatly renewed vigor, will wake again this old-time camp.

◆

A Spanish Mines Consolidation is scheduled to take place, according to "Madrid Cientifico," between two companies opearting lead and copper mines in the Province of Cordoba. The proposed plan involves the absorption of the Sociedad Los Almadenes by the Sociedad La Argentifera de Cordoba, with a corresponding increase in the capital stock of the latter.

Progress of First-Aid Work in British Columbia

SPECIAL CORRESPONDENCE

The experience in connection with efforts made to arouse general interest among metal miners in British Columbia in matters relating to instruction in first aid has not been as favorable thus far as could be desired. Nevertheless the officials directly charged with the duty of encouraging men engaged in and about metalliferous mines in the province to attend classes for instruction and to become competent to render first aid in cases of emergency are steadfastly persisting in this important and beneficent work. They are looking forward with confidence to increasingly good results as time passes and more of those who should be chiefly concerned come to a realization of the necessity rather than the mere desirability of taking upon themselves personally this duty to their fellow workers as well to themselves. Only recently was the report of the British Columbia Department of Mines for the calendar year 1915 published, which accounts for this apparently tardy reference to the information given by the department's instructor in first aid, Dudley Michell, of Victoria, of the results of his work during the year.

As Mr. Michell's report for 1915 covers only his second year's official work in giving attention to first aid and the use of mine-rescue apparatus, it may be of interest to first recall what he accomplished in 1914 and then briefly review what was done in 1915. It should be understood, though, that Mr. Michell is not generally called upon to instruct those who attend classes in first aid, that duty falling to duly qualified surgeons. The policy of the Department of Mines is to encourage men to endeavor to obtain first-aid certificates of competency, from a recognized ambulance association. This can be secured only by passing the examination under the auspices of such an association after the prescribed number of lectures, given by an approved surgeon instructor, shall have been attended. The requisite percentage of marks must be earned at an examination held by an authorized surgeon examiner.

WORK ACCOMPLISHED IN 1914

Mr. Michell entered upon his duties in May, 1914, and about the end of that month met several mine managers at a meeting of the Western Branch of the Canadian Mining Institute at Nelson, West Kootenay, and placed before them the proposed policy of the Department of Mines with the object of inducing miners to take first-aid instruction. Directly afterward he set about organizing St. John Ambulance Association "centers" and forming first-aid classes. The immediate result was that two classes were formed at Rossland, followed by three in Boundary district, and afterward by five in various parts of West Kootenay. Then the European War began, and as a result of the consequent demoralization of the markets for metals, many of the metalliferous mines were closed for the time and most of those who had been employed at them scattered far and wide. Rossland mines only, escaped the general disorganization, so that the first-aid work begun in that camp has been continued without interruption, until today it is established with little likelihood of the larger mines there [illegible] being content to go along without having [illegible] mine employees a considerable number of men trained in first-aid or mine-rescue work, or both.

In the cases of the mines employing comparatively large numbers of men and having the services of a resident surgeon available for purposes of instruction, there was, in important instances, not much difficulty, but as Mr. Michell reported, "It has been proved that in the small mines situated long distances from town successful results are not obtained by an instructor, owing in most part to the large proportion of men employed at these mines being unable to properly speak and understand English, while the others do not seem to care to have their leisure hours taken up by instruction in first aid, especially in the only place they have for recreation—the bunkhouse.

It is noteworthy that during Mr. Michell's first year of office, 405 men attended first-aid instruction classes in Kootenay and Boundary districts and 76 in the Coast district, making a total of 481. These figures relate only to metalliferous mines. For 1915 Mr. Michell's report included the following: "More than 700 miners attended first-aid lectures at the various mines of the province. The net results show that 301 men (from coal mines 242 and from metal mines 59) passed a final examination in first-aid work and were awarded various grades of certificates by the St. John Ambulance Association. The actual number of men finishing this course may be placed at 450. The difference between the total number attending the lectures and the number passing final examinations is due to various causes, some of which are: Failure to pass examinations, class completing lectures but not examined, class disbanded, and lack of interest; all of which causes have unfavorably affected results. I regret to say that the results obtained from the metal mines are not as good as were to be expected."

PROGRESS IN 1915 IN DIFFERENT CAMP

Classes were conducted in coal-mining districts of Crowsnest, in Southeast Kootenay, Nicola Valley, and Vancouver Island, and in metal-mining camps at Kimberley, East Kootenay; Rossland, West Kootenay; Greenwood, Boundary; and Van Anda, Texada Island. Mr. Michell reported, further: "The largest number of men trained in first aid in one year and at one company's mines was at the mines of the Crow's Nest Pass Coal Co., where 139 passed first-aid examinations. This number shows approximately one trained man for every 14 persons employed above and below ground at those mines, which result is highly satisfactory for one year's undertaking. All the classes were taught and examined by duly qualified medical practitioners and were conducted in accordance with the prescribed rules of the St. John Ambulance Association. At the Le Roi gold-copper mine, Rossland, a most systematic method of training was adopted. The afternoon shift was divided into three sections; each section reported at the mine once a week, an hour before the shift commenced, and received practical instruction, by a trained first-aid man, in the work of bandaging, etc. There has also been established at this mine a safety department, a safety committee and a safety engineer; their duties are the systematic inspection of the mine and the headworks with regard to safety, encouragement of first-aid instruction, and 'safety first' teachings.

It may be added that this year interest in first-aid work is being well maintained at the Consolidated Mining and Smelting Co.'s Centre Star and Le Roi mines, Rossland; attention is being given to it at the Britannia Mining and Smelting Co.'s copper mines in Vancouver mining division, Coast district; and a mine safety committee has been organized and is doing good work, including arranging for giving instruction in first aid, at the Granby Consolidated Co.'s Hidden Creek copper mines near Observatory Inlet, also in the Coast district.

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Works of American Zinc and Chemical Co. at Langeloth

The property of the American Zinc and Chemical Co. at Langeloth, Penn., according to a recent bulletin of the Engineers Society of Western Pennsylvania, embraces 900 acres, 200 of which are in the townsite and 100 acres in the present plant, consisting of about 30 buildings. Besides this there is a coal mine of 2,500 acres having a daily capacity of 1,500 tons, which will soon be increased to 2,500 tons daily.

There are 15 ore bins having a capacity of 2,000 tons each. The orehouse is equipped with a heavy electric traveling crane. The crushing mill, which consists of a drier, crushing rolls and screens, has a daily capacity of 200 tons of ore.

The four Hegeler roasting furnaces, each 80 ft. long, having a capacity of 50 tons of raw ore, have 14 ore hearths. Six of them are fired by Hegeler gas producers. Heat in the remaining eight is furnished by the burning of the sulphur in the ore.

The sulphuric-acid plant uses the chamber process, there being four systems of lead chambers in which 2,500 tons of sheet lead is used. Nitric acid and zinc-sulphate plants are under construction.

The distillation furnaces are of the Hegeler-type, seven blocks being in operation and one under construction. Each block contains 912 retorts. Four blocks are heated by a new type of Wood mechanical producer, each using 3,000 lb. of coal per hour. The three remaining blocks are heated by Hegeler gas producers.

In the mixing plant the ore, reducing material and coal for charging the retorts are mixed in two 80-cu.ft. mixers. The retorts, condensers and other fireclay shapes are made in an uptodate pottery.

A small zinc-dust furnace is now operating, but will soon be replaced by a large furnace in which both zinc-dust and sherardizing zinc will be produced. The zinc-oxide plant is now being built.

The power plant contains two 2,000-kw. Curtis horizontal turbines driving General Electric generators. The boiler plant consists of four 588-hp. and three 529-hp. Rust boilers using waste heat from the smelting furnaces. Four additional boilers are in the course of construction.

The company has built the modern industrial town of Langeloth. A sanitary sewer system is being built. Over 200 houses are now occupied, and 100 more are being built. These houses can be purchased by the workmen on easy terms. The school, which cost $25,000, will be run on the Gary plan.

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A New Gold Discovery in Tasmania is reported near Waratah in Russell County. This locality is not far distant from the Mount Bischoff tin mines. The American consular representative is quoted as believing that the recent strike may create a demand for mining machinery.

Improved Magnetic Separator

By August F. Jobke*

SYNOPSIS—An improvement of magnetic-separation work is claimed for the Jobke machine, which utilizes several magnetic zones in a given field, all of the same length of air gap. It is declared that time is not a factor influencing the rapidity of magnetizing ore particles, and the overshooting of a magnetic zone by a particle must be attributed to inertia and not to slowness of magnetic action.

Since the introduction of the invention of J. P. Wetherill, U. S. patent 555,792, which concentrates the magnetic field between opposing poles of wedge form, this style has been found the most effective for the purpose of concentrating ores, especially those of low permeability. Before this invention the shape of magnet poles was not altogether wrongly defined, since the action of corners or edges of flat poles was the factor that made separation possible, whereas an evenly distributed field does not attract fine particles. This fact can easily be demonstrated in a field between flat poles, where the particles to be attracted tend to cling to the outside edges. In order effectively to attract magnetic particles to a pole, it must have a wedge-shaped edge opposite another pole, to form a diverging field so that the particle during attraction may enter a field of increasing intensity, thereby encountering a concentration of more lines of force as it proceeds on its way.

Opposing cylindrical poles show a similar tendency to converge the field toward their surface in a degree depending on their curvature, the smaller the curvature, thereby approximating the wedge shape, the stronger the convergence and the attractive force.

The best form of field which has the advantage of a small reluctance is that made by an upper wedge-shaped pole and a lower flat pole. This field converges toward the upper pole, toward which alone the attraction takes place. With a practical length of air gap, the field converges right from the face of the lower pole, so that the ore particle is bound to move toward the upper pole, even if it rests on the face of the lower. This latter form is therefore the one used in modern magnetic separators.

Number of Fields Regulated by Ore Components

Where the separation of different components in complex ores is sought, as many different fields of varying strengths are required as there are components, and each must correspond in strength to the permeability of the individual component in order to effect a perfect separation.

When the concentration of a single ore is desired, a single field may be sufficient to accomplish it. Since the majority of ores are usually more or less finely comminuted, and crushing will not completely liberate the ore from the gangue, it is desirable to have not less than two different fields in order to produce concentrates high enough in value to pass and middlings too poor to be used, but too valuable to be dumped, from which a large percentage of the value will be liberated by further crushing. For this reason machines are often placed in tandem, or two magnet units capable of different excitation are combined in the same machine, to treat the ore successively.

The separation of complex ores containing a number of components of different permeability often requires the application of a series of zones, varying from a relatively weak zone to a very strong one, mostly between attainable extremes. Ordinarily, for the provision of these zones a number of different magnet systems would be required, in order to furnish the necessary excitation, and such machines are bulky and costly owing to the material necessary for their construction.

A single electromagnet capable of performing the different functions at the same time is a desirable aim, in that it simplifies the machine, lessens its cost and maintenance, and permits the additional weight of magnets to be used for the enlargement of the capacity of the separators. One way of accomplishing this end hitherto has been to supply the upper pole with several edges, each to provide a separate zone of field, the intensity of the same to be determined by its relative distance from the common lower pole with a flat face.

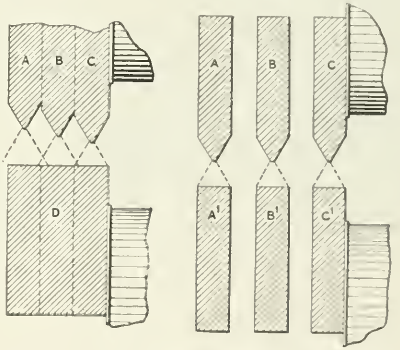

FIG. 1 FIG. 3

FIGS. 1 AND 3. OLD AND NEW METHOD OF OBTAINING THREE ZONES OF FLUX

As Fig. 1 shows, the upper pole may have several edges *A*, *B* and *C*, which are consecutively placed in closer proximity to the lower pole *D*. From each edge a magnetic flux is supposed to diverge toward the lower pole, the strength of which is determined by the reluctance of the air path, so that from *A* to *C* the zones increase in strength. Several factors enter to disturb the accomplishment of this simple combination, and in fact the production of decidedly separate zones is not possible with this arrangement.

While the strongest zone has a distinctly convergent field due to its shortness, the following zones have fields of much less convergence; and even with only three zones, as shown, the second and third hardly show any effect as separating zones, as shown by the lines of iron filings in Fig. 2.

Owing to the fact that both the upper and the lower poles have the same magnetomotive force over these complete faces, the lines of force tend to distribute themselves according to the reluctance of the air path for each individual line, and most evenly over the flat lower pole face. Since in the shortest zone the difference in distance between the point and the base of the wedge-shaped field is large, the field, concentrating at the upper pole edge, necessarily will converge thereto to some extent, and this would be the same in the other zones, if they had the same air-gap length.

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*No. 405 Pitt St., Wilkinsburg, Penn.

As the length of the zones increases with their successively lesser strength, the relative difference in distance between point and base of the wedge and the lower pole decreases, and therefore the resulting field is much less converging. In reality the total field, instead of the weaker zonal fields, converges toward the strongest pole edge *A*, and the result is that with any appreciable difference in zonal strength the strongest ore component, instead of being attracted by the weakest zone *A*, as might be expected, will move with the weaker components to the strongest pole *C* to be held there. Experiments with the arrangement from which Fig. 2 was made showed that a small steel ball, set in motion by the attraction of the field, would move through zones *A* and *B* toward *C*. Similar effects took place with irregular iron pieces and crushed magnetite.

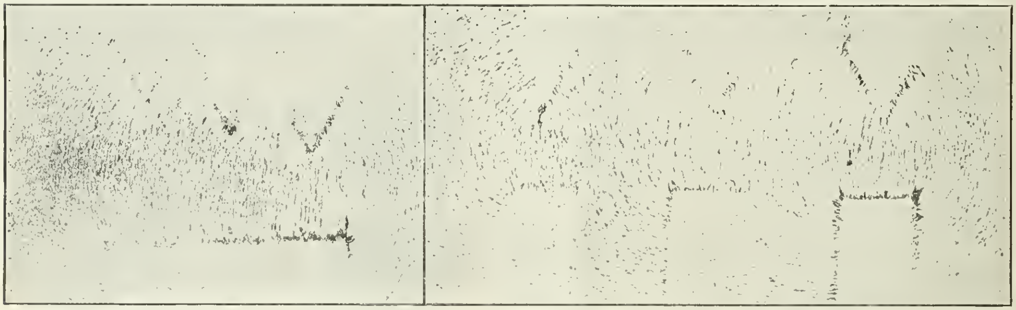

Fig. 2. Field in arrangement of Fig. 1 Fig. 4. Field in arrangement of Fig. 3

FIGS. 2 AND 4. LINES OF MAGNETIC FLUX SHOWN BY IRON FILINGS

The partial cause of this effect may be seen in the dotted lines of Fig. 1. For similar forms of fields in the three zones the weakest one would naturally occupy the larger area on the lower pole, while the strongest zone, owing to its shortness, could occupy the smallest area. Since just the opposite should take place, it is evident that the three zonal fields have to be disturbed in order to fulfill this requirement.

ZONAL CONDITIONS FOR CLEAN SEPARATION

An arrangement suitable to overcome the difficulties as described above must satisfy the following conditions:

The m.m.f.[1] at the poles of each zone must correspond to the strength of the same. The field strength between the different zones should be as low as possible. The strengths of the different zones should not depend on the length of their air gaps. A variation in zonal strength should therefore be accomplished by some other means than by varying the length of air gap.

The invention (U. S. patent 1,132,016) described below fulfills these four conditions and has proved to provide a perfect form of field for producing zones of extremely different strengths in the same magnetic field.

As Fig. 3 shows, an experimental form of this field is produced by employing separate upper and lower polepieces for the production of the three individual zones and having only the two polepieces of the strongest zone in direct contact with the electromagnet. The other pairs of poles are separated by air gaps from one another, thus introducing reluctances, which will reduce the m.m.f. symmetrically between upper and lower poles for each successive zone. While in Fig. 1, the flux from pole top *C* tends to flow to any point of the lower face *D*, in Fig. 3 this tendency is restricted to the fractional face C^1 of the lower pole, since a flow toward B^1 would introduce into its path the reluctance between polepieces B^1 and C^1. A magnetic flux seeks its path along the line of least reluctance, and therefore the flux will pass through C^1 at a greater density.

Similarly a flux from polepiece *B* would have no tendency to flow to A^1, and it will not flow to C^1 on account of the denser field present in the latter, which requires a higher m.m.f. for the flux to pass than *B* possesses.

In this arrangement the polepieces were made from ⅞-in. boiler plate and connected so that between individual polepieces horizontally and vertically there was an air gap of ¾ in. width. The same material was also used to build the arrangement of Fig. 1. A mixture of magnetite and weakly magnetic hematite was clearly separated at polepieces *A* and *C*, the former holding all of the magnetite when *C* could gather all of the hematite. A bearing ball released into the field toward the weakest zone was promptly arrested there, and it showed no tendency to enter the stronger ones, although the acceleration is naturally high. The explanation is found in the compliance of conditions with the rule stated above. The space between the zones is filled with lines of force of relatively great length, as they originate from between the polepieces *A*, *B*, *C* and A^1, B^1, C^1 respectively. Consequently their density must be extremely low.

In Fig. 4—a picture of iron-filings lines in the field shown by Fig. 3—it will be noticed that each zone is formed as perfectly as if it had no connection with any of the others, and each individual zone bulges in almost circular curves around its center. The length of interzonal lines of force can easily be traced and approximate deductions made as to their relative density.

CONSTRUCTION OF JOBKE MAGNETIC SEPARATOR

A drawing of a three-zone field designed for a full-sized working model of a separator is shown in Fig. 5. The distances between center lines of the zones are 3 in.

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[1] Magnetomotive force.

Each zone is dimensioned for the flux it is supposed to carry and for similar forms of zonal fields. This reduces the material required for the arrangement and also the space taken up by it. All three lower faces are 2 in. wide. While the two heaviest polepieces are bolted directly to the electromagnet, the other pairs are bolted immovably to them, and any vertical movement of the primary polepieces to secure a variation in the length of the air gap affects the other gaps equally; therefore a relative variation in the length of the air gap is not sought. Under all conditions the separating fields of the three zones have the same shape, and the most favorable form for the one zone is secured at the same time for the others.

The length of the polepieces for the different zones is varied to produce a certain ratio of strength, which in this case was determined as 1:5:10. A ratio as large as this one is unattainable in the arrangement of Fig. 1. Since this ratio of field strength is determined by the lengths of air spaces between successive poles and their vertical dimensions, which need not be changed if the maximum possible is provided for, a reduction can be made by reducing the reluctances in the different horizontal air gaps. This can be accomplished in the simplest manner by placing iron-bridging pieces, *D* in Fig. 5, across two or all zones, their section and permeability determining the reduction in reluctance. This method permits a regulation over the widest range, as either the thinnest sheet and wire or solid bars, filling the total air gap, can be employed. In this manner a wide range of usefulness is secured since the machine may be employed as a multizonal high-intensity separator, with extreme differences of strength, or as a concentrator of large capacity for strong and medium magnetic ores, since there can be several edges employed of slightly different strength to take off concentrates, or concentrates and middlings. The number of zones is not limited, provided the electromagnet is able to deliver the necessary flux.

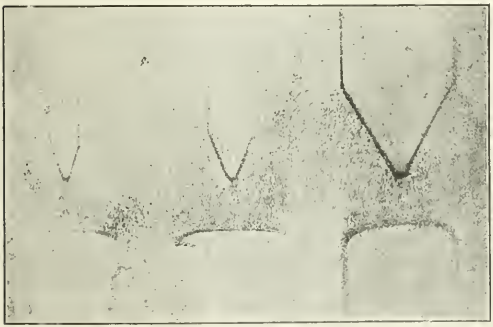

FIG. 6. LINES OF FLUX IN JOBKE MACHINE FIELD SHOWN BY IRON FILINGS

Fig. 6 shows the lines of iron filings made by the machine of Fig. 5, which demonstrates that even here, with an apparent irregular shape of poles, the flux forms very regularly and that the space between zones is filled with lines of force of low density. The separator provided with this field has a single system of electromagnets of high intensity and a continued width of conveyors of 6 ft., and is therefore a machine of high capacity.

In this connection there is a point to be discussed that heretofore has often been wrongly defined, and it appears that even authorities are apt to take an erroneous view of the matter—namely, that a certain length of time is supposed to be required to magnetize a permeable particle in a field. The only factor that could enter into consideration is the induction of eddy currents, if the particle is of sufficient size and of high conductivity. The conductivity of all ores, however, is too low to permit this factor to be considered.

Experiments with iron laminated so as to avoid eddy currents have disclosed that as high as 400,000 alternations per second is not the upper limit in the speed of magnetization, and the conclusion is that the time factor does not enter into the magnetization of materials. That ore overshoots the field in a magnetic separator finds its cause in inertia, which increases with the square of the velocity. While the ore travels on the belt toward the field, its velocity is that of the belt itself. On near approach to the field it is accelerated by magnetic attraction until it is in the center of the field, and only from here on is magnetic attraction enabled to retard and stop it. This is the reason that one can observe a particle shooting past the field for an appreciable distance, to be pulled backward in a curve toward the upper pole. The ore must be removed from the traveling belt before the influence of the pull can cease. For this reason also the multizonal field must conform to the second rule before stated, so that the next stronger zone cannot affect the particle before the previous one has pulled it back.

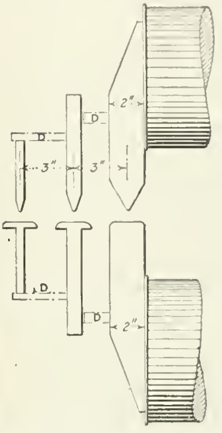

FIG. 5. JOBKE SEPARATOR THREE-ZONE MAGNETIC FIELD

Owing to the proximity of the zones to each other in the arrangement just described, the point may be raised that with a high speed of belt the time required for the ore to travel from zone to zone may be too short to secure a clean separation. Tests have proved that this is not the case and that a separation can be attained just as distinctly as in separate units.

This new form of field is not restricted to any particular type of magnetic separator, but lends itself to many different styles. Owing to its compactness (a pair of plate-shaped poles practically replace a complete magnetic system) it permits the raising of the capacity of the separator enormously. The machine has a pair of electromagnets of dimensions similar to those employed for a conveyor width of 1½ ft. The new apparatus promises to play an important part in the concentration of iron ores, where the lack of machine capacity has so far been an obstacle.

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Mineral Exports from French Indo-China in 1915, according to a consular report, were 98,532 metric tons gold and [illegible] ore; 297 tons tin and tungsten ore, 630 tons antimony [illegible] 33,335 tons zinc ore, 400,000 tons coal; 50,000 tons [illegible] 27,326 tons salt. One item of particular interest is the shipment during October-December, 1915, of 7,825 tons of [illegible] from Haifong to Baltimore and Galveston.

Flotation Tests on an Antimony Gold Ore*

By Earl R. Pilgrim†

The Sliscovich Mine is situated on Seward Peninsula about 20 mi. from Nome, Alaska, at an elevation of 1,100 ft. The lode is composed of quartz and stibnite. The ore assays from 18 to 40% antimony and from 0.1 to 0.2 oz. of gold. The gold is not evenly distributed throughout the ore, but appears in bunches inclosed in the quartz. The stibnite and quartz are so finely intermixed that coarse-concentration methods are impossible. Our problem in these tests was to determine the feasibility of separating the gold from the stibnite by flotation.

These tests were run on a Case experimental machine, mechanically agitated type; the ore was ground to pass a 60-mesh screen in all but the last series. The consistency of the charge for the machine was 6 H_2O to 1 ore. This was found to be the most satisfactory.

Assay of feed: Sb, 18.96%; Au, 0.13 oz.; Ag, 0.15 oz.

Screen test of feed: On 65-mesh, 4%; on 80-mesh, 9%; on 100-mesh, 26%; on 150-mesh, 25%; on 200-mesh, 25%; through 200-mesh 11%; total 100%.

TABLE 1. ACID VARIATION

No.	Variable %	% Concentration	% Sb in Conct.	% Sb in Tails	% Au in Conct.	% Extraction Au	% Extraction Sb	Remarks
1	0.0	50.0	13.9	11.0	50.0	50.0	42.0	Slight froth, excess gangue
2	0.2	39.0	34.0	8.6	6.0	94.0	67.3	Dirty gangue
3	0.3	52.5	30.0	6.6	19.6	80.4	83.0	Excess gangue, good froth
4	0.4	38.0	35.0	9.2	10.4	89.6	70.0	Good froth
5	0.6	31.5	40.0	9.3	00.0	100.0	66.3	Good clean froth
6	0.8	18.0	50.7	12.0	00.0	100.0	48.24	Slight froth

In the experiments shown in Table 1 0.15% pine-tar oil; time of agitation, 5 min.; speed of impeller, 1,550 r.p.m.; and temperature 9° C. were used. Pine-tar oil was used because of its ability both as a frothing and as a selecting agent. The low extraction of Au in the tails in No. 3 is due to the large percentage of concentration. The excess gangue carried the Au values into the concentrates.

TABLE 2. KIND OF OIL VARIATION

No.	Variable	% Concentration	% Sb in Conct.	% Sb in Tails	% Au in Conct.	% Extraction Au	% Extraction Sb	Remarks
7	Wood creosote	31.2	51.3	4.32	0.0	100.0	84.0	Tough bubbles
8	50% wood creosote 50% sludge acid	23.0	54.3	4.80	2.2	97.8	66.0	Thick froth
9	Tar oil	23.0	41.5	12.10	0.0	100.0	51.0	Small bubbles
10	Castor oil Tar oil Turpentine	40.7	32.0	9.87	27.0	73.0	69.0	Thick froth
11	Pine tar	30.0	38.6	10.50	24.6	75.4	61.2	
12	Sludge acid	19.5	...	...	...			Brittle froth
13	Eucalyptus oil	25.0	32.8	14.30	7.7	92.3	43.2	Thick froth
14	75% sludge acid 25% wood creosote	28.0	....					
15	Castor oil							
16	Stove oil							
17	Union Oil Co. No. 1							
18	Union Oil Co. No. 2							
19	50% stove oil 50% wood creosote							
20	50% Union Oil Co. No. 1 50% wood creosote							
21	50% Union Oil Co. No. 2 50% wood creosote							

In the tests shown in Table 2, oil, 0.2%; time of agitation, 10 min.; acid, 0.3%; speed of impeller, 1,700 r.p.m.; and temperature 11° C. were used. All tests from 14 to 22 gave such poor results that they were not considered. Results show wood creosote to be best suited for this ore.

TABLE 3. AMOUNTS OF OIL VARIATION

No.	Variable %	% Concentration	% Sb in Conct.	% Sb in Tails	% Au Value in Conct.	% Extraction Au	% Extraction Sb	Remarks
22	0.05	17.5	51.3	12.0	Trace	99.9+	47.5	Light froth
23	0.10	20.0	53.0	10.47	1.1	98.9	56.0	Light froth
24	0.20	31.2	51.0	4.32	1.1	98.9	84.0	Good thick froth
25	0.30	37.4	36.3	6.10	3.1	96.9	83.3	Good thick froth
26	0.1	8.0	.	.				Very light froth
27	0.2	19.3		.		...		Slight froth
28	0.05	25.0	..	14.3	...	......	.	Good froth but not carrying Sb
29	0.20	16.0						

In the tests of Table 3 wood creosote oil (22-25); sludge acid (26, 27); pine tar (28, 29); time of agitation, 10 min.; speed 1,700 r.p.m.; temperature 11° C.; and acid 3% were used. The tests using wood creosote were the only ones giving good results. The others were not assayed.

TABLE 4. IMPELLER SPEED VARIATION

No.	Variable (R.P.M.)	% Concentration	% Sb in Conct.	% Sb in Tails	% Au Value in Conct.	% Extraction Au	% Extraction Sb	Remarks
30	1,140	26.0	47.0	5.3	0.0	100	76.0	Thick froth, brittle
31	1,440	24.3	51.0	5.0	0.0	100	76.7	Bubbles
32	1,480	24.2	51.0	5.1	0.0	100	76.0	

In the series shown in Table 4 50% sludge acid and 50% creosote was used. Time of agitation, 12 min; 0.2% oil, and constant temperature of 12° C. It is rather interesting to note the apparent effect of varying the speed. It was decided that from 1,150 to 1,400 r.p.m., with a peripheral speed of from 950 to 1,320 ft. per min., was the best.

TABLE 5. EFFECT OF FINE GRINDING

No.	Variable (Mesh)	% Concentration	% Sb in Conct.	% Sb in Tails	% Au Value in Conct.	% Extraction Au	% Extraction Sb	Remarks
34	60	37.4	36.3	6.1	34.0	66.0	83.9	Good clean concentrates
35	100	38.0	38.6	2.5	1.0	99.0	90.5	Good clean concentrates
36	150	40.0	27.3	2.1	Trace	99.9+	92.4	Considerable gangue in froth
37	200	47.0	26.0	7.0	11.0	89.0	77.6	Considerable gangue in froth

In the tests shown in Table 5 the conditions were: 0.2% wood creosote oil; 0.3% acid; time of agitation, 15 min.; and constant temperature of 13° C.; and 150-mesh gives the best result. Other tests were run, varying the temperature, but the general effect of increasing the temperature was not noticeable.

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*Conducted at University of Washington College of Mines.

†217 Cedar St., Wallace, Idaho.

Celestite and Strontianite

Most of the strontium salts used in the United States are imported, the production in this country being small, according to University of Arizona Bulletin of Mineral Technology, Series No. 13. No production has been reported in this country since 1910. Deposits are known to occur in Arizona, and it is thought that they may be developed to some commercial importance.

There are two strontium minerals of commercial importance; namely, celestite, or strontium sulphate, and strontianite, or strontium carbonate. Of these, strontianite is the more valuable because it is more readily converted into salts desired for commercial purposes. Strontium is a metal, but does not usually occur as a metal in nature, nor is it commercially used in metallic form. Its salts, however, find various uses. The hydrate and the nitrate are the most important of these. Strontium hydrate is used principally in the recovery of sugar from beet molasses. The process is used in some localities, but the cost of the hydrate is too great for its use to become general. Strontium sucrate is more easily formed, and for that reason its use has been urged in sugar factories.

Strontium nitrate finds its chief use in pyrotechny, owing to its property of imparting a red color to the flame. In various other forms, as iodide, bromide, acetate, carbonate, phosphate and other salts, it is used as a medicine and in the chemical laboratory. The demand for strontium mineral is rather small and fluctuating.

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Electric Furnace in Norway Under War Conditions

One of the French periodicals that suspended publication at the outbreak of the war was the *Journal du Four Electrique et de l'Electrolyse*, which resumed in August, 1916. It calls attention to the fact that the war has given a great impetus to the use of the electric steel furnace and has witnessed the installation of a hundred or more of them, carrying the number in the world to above 300, whereas in 1913 there were hardly half that number. France has lost some that it already possessed, so that it cannot show an increase, but the United States is credited with constructing 50 last year and England with putting in 30 since the war began, while Germany, without new installations, produced 130,000 metric tons of electric steel in 1915 against 90,000 in 1914. Italy also is making additions. It may be presumed, although the writer does not so state, that the German increase comes in part from captured French furnaces.

A letter by M. Knudsen, from Christiania, is also published, reviewing the progress in Norway since the beginning of hostilities. The Norwegian works were overtaken by the war while executing contracts with belligerent powers, as a good part of the national production is for export. Some of these contracts were broken by force of circumstances, such as inability to get the raw materials, most of which are bought abroad. A crisis was feared, but a heavy war demand came in for such products as nitrates, carbide, cyanamide, ferroalloys and aluminum. The cost of materials and labor advanced and imposts increased, but high prices were realized. A long miners' strike turned into a general strike and lockout, which were ended by Parliament through compulsory arbitration. The banking and private reserves of the country are swollen to an unprecedented extent, for the war has enriched all interests that have to do with armament or shipping, even remotely. Some of the banks have even refused deposits, which has turned money to industrial openings, whereas formerly the capital for this purpose had all to be sought abroad. Industrial nationalism is in the air.

The Norsk Hydro has completed the installation of Rjukan II and increases its production of calcium nitrate and nitric acid. It is particularly interested in the manufacture of ammonium nitrate by combination of nitrogen products with the cyanamide furnished it by the Odda carbide works. The Nitrogen Products & Carbide Co., which owns these works and a majority of the stock of the Northwestern Cyanamide Co., by which the calcium carbide is manufactured into cyanamide, has installed a great industrial group at the foot of the Odda Fjord. Beside the carbide and cyanamide plants are erected factories for ammonium nitrate, nitric acid and perchlorate, which use over 70,000 hp. rented from the Tyssefaldene A. S. To complete this ensemble are the new Aura works, under construction.

Among new installations may be noted the increase of the aluminum plant of the Norsk Nitrid, at Eydehavn, near Arendal. The works have been doubled, and this same company is starting a new and very important aluminum factory at Tyssedal, in the Odda Fjord. In the line of ferros, the electrochemical works of Hafslund have considerably increased their production of ferrosilicon, as have also the Porsgrund works of the Motor company. Speaking of Hafslund, the Hafslund A. K. Co., which controls waterfalls and supplies power to the electrochemical works, has passed entirely under control of Norwegians, who have bought the stock (three-quarters of the capital) belonging to the German Schuckert firm.

The Kristianssand nickel refinery has increased its production; a new ferrochrome plant has been installed at Tyssedal by the Tyssefaldene concern. But the industries that are dependent on foreign minerals, such as special ferro, zinc, nickel, and aluminum ores, are far from sharing in the general prosperity, because raw materials are scarce and freights high. The group of the Elektrokemisk Industri has imparted activity to its affiliated concerns, the Arendal Smeltverk, which makes carborundum and ferrosilicon, and the Bjolvefossen, which is building an important carbide and cyanamide factory in the Hardanger Fjord.

A type of the new national enterprises is the Hoyangfaldene, or Norsk Aluminum Co., with exclusively Norwegian capital of 12,500,000 kr. ($3,350,000). This company has begun to utilize the waterfalls in the Sogne Fjord and to build an aluminum factory which will obtain raw materials from France.

Finally, there has been formed, with a small capital, the Florli A. S., which proposes to establish an electric steel works in Norway. This will be watched with interest, since steel is the only electric-furnace product consumed in the country.

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Japanese Copper Production

Copper production in Japan for the first seven months of 1916 increased 20% over that in the corresponding period of 1915. Increases in the rate of output of the individual mines is seen in the following table, in which the second column gives the entire production for 1915 and the third column the seven months' production of 1916:

JAPANESE COPPER MINES PRODUCTION

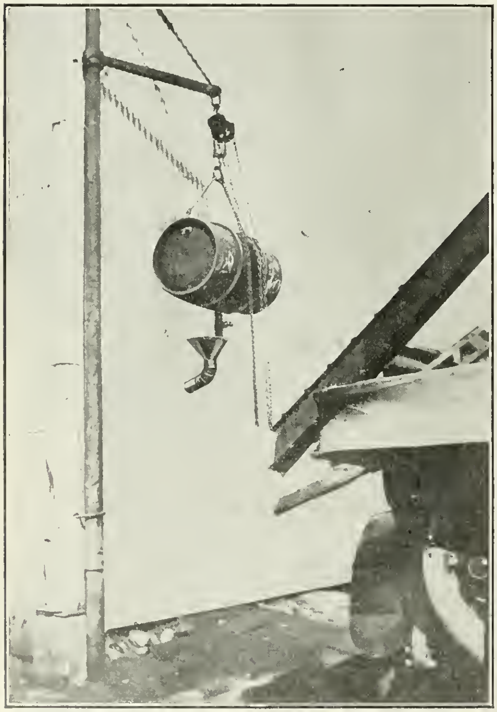
	1915 Metric Tons	January-June 1916 Metric Tons
Ashio mine	12,176	6,568
Hitachi mine	12,038	7,162
Kosaka mine	7,278	3,487
Beshi mine	7,886	4,593
Osaruzawa mine	1 913	1,213
Ikuno mine	2,401	1,350
Abeshiro mine	2,379	1,640
Okoya mine	1,658	1,039
Obiye mine	1,574	1,516
Ani mine	1,322	676
Kamaishi mine	1,417	799
Kunitomi mine	1 111	614
Yaguki mine	958	[illegible]
Hannaoka mine	670	[illegible]
Kidigazawa mine	565	444
Hibira mine	992	[illegible]
Arakawa mine	807	
Yusenji mine	819	[illegible]
Yoshioka mine	709	[illegible]
Okura mine	731	[illegible]
Nagamatsu mine	782	[illegible]
Oarasawa mine	771	[illegible]
Makimine mine	[illegible]	[illegible]

Details of Practical Mining

Method of Discharging Oil Barrel

By M. R. Percy

At the Sacramento Shaft power house of the Copper Queen, at Bisbee, Ariz., lubricating oil is discharged from the barrel to the storage tanks inside the house with the minimum of labor and trouble and the maximum of cleanliness and satisfaction. The accompanying illustration tells its own story. The barrel is hoisted by light chain block and small-pipe derrick after it has been tapped and a nipple and valve screwed in. The oil flows into a funnel, as shown, and thence to the oil reservoirs inside, from which the engineers' oilers are filled by means of the usual spigot. No time is wasted waiting for the barrel to be emptied and removed, because it is up out of the way and can be taken care of at any time, and nobody's disposition gets damaged handling the barrel and spilling oil over the engine room. The arrangement is a good illustration of the little conveniences that tend toward smooth working—things that help to avoid waste and conserve energy.



DISCHARGING AN OIL BARREL AT THE COPPER QUEEN

Automatic Car-Closing Device

By L. A. Rossman*

For the last year the Oliver Iron Mining Co. has had in operation an automatic car-closing device at its Trout Lake concentrating plant. The Trout Lake concentrator is the largest plant for the improvement of iron ore in the world. As high as 500 cars of crude ore are brought to the plant and dumped during a shift, so that the closing of the dump cars is quite a problem.

Dumping is not a hard task, but to close 500 cars a day is difficult work. All the ore is brought to the plant in 50-ton Sommers ore cars. The old way of closing was by means of a bar with which the sprocket wheel was turned. This method required four men, a great deal of strength and took considerable time. Besides this, the breaking of a bar, a common accident, often resulted in injuries to employees.

A DEVICE THAT CLOSES 500 CARS A DAY AUTOMATICALLY

For two years experiments were carried on to secure an automatic closing arrangement. The earliest machines were operated by compressed air, the first one being an air drill attached to a duplex hoist. In another effort which was made, an air hoist was procured, the drum taken off and a sprocket put on in its place. However, this was not successful because of the lack of continuous power. In the present machine the screw attached to the sprocket wheel, or spider, is operated by an electric motor. This machine has been eminently successful and works without a hitch. It is known as the Nicholls' Automatic Car Closing Device, named after its inventor, William Nicholls, superintendent at the concentrating plant. The machine is suspended from a 10-in. I-beam on trolleys so that it can move to all the cars. A box suspended close to the beam contains a magnetic control panel. The motor and the screw for the closing device are suspended on the same level with the sprocket on the car. The machine is geared down so that the screw is run at 11.5 r.p.m. It is fitted into the sprocket wheel as shown in the illustration. The power is turned on by a hand switch, and after the car is closed the machine is withdrawn. The whole operation of adjusting, closing and removing takes but eight or ten seconds.

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*Grand Rapids, Minn.

Two men are required to operate the machine. It has thus been a saving in labor and even a greater saving in time. Besides this, it has eliminated a work that was quite dangerous. It has shown its efficiency in actual operation and should find a reception at docks and in many other places where such a device is a necessity.

*

The Flume at Braden*

The water destined for the production of power is taken from two small rivers which, although of small volume, have a very steep course: they are called the Coya and Teniente respectively. The maximum water is received in the rivers in October, November, December, January and February. The average for this period in the Teniente is 243 gal. per sec., and 361.9 gal. for the Coya. June, July and August are the periods of minimum supply, 55.5 gal. and 60.7 being the quantities for the respective rivers.

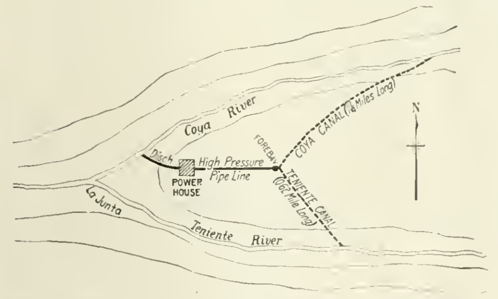

FIG. 1. GENERAL LAYOUT OF THE BRADEN HYDRAULIC SYSTEM

Fig. 1 shows the general arrangement of the flumes and pipe line. The diverting of the Coya water is effected by means of a small dry-stone wall 1 ft. 7 in. high, which is built across the bed of the river; this dam diverts the water to a wooden canal which, with a length of 1.24 mi., carries the water to the pressure chamber or forebay. The wooden canal rests on a ledge that skirts the base of the hills, and is covered in all its length to avoid the obstructions that might occur due to landslides, as the surface of the hill consists of loose earth and rock fragments. Subsequently the canal has been covered with the detritus in many parts without suffering harm.

The canal is 2 ft. 11 in. wide by 1 ft. 7 in. high. The casing is formed of 1-in. pine boards, 12 in. wide, reinforced every 3 ft. with a wooden framework. The covering is of loose 1-in. boards. The entrance to the canal is closed by a sluice gate behind which the canal is increased in width and depth. This portion acts as a settling chamber where, owing to the decrease in the velocity of the water, the sand and rocks carried along to this point are settled out at the bottom. From time to time four gates on the side near the bottom are opened, the accumulated material is discharged and the settling chamber cleaned. The velocity of the water in the canal is 1.25 ft. per sec.

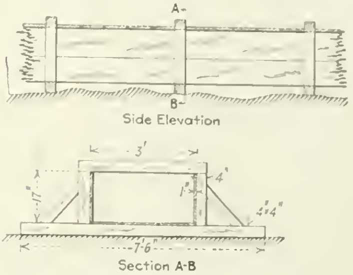

FIG. 2. DETAILS OF FLUME CONSTRUCTION

The diverting of the water in the Teniente River is accomplished in the same manner as in the Coya, except that the flume is 2 ft. 6 in. by 1 ft. 7 in. in section and 0.62 mi. long.

The two canals are united 33 ft. before entering the pressure chamber or forebay. Details of the flume are shown in Fig. 2, and of the forebay in Fig. 3. This consists of a wooden box, to the upper part of which the incoming canal is fixed. To the lower part and on the opposite side the pressure piping is bolted. This chamber has a lateral orifice fixed at the bottom through which any solid material that may collect in it can be withdrawn. The details of construction and dimensions may be seen in the figure. This chamber has a wooden covering. The piping that extends in a straight line has a length of 3,280 ft. and drops 885 ft. between the forebay and the power plant. The piping is composed of three equal sections. The first section is 2 ft. in diameter, the second 1 ft. 7 in. and the third 1 ft. 6 in. The pipes that form the line

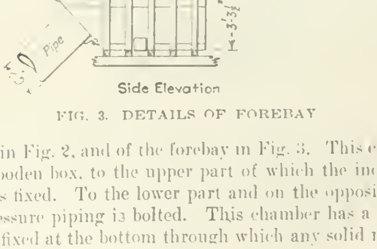

FIG. 3. DETAILS OF FOREBAY

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*Excerpts from "The Hydroelectric Installation of the Braden Copper Co., in 1909," in "Teniente Topics," June, 1916.

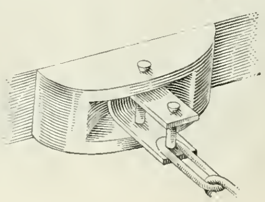
are each 23 ft. in length and are composed of five steel plates, riveted and having staggered longitudinal seams. The pipes are flanged and bolted together. The piping rests directly on the ground and in some places on wooden sleepers.

Properly speaking, there is no power house; the lower part of the piping branches into two parts of 12 in. in diameter, each one of which conducts water to a tangential waterwheel. A third branch leaves the main piping and operates a third waterwheel. The three waterwheels are alike, each being of the Pelton type and capable of developing 340 hp. at 930 ft. effective head. The Pelton wheel is 3 ft. 3 in. in diameter and carries on its periphery 32 bronze buckets; the nozzle, also of bronze, has a diameter of 2½ in. and is closed by means of a needle valve which may be moved directly by hand from the outside or by means of a ball-type governor that operates the needle through a suitable gearing. Two of these waterwheels supply the motive power for the concentrator, which has a daily capacity of 200 tons. The third wheel is directly coupled to a 3-phase 200-kw. generator.

⁂

A Handy Clevis

A device that has proved useful in mine haulage consists of a flat clevis that extends out from the locomotive bumper and saves the use of long coupling links, says R. Z. Virgin in *Coal Age,* Sept. 30, 1916. Often, when a locomotive goes in and out of the rooms over curves of short radius, the cars are derailed unless a long coupling is employed. The clevis shown is made of flat iron 4x½ in., with a 1-in. hole for the coupling pin. This clevis allows the link to swing sideways, and when carried on the locomotive permits a coupling to be made at either end of the car. It is especially useful where couplings are permanently fastened to one end.



A CLEVIS THAT REPLACES LONG COUPLING LINKS

⁂

A Convenient Backsight

In rough country where it was difficult to get about and where the field party was small, the following backsight was used successfully. An ordinary block pad of white paper was cut so that the paper was square—about 3 in. on a side. Near one corner a small hole was punched, while near the opposite diagonal corner a larger one was placed. A piece of paper from this pad, placed on a pointed stick stuck into the ground at the time the rodman was there permitted him to go ahead and left a permanent backsight. The diagonal corners of the paper formed an accurate sight.

⁂

Handy Metal Expansion Chart[*]

By W. F. Schaphorst[†]

The chart herewith shown is handy to use in finding the number of inches expansion in any metal from mild steel to bronze. All lengths of steam pipe or metal structure from 20 to 10,000 ft. are included in its range.

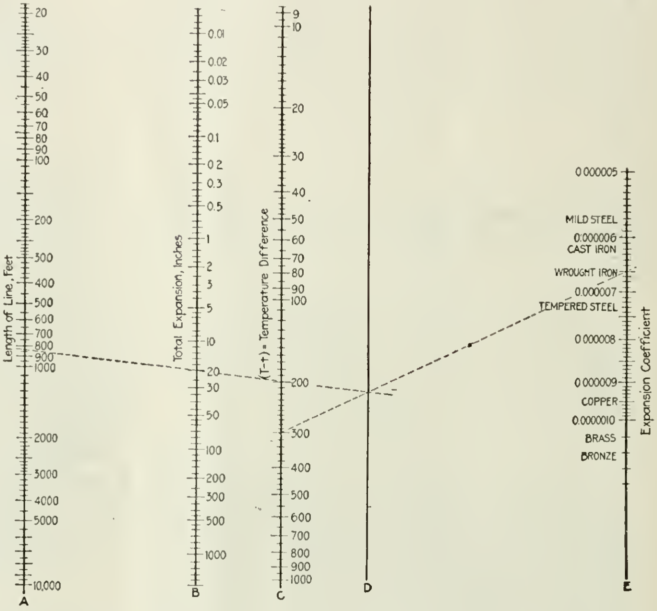


CHART FOR FINDING AMOUNT OF EXPANSION IN METAL

Example: How much will 850 ft. of wrought-iron steam pipe expand when the temperature variation is 300° F.? Connect the 300 (column C) with the coefficient of expansion of wrought iron (column E) and locate the intersection with column D. Then, from that point of intersection run over to 850 (column A) and the expansion is found to be 20 in. (column B).

The temperature variation ($T - t$) is found by subtracting the minimum temperature from the maximum. Thus a steam pipe at its coldest may be 40° F., and at its hottest it may be 440° F. The difference is therefore 440 — 40 = 400° F.

Thus all you have to do is to lay a straight-edge across the chart a couple of times and the total expansion in inches is determined without bothering with the decimal point.

It will be seen that this chart can be used for any material having a coefficient of expansion between 0.000005 and 0.000012. I have indicated the coefficients of the principal metals that fall between those limits.

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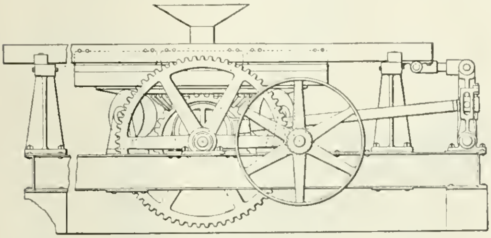
[*] Copyrighted, 1916, by W. F. Schaphorst.

[†] Mechanical engineer, Woolworth Building, New York City.

Details of Milling and Smelting

A New Type Grinding Mill

A grinding mill that is designed to reduce ductile metal in a flaky condition is covered by U. S. Patent No. 1,194,757, granted on Aug. 15, 1916, to Thomas J. Lovett, of Chicago. This grinding mill consists essentially of two horizontal plates, the lower one made to rotate and the upper one to reciprocate. Ore is fed through the upper one and is subjected to the motions of the two plates. The result is a torsional rubbing action which tends to roll up flaky metallic particles into pellets and thus effect their separation from the gangue. The under side of the lower plate is fitted with one member of a bevel gear, the other member of which revolves in a vertical plane. This is connected through shafting and gears to a pulley to which the power is supplied by a belt. An eccentric on the shaft connects through a toggle joint to the upper grinding member and thus imparts the reciprocating motion. The details of the mill are shown in the accompanying illustration.



THE LOVETT GRINDING MILL

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The Use of Flotation Oils

Some experiments on flotation oils have recently been made by C. Y. Clayton and C. E. Peterson, the results of which were published in the August *Bulletin* of the School of Mines and Metallurgy of the University of Missouri. A large number of oils were examined and the general conclusions arrived at are, first, that it seems that the oils that are miscible with water are the frothing oils, and theoretically, at least, the oils that will give the ephemeral, small-bubble froth will give the cleanest concentrates when compared with an oil that forms a thick, stiff froth, but the recovery may be greater in the second case. To get clean concentrates, therefore, it may be necessary to sacrifice recovery, and vice versa, when using only one oil. With more than one oil a new problem comes in. From the small amount of preliminary work done, it was found that when mixing two oils in varied amounts, the frothing and selecting properties of the mixer did not always lie between the values found for the separate oils, tending to show the possibility of the formation of a chemical compound rather than a simple physical mixture; or at any rate, this would show that the physical properties of each were considerably modified by the presence of the other.

After studying the various oil groups and the flotation results, it has been said that, in general, the various groups behave in a similar manner in flotation. Even though this fact is granted a careful study of the physical and chemical properties of the oils does not lead to a solution of the problem of what property or combination of properties of an oil give it flotation value.

A comparison of the data secured through experimentation brings out the fact that as a class the essential oils give the best flotation on the dolomitic lead ore used in the experiments. While coal-tar creosote gives the highest-grade concentrates, oil of cloves would give the highest extraction, as indicated by the number of grams of lead obtained in a 20-min. test.

⁂

Safety in Use of Oil Burners

Serious accidents to engineers and firemen are of frequent occurrence from the practice of improper methods of lighting and handling oil fires, and A. C. McHugh calls attention, in a recent issue of *Power*, to a few general rules which, if followed, will greatly lessen the danger of injury to those using oil fuel.

Oil burners may be broadly divided into two classes—those that use steam for atomization of the oil and those that do not. As the former are more generally used, the present remarks will be confined to steam atomizing burners. These are of two types—the inside-mixture type, in which the oil and steam come together inside the burner and are introduced to the furnace through one slot; and the outside-mixture type, by which the oil and steam are introduced separately. There is, however, very little difference in the method that should be employed in lighting or handling either type.

In starting a new fire the steam should be turned on and the bypass opened in order that the oil and steam passage may be cleaned out and warmed up. The bypass should then be closed and the steam shut off. Then the damper must be opened. This is one of the most important things to impress upon one's mind. Do not try to start a fire with the damper closed. Next light a torch or bunch of oily waste and place about 10 to 12 in. in front of the burner, turn on a small amount of steam (just enough to carry the oil from the burner tip to the torch) and crack the oil control valve a little. As it generally takes some little time for the oil to fill the burner passage, do not turn on more fuel but wait until the passage is filled, when the fire will light easily.

Until the furnace is thoroughly warmed up, the fire should be closely watched, as it is easily put out, especially if either the steam or oil contains much water. Should the fire go out and the oil still be left to flow, the heat of the furnace will generate volatile gases that will appear at the stack in the form of grayish-white smoke. Should a torch then be applied, a violent explosion would occur. Cases are on record where these gases have been ignited through the breechings of other boilers. The moment the fire is out, the oil should be shut off and the door opened. After a few minutes the gases will have passed off and the fire may be rekindled. When the furnace is hot, there is not so much danger, as the incandescent furnace will immediately relight the oil if its flow should be interrupted for a moment; but even then no chances should be taken, for it is in this way most men are burned. The fire goes out; the attendant opens the door and turns on more oil, expecting it to light immediately, which it generally does, to his sorrow. It is always cheaper to rekindle than to take a chance. In regulating a fire the attendant should hold the door open just enough to enable him to watch the flame and be in a position to duck his head in case of a flare back. To increase the fire the oil valve should be operated first, then the steam turned on until the flame is clear. If not enough steam is used, the flame will appear red and smoky: too much steam will cause the fire to look ragged and will have a tendency to extinguish it. In reducing the flame the steam is throttled down first, then the oil is reduced.

Once the fires have been set, they may be regulated over quite a range by increasing or decreasing the pressure applied to the oil supply without opening the firedoor or changing the steam supply. This can be done by manipulating the pump throttle or a bypass valve between the suction and discharge lines.

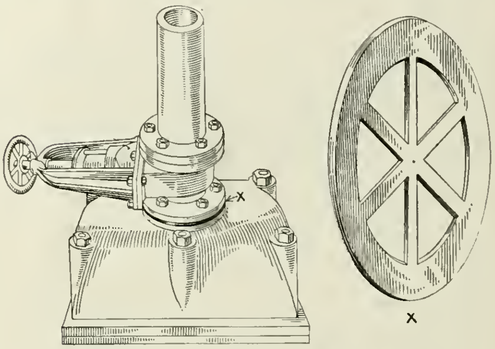
When extinguishing a fire, the flame should be cut down as low as possible; then by opening the bypass immediately after shutting the oil valve, the oil passage will be blown out without danger, as the flame will not be extinguished until the passage is clear.

Another point of great importance is that of air supply, or draft regulation. The importance of smokeless combustion is impressed upon the minds of nearly everyone. In fact, a smokeless stack is demanded of all oil-burning plants, but the truth is that a large percentage of these same smokeless plants are operating in utter disregard of fuel economy. One of the chief virtues of oil over coal as a fuel is the fact that on account of its volatile nature, it is more readily mixed with air, thus permitting the air supply to be reduced to a minimum. In properly designed furnaces but little more than the theoretical amount need be used; but in a great many plants little or no attention is paid to this, and as a result, the average oil furnace is more wasteful than the average coal furnace, because of the small resistance offered to the passage of air, there being no fuel bed to check its flow. Thus without close regulation large quantities of air are admitted to be heated and to flow blissfully from our pride, the smokeless stack. The proper method is to reduce the air supply until a faint haze is observed at the stack. This may at first seem difficult, especially with a large string of fires, but after a little practice an intelligent fireman will experience little difficulty even with a widely variable load.

In some plants the stack or breeching dampers are used entirely for air regulation, others use only the draft or ashpit doors, and still others, a combination of the two. From a safety point of view the writer prefers either of the two last-named, although it must be admitted that the pressure drop in the furnace due to the resistance at the entrance will stimulate air leaks through the settings to a greater extent than would be the case should the breeching damper be used. But on the other hand, the draft doors are generally more accessible and more likely to be used, and there is not so much likelihood of the dampers being entirely closed and the air supply shut off, for in this lies one of the greatest dangers. Should the breeching damper be closed while the fire is still on, the chances are that an explosion will occur, as the oil in the hot furnace will generate a large volume of volatile gas, which only awaits the admission of air to be ignited with disastrous results. To prevent the possibility of an occurrence of this sort, a safety stop should be placed so as to prevent the complete closing of the damper without removing the stop.

To Catch Loose Pump Valves

A strainer such as that shown in the accompanying illustration may be profitably used in the discharge line of a boiler-feed or other pump, says C. W. Watkin, in *Power*, Oct. 31, 1916. If any of the pump valves work loose, they are apt to get lodged in the pipe line or some of the valves. The best location for a strainer is next to the pump, but the one shown can be placed between flanges anywhere. It is made out of a sheet of brass or bronze cut to the diameter of the inside of the bolt circle and the web openings or perforations made of sufficient size not to obstruct the flow of water by decreasing the area of the pipe.



STRAINER IN FLANGE JOINT NEXT TO PUMP

Coarse-Crushing Systems

In the installation of coarse-crushing systems in the most modern of wet-treatment mills, a tendency may be noted to avoid the practice of returning oversize material to a crushing machine of any kind. One of the newest large mills deposits the coarse ore from the mine into a bin from which it is fed into large gyratory crushers. Thence the material is delivered to another bin, and from there passes over a grizzly, where the undersize goes to the mill bin and the oversize passes through a group of disk crushers, there being no return, only one pass through the machine being made. Any further crushing required is given in separate machines, no provision being made for returning oversize material to a machine through which it has already passed. This arrangement has the advantage of simplifying the route taken by the ore, although it may require the installation of more crushing machinery.

The Assayer and Chemist

The Analysis of Tin Ores

By Tony F. Golick*

The increasing importance of tin has rendered necessary a more rapid and accurate method for the analysis of tin ores than has heretofore been available. The principal methods in use are the fire assay with KCN and Low's iodometric method. Any fire-assay process is obviously subject to large losses, and cassiterite ores are not readily decomposed by Low's method. The present method, worked out through the assistance of Prof. V. H. Gottschalk and R. S. Dean, is based upon the titration of the sulphide with potassium iodate, as has been described by Mr. Dean for other sulphides.[1]

The ore, whether cassiterite or sulphide, is decomposed by fusion with potassium carbonate and sulphur (1 part S to 1 part K_2CO_3), which we found may be most conveinently done in a Jena Erlenmeyer. About 15 min. is usually sufficient for complete decomposition of the ore. The melt is then treated with warm water and filtered, the tin passing into the filtrate as potassium sulpho-stannate. This filtrate is then evaporated and taken to acid sulphate melt, also most conveniently made in an Erlenmeyer according to the directions given by Low.[2]

This fusion is taken up with 1 : 1 HCl and treated with H_2O_2 to insure complete oxidation of the tin to the stannic state. The tin is then precipitated at SnS_2 by H_2S. This precipitate is filtered and washed free of H_2S. The sulphide, together with the filter paper, is then placed in a known amount of standard iodate and hydrochloric acid added so that the solution is 30% by volume strong HCl (sp.gr. 1.2) measured at the end of titration. The titration is then finished with iodate if an excess has not been added, or if an excess has been added it is titrated back with standard iodide solution using CCl_4 or $CHCl_3$ as indicator in either case. Some of the results obtained by this method are shown in the following table:

RESULTS OF ANALYSES OF TIN ORES

Pure Sn	C.C. Used	0.05 Molar Iodate, Theoretical
0.1	16.8	16.82
0.1	16.8	16.82
0.1	16.85	16.82
0.1	16.8	16.82
0.1	16.7	16.82
0.1	16.9	16.82
Sn. ore fire assay, 7.92%; iodate............................		72.7 72.85

By this method the sulphide is oxidized entirely to sulphur according to the equation,

$$SnS_2 + KIO_3 + 6HCl =$$
$$SnCl_4 + S_2 + KCl + ICl + 3H_2O$$

which is found to be the most satisfactory, although by measuring the concentration of acid the sulphide may be oxidized partially to sulphuric acid. Accordingly, the acid present must be carefully regulated to the stated quantity. The iodate solution should be about 0.05 molar, and may be readily standardized by weighing, and is found to keep indefinitely. In the titration a bottle devised in this laboratory may be used to good advantage, a description of which will soon be published by O. D. Neal in the *Journal* of the American Chemical Society.

It seems possible that, according to Linden and Rector,[3] stannic sulphide might absorb H_2S and thus give high results, but our results have not shown this to be the case, and tests on other sulphides by Mr. Dean have shown that the amount absorbed is negligible.

While we have not made investigations over a sufficiently wide range to recommend the method for technical use, it seems possible that further work might find it capable of practical application. The method has the advantage of a permanent standard, and free access of air causes no difficulty since strange as it may seem, iodide solutions are perfectly stable in strong hydrochloric acid.

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*School of Mines and Metallurgy, Rolla, Mo.

[1] "Journ. Am. Chem. Soc.," 37, 1134 (1915).

[2] Low, A. H., "Technical Methods of Ore Analysis," Wiley & Sons.

[3] "Journ. Am. Chem. Soc.," 67, 63 (1895)

* * *

Pulp and Metallic Assays

By J. T. King*

In the *Journal* of Apr. 1, 1916, Donald M. Liddell gave a useful formula for the calculation of pulp and metallics problems in assaying. Those who have had many of these calculations to make will appreciate the importance and usefulness of such formulas. While assayer at the Temiskaming mine, at Cobalt, I had occasion to make daily a large number of assays on samples containing metallics. The ore at this mine was notorious for its metallics—almost half the samples contained them.

These samples weighed about 200 grams. After grinding, they were screened with a 100-mesh screen, the undersize being pulp and the oversize metallics. Any iron particles in the metallics were removed with a hand magnet. Two $\frac{1}{10}$ A.T. samples of pulp were scorified for each sample. The clean metallics were cupelled direct with sheet lead, while dirty metallics were first scorified. If the weight of the total metallics present was under $\frac{1}{20}$ A.T., all were assayed in one portion. When the weight was over this amount, one or more $\frac{1}{20}$ A.T. samples were assayed.

It was found expedient to have a formula for each case when all the metallics were run, and when samples were run. The derivation of the formulas used is given here in detail for the sake of clearness, though their significance seems apparent in the final forms.

Formula used when all the metallics are assayed:

Let

S = Weight of the sample expressed in grams;
P = Weight of the pulp expressed in grams;
M = Weight of the metallics expressed in grams;
p = Assay of the pulp expressed in milligrams per assay ton;

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*University of Toronto, Ont

m = Weight of the bead from all the metallics expressed in milligrams.

Now

$\frac{P}{29.16}$ = Weight of pulp in assay tons

$\frac{M}{29.16}$ = Weight of metallics in assay tons

$P + M = S$

$\frac{P + M}{29.16}$ = Weight of sample in assay tons

$\frac{Pp}{29.16}$ = Weight of values in pulp in milligrams

$\frac{Pp}{29.16} + m$ = Weight of values in sample in milligrams

Then

$\frac{Pp}{29.16} + m \div \frac{S}{29.16}$ = Weight of values in one assay ton of sample in milligrams

or

$Pp + 29.16m \div S$ = Ounces of values per ton avoirdupois

Formula used when the metallics are sampled:

Let

m = Weight of the values from the metallics per A.T. expressed in milligrams

$\frac{P}{S}$ = The ratio of the weight of the pulp to the weight of the sample;

$\frac{M}{S}$ = The ratio of the weight of the metallics to the weight of the sample;

Now

$\frac{Pp}{S}$ = Weight of the values per assay ton from the pulp in milligrams

$\frac{Mm}{S}$ = Weight of the values per assay ton from the metallics in milligrams

Then

$\frac{Pp}{S} + \frac{Mm}{S}$ = Weight of the values per assay ton from the sample in milligrams

or

$\frac{Pp + Mm}{S}$ = Ounces of value per ton avoirdupois

For using the first formula, take the assumed example:

Sample weighed, 100 grams.

Pulp weighed, 97 grams.

Pulp assayed 100 mg. per assay ton.

All the metallics gave a 1,000-mg. bead.

$$\frac{Pp + 29.16m}{S} = \frac{97 \times 100 + 29.16 \times 1{,}000}{100}$$

$$= 388.7 \textit{ oz. per ton}$$

Case 2:

$\frac{1}{20}$ A.T. of metallics gave a 486.1 mg. bead, or 9,722 mg. per A.T.

$$\frac{Pp + Mm}{S} = \frac{97 \times 100 + 3 \times 9{,}722}{100} = 388.7 \textit{ oz. per ton}$$

Beryllium Extraction from Gadolinite

A large-scale method for the extraction of beryllium from gadolinite is described by C. James and J. A. Perley in the *Journal* of the American Chemical Society, Vol. 38, p. 875 (abstr. *Journ.* Soc. Chem. Ind., May 31, 1916). The method is not suitable for the quantitative separation of beryllium from iron, but is rapid and gives a product completely soluble in sodium bicarbonate solution.

The finely powdered mineral is decomposed by heating with concentrated sulphuric acid, the sulphated product extracted with water, the solution precipitated with a hot solution of oxalic acid, allowed to stand for 12 hours, and the rare-earth oxalates filtered off and washed with boiling water. The filtrate is treated preferably as follows: The solution is oxidized, e.g., by potassium bromate, to remove the oxalic acid, and ammonia solution is added (about a liter for an initial charge of 75 kg.), followed by a solution of caustic soda until the odor of ammonia becomes apparent. The mixture is well boiled, and the hydroxides, separated by filtration, are stirred with sufficient hydrochloric or sulphuric acid to dissolve about two-thirds of the whole.

The acid extract, containing the beryllium and some iron, is heated to boiling, precipitated with caustic soda until a little of the filtered liquid gives a light-colored precipitate with ammonia, and the whole filtered. The filtrate is again heated to boiling, treated with a little sodium hypobromite, and precipitated with caustic soda until the liquid gives a white precipitate with ammonia. The mixture is filtered, sodium hydrogen sulphide is added to the filtrate to separate the last traces of iron (the precipitate and the preceding precipitate containing beryllium being worked up with a subsequent batch of material), and after boiling off hydrogen sulphide, the beryllium is at once precipitated by adding a concentrated solution of sodium carbonate and boiling the mixture thoroughly. The precipitated basic carbonate is filtered off and well washed with boiling water. If the filtrate from the rare-earth oxalates be very rich in beryllium, it may be oxidized and the boiling solution precipitated with caustic soda until nearly all the iron is removed, and then the last traces of iron removed by adding more caustic soda and sodium hydrogen sulphide, as already described.

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Hydrogen Can Be Generated Readily, according to O. Hutchins, of the Carborundum Co., by treating silicon with caustic soda.

$$2\,Si + 2\,NaOH + 3\,H_2O = 2\,Na_2O \,.\, 2\,SiO_2 + 4\,H_2.$$

To produce 1,000 cu.ft. of hydrogen at 0° C. and 76 cm. pressure theoretically requires 49 lb. of silicon and 62.2 lb. of NaOH. The recovery under ordinary conditions is actually about 90% of the theoretical.

⁂

Simple Tests for Phosphates are given by W. B. Hicks in "Mineral Resources of the United States," 1915, part 2. For field use the simplest and most satisfactory method is to moisten the fresh rock surface with a drop of nitric acid (sp.gr 1.2) and then place a small crystal of ammonium molybdate on the moist spot. Appreciable amounts of phosphates give a yellow color which spreads gradually through the crystal and over the rock surface. A more delicate test is to place a small quantity of powdered rock in a test-tube, add a few drops of nitric acid, warm over a flame and add an excess of ammonium molybdate solution. A rough estimate of the quantity of phosphate in the rock may be made by comparing the yellow precipitate with that produced by rock samples of known composition under similar treatment.

Company Reports

New Jersey Iron Mines in 1915, according to the report of the state geologist, produced 415,234 gross tons of iron ore; an increase of 65,099 tons, or 19%, over 1914. The ore marketed in 1915 was 391,115 tons, valued at $1,140,000. The stocks on hand at the close of the year were 178,284 tons. The total ore mined in New Jersey since 1870 has been 20,905,461 gross tons. In 1915 there were five important mines active in the state: Allen, Mount Hope and Richard in Morris County; Peters in Passaic County; Washington in Warren County.

*

The Right of Way Mines, Ltd., operating at Cobalt, Ont., reports for the year ended Dec. 31, 1915, that net receipts from ores mined were $12,253, and from interest $527, from which general expenses and depreciation of $8,334 were paid. The balance from operations plus previous balance leaves net of $13,189 on hand at the close of the year. Shipments during the year amounted to 102,274 oz. with 11,263 oz. estimated on hand on Dec. 31, 1915, the total having a gross value of $56,836, from which direct operating expenses of $44,583 were paid. High-grade orebodies seem to be exhausted, but there appears to be some hope of making a showing through the low-grade bodies at No. 2 shaft. A dividend of ½%, or $8,428, was paid Mar. 15, 1916.

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Pittsburgh Steel Co.'s report for the year ended June 30, 1916, shows strikingly the prosperity that has come upon the American steel industry. The gross sales for the fiscal year were $21,848,036 as compared with $11,649,864 for the previous year. The net profits for the period were $4,564,067, after allowing $500,000 for depreciation compared with $858,160 in the year previous. Shipments amounted to 618,761 tons at an average price of $35.39 per ton as compared with 333,773 tons at $34.90 per ton in the year previous.

Total sales were $21,848,036. The manufacturing cost, including maintenance and repairs of $800,841, was $15,608,866, in addition to which provision for depreciation of $500,000 was made, leaving a gross operating profit of $5,739,169. Selling and administration expense was $1,194,260; other income, $19,158, making net profit to surplus of $4,564,067. The company decreased its capital obligations during the year by redeeming $3,000,000 of its own and $25,000 of its subsidiaries' notes and paid off a purchase money mortgage of $21,283. In addition it paid off all accrued dividends on its preferred stock and paid 4% on its common. Capital obligations are now $10,000,000 of preferred, $7,000,000 of common and $2,384,000 of funded debt, of which $1,009,000 has been called.

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Colorado Fuel and Iron Co.—This company is the largest iron- and steel-making concern west of the Missouri River. It owns extensive estates and operates coal and iron mines in Colorado, Wyoming, Utah and New Mexico, and large iron and steel works at Pueblo in Colorado. The fixed liabilities are $36,235,500 common stock, $2,000,000 preferred stock, $45,005,000 funded debt. Current liabilities as of June 30, 1916, were $2,574,563; surplus balance of profit and loss, $4,922,127. As compared with the previous year, there were increases of $9,048,566 in earnings, of $6,467,538 in expenses and of $2,581,028 in net earnings. The report for the year ended June 30 gives production for two years past as follows, in net tons:

	1914-15	1915-16	Changes
Coal mined	2,329,069	3,241,505	I. 912,436
Coke made	520,261	702,061	I. 181,800
Iron ore mined	441,026	709,601	I. 268,575
Limestone	344,033	369,513	I. 25,480
Pig iron made	286,661	339,968	I. 53,307
Finished iron and steel	324,600	454,220	I. 129,620

Of the coal mined last year, 1,206,028 tons was sold; 761,506 tons used at the company's plants; 1,273,971 tons used in making coke, this being 1.81 tons coal per ton of coke.

Two increases, each of 10%, were made in the wages of the iron and steel workers, and one of 5% in wages of miners. The report goes at some length into the adjustment made of difficulties with the employees and the results so far attained. Regarding plant improvements the report says: "The improvement in the business and earnings has made possible a program of new construction and additions to equipment, essential to the most profitable operation of the business. A byproduct coke plant of 120 ovens is to be built at the Minnequa steel works, and other additions and improvements at various points have been authorized during the year. The estimated cost of these authorizations, all of which are chargeable to capital account, is $3,300,000 . . . When the annual report of a year ago was written, the prospect of steel business with railroads, as well as with other trade, was not encouraging. However, the buying demand which commenced in the East about the middle of 1915 reached us in October, and during the last eight months of the fiscal year under review the mills producing wire and nails, merchant bars and other of the smaller products operated double turn, while the rail-mill production was close to its capacity. . . . Heavy rails represent more than 50% of the output of the steel plant, and as wage advances added materially to their cost, with no increase in the selling price, the average earnings per ton on all steel sold were not such as might have been anticipated in view of the high prices prevailing for certain steel products. In normal times the steel plant is dependent primarily upon railroad business, and it is the view of the management that every effort should be made to take care of the requirements of regular railroad customers during the period of abnormal demand in other lines. . . . The orders for steel already booked for forward delivery and the reasonable expectation of business from regular customers insure practically full operation of all mills up to July 1, 1917. Some orders for heavy rails have already been booked for delivery in the last half of 1917."

*

Seoul Mining Co., Holkol, Chosen, in its report for 1915 shows a total ore reserve of 1,221,331 tons, having a gross value of $13,460,210, as compared with 1,206,133 tons having a value of $15,914,375 in 1914. The ore is complex, containing gold and copper, and it is noteworthy that in the present estimate copper is calculated at only 15c. per lb. The usual dividend of 50% on the capital stock was paid during the year. The Suan mine has a total ore reserve of 114,616 tons, containing $9.20 in gold, 1.15% copper and 1.7 lb. of bismuth, or a total value of $13.67 per ton. In this estimate copper is calculated at 15c. per lb., and bismuth at 60c. The mill treated 83,560 tons of ore during the year, after discarding 6,257 tons as waste. The actual running time of the mill was 332 days of 18½ hours, or 91.16% of the possible time. The stamp duty per day was increased from 5.5 tons to 6.28. The flotation process installed during the previous year yielded excellent results, increasing the copper extraction from 56.24% to 75.35%, and a combined copper and gold recovery of 85.43% was obtained, as compared with 80.04% for 1914. The total yield from the mill was $899,443. At the Tul Mi Chung mine the total ore reserve is 1,099,715 tons, containing $6.57 in gold, 1.49% in copper, and 0.5 oz. of silver per ton. Early in 1915 a change from steam to electric-motor power was effected at the Suan mine and mill, and the plant is now working satisfactorily, reducing power to $73.13 per hp.-yr. as compared with $110 when steam power was used. The operating cost per ton is shown in the table.

OPERATING COST OF THE SEOUL MINING CO.

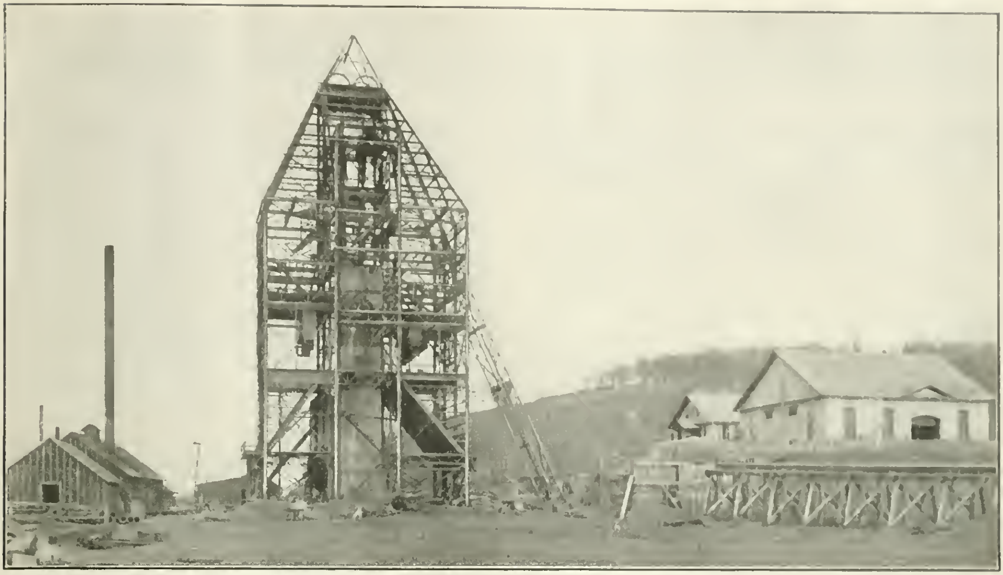
Mining	$1.17
Starting and transporting ore to mill	.06
Milling	.90
Concentrating	1.05
Office expenses	.19
Agencies	.10
General expenses	.09
Insurance	.02
Freight and transportation	.02
Messengers and police	.03
Livestock	.02
Surveying	.02
Traveling expenses	.04
Cables and telegrams	.04
Bullion expenses	.02
Pesident's and secretary's offices	.10
Legal	.01
Hospital	.06
Total	$3.94

The average receipts per ton from all ores were $9.05, the operating cost $3.94, and the profit per ton $5.11. Operations are continuing, ore reserves are being increased, and an active prospecting campaign is in progress under the direction of Mr. B. V. Barton, who has the title of chief engineer of the prospecting department. The sum of $44,763 was spent during the year on this item, and a total of 6,253 ft. of work was done at the various prospects. Development warrants the recommendation that the milling capacity of the Tul Mi Chung mill be doubled, so that it will treat 700 tons daily with the necessary addition of 1,000 kw. to the power-plant capacity.

Photographs from the Field

WORKINGS IN OLD PART OF THE LÖKKEN MINE OF THE ORKLA MINING CO., AT LEAST 250 YEARS OLD

OFFICE AND STAFF RESIDENCE OF THE ORKLA MINING CO., 16 MILES FROM THAMSHAVN, NORWAY



HEADFRAME AT THE HOLMES MINE OF THE CLEVELAND-CLIFFS IRON CO., ISHPEMING, MICH.

The headframe is 150 ft. high over all, and is the highest on the Marquette Range. It will have three crushers in it and is designed to crush and handle both hard and soft ore, making five grades. The concrete pier shown near the center will be 77 ft. high and will carry the No. 8 gyratory crusher. Two No. 6 crushers will be supported by the steel-work. The head-frame will be enclosed on the working floors. The shaft has four compartments, and will be equipped with two skips and a cage.

A KEYSTONE DRILL PROSPECTING IN CALIFORNIA

EMPTYING THE SLUDGE FROM THE B[illegible]

Correspondence and Discussion

High Titanium Products From Ilmenite

In the *Journal* of Feb. 19, 1916, which came into my hands only a few days ago, I have found, on p. 357 in the little article, "High Titanium Products from Ilmenite," obviously erroneous data which I take liberty to correct. In the citation from U. S. Pat. No. 1,156,220 it is said: ". . . This mass is still further heated to about 600° C., during which heating the titanium is decomposed, the iron sulphate remaining unchanged . . . The iron sulphate is then leached with water, . . . "

The temperature of decomposition of iron sulphates I know very well from experience, having made in 1906 to 1909 careful studies on the roasting of mixed iron and copper pyrites in a plant in the South Tyrol. The temperatures were controlled with a thermoelectric pyrometer with autographic record. The chief results of my studies—as far as the question here is concerned—are as follows: (1) Iron sulphate if heated to a temperature of from 480 to 500° C.—with or without the admission of air does not matter—readily changes into a basic sulphate, which is insoluble in water; (2) at a temperature of 560° C. the basic iron sulphate by persistent heating yields ferric oxide, a compound which is not only absolutely insoluble in water, but even resists diluted acids. See my publication, "Die Betriebe der Kupfererzbergau-Gewerkschaft Oss-Mazzurana in Predazzo," in *Metallurgie,* 1909, VI, Nos. 18 and 19. See also, H. O. Hofman, "General Metallurgy," 1913, p. 99, Table 53, and the thorough researches of Dr. Felix Warlimont on the temperatures of decomposition of the sulphates of Fe, Cu, Ni, Co (*Metallurgie*, 1909, VI, p. 130).

Concerning titanium sulphate and the temperature of its decomposition, I have no personal knowledge and have no literature at hand to get exact information. But what I believe I know is that: (1) It is extremely difficult to bring mineralized TiO_2—regardless of the mineral in which it be present—into solution with acids, and that (2) there is known only one basic sulphate of titanium (TiO, SO_4) which is already easily decomposed with water in the heat. So it does not seem necessary to perform the decomposition by heating to 600° C.

Robert Hesse.

Tsumeb, Southwest Africa, July 30, 1916.

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Chilled Conveyor Idlers

The Nevada Consolidated works, of McGill, Nev., evidently have no faith in ordinary idlers. This is shown by the article on page 646 in the *Journal* of Oct. 7.

The Nevada people say that the surface of their idlers is wearing. It is true that they will wear if the bearings bind and let the belt slide along. In that case chilled-surface idlers are fine. But is this the object of idlers? Aren't they used to eliminate sliding friction? Aren't they supposed to roll all the time and carry the belt along without excessive wear?

The correct way to get efficient results is to investigate the bearings of the idlers. If the plain bearing will not give results, try the anti-friction bearing. The truth of the anti-friction bearing proposition has been accepted by 75% of the industries. It is no longer considered an experiment. Why shouldn't conveyor idlers be equipped with good anti-friction bearings? Give the idlers a chance to roll and they will do more than is expected of them.

Walter R. Bylund.

Chicago, Oct. 26, 1916.

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Revision of the Mining Law

On the subject of mining-law revision, while I am by no means in favor of "patchwork," let us for the sake of lucidity first consider the things which could be instituted without abandoning the apex control or the prediscovery requirement and without interfering with the "phraseology" or "the wealth of legal definitions that have been rendered."

Of these the most important, undoubtedly, is a requirement that annual assessment work be recorded in the form of strict affidavits, with details and penalties. This would do away with about all the extensive fraud in this line which heretofore has been imposed on the public. And it would completely do away with the blackmailing practice of resurrecting dead claims after someone else has proved the ground valuable.

The matter of allowing cash paid instead of annual expenditure I regard as unimportant, but not objectionable if the cash amount be made somewhat larger than the work expenditure. Another desirable change is the provision for court review of Land Office decisions. The incompetency of Land Office officials to decide many questions presented to them is well known to all who have much business in that department.

Another change which (strangely, it seems to me) has not been brought out in any of the discussions is the injustice of requiring the same annual assessment and the same patenting prerequisite expenditure on a fractional claim as on one of full area. The present law requiring $100 expenditure on a claim makes $5 per acre for the full claim allowed by the Government, but permits of no reduction where the state law reduces the width of claims. In Colorado for 40 years claimants had to pay $10 per acre and in four of the counties $20 per acre. That is not just. But further, there is a positive advantage in an assessment according to the area of the claim; instead of enticing a locator to grab all the ground possible because it comes at the same price, let us rather encourage him to stake only what he seriously wants, cutting down his claim in either length or width in order to save on his annual assessment, thus leaving open more ground which may be explored by others. And furthermore, this tends to reduce conflicts, with their attendant litigation.

The same injustice applies to the required expenditure of $500 for patent work. The man who needs to take up a small fraction for protection should not be taxed such an enormous expenditure if he wishes to patent the same. Hundreds of claims have been patented with less than one-tenth of an acre, making the cost from $5,000 to $10,000 per acre. Of course both annual assessment and patent expenditure should have a healthy minimum; for annual assessment, say $5 per acre with a minimum of $25 a claim. The annual expenditure for a group at one point should be allowed; this is only meeting a natural physical condition. But it should be required that the work so done be in such position as to benefit each location, otherwise it should not be accepted. Applying an excess of expenditure to future years should not be allowed. I regard this as decidedly objectionable and almost without a redeeming feature. I fail to understand why so many advocate it. The proposition made by one writer to allow this for one year is not particularly objectionable.

Recording at the Land Office I regard as worse than useless. First, with anything like their present equipment, such a record is practically impossible unless all claims are taken by the sectional subdivisions, and even then such a record would be useless without also requiring the record of the annual expenditure. If any such record should be required it should follow, not precede, the record with the county recorder.

In regard to notices, monumenting, recording and patenting, our present law is fairly satisfactory, but much more stringent requirements as to number, size and marking of monuments would be an improvement. I think 60 days instead of 90 should be the time limit for recording. When the present law was made, there were no such means of communication as at present; and we should rather discourage the early "stake" man who tries to hold ground as long as possible without doing work.

The 33 questions do not bring out the subject of separating surface and mineral titles, which I regard as about the most important question involved, though A, C, D and E mention it in the *Journal* of Oct. 14, 1916. As aptly remarked by D, "If you divorce surface and mineral rights, you get rid of the town-site locator, timber grabber, etc." And if this can be accomplished, it goes far to dispose of the troubles encountered under other heads such as classification and discovery. Classification I regard as impractical in any event, and it is useless if surface and mineral titles are divorced.

The discussion on the size and shape of mining claims with reference to a law confining mineral titles to vertical boundaries discloses a wide variance in ideas. The 40-acre claim seems to me to be the most seriously detrimental proposition that has been advanced. The 40-acre advocates apparently have had their recent experience about the iron mines and low-grade coppers where such a claim would be satisfactory; but for high-angle precious-metal veins such a claim is entirely out of place. Among narrow, precipitous mountain cañons and ridges a quarter of a mile is a long, long way. Most discoverers would never go to see the far sides of their claim after once staking it. Remember that, in precious-metal veins, a mine—that is to say, an oreshoot—is on the average less than 500 ft. in horizontal extent. No, the 20-acre claim now allowed is too large to serve the best interests of the public—the *development* of the mineral resources. For forty years Colorado has had 10-acre mining claims and in four counties 5-acre claims; yet Colorado is recognized as the best-developed mineral state, and I have often heard the complaint from other states that development capital could be obtained here when, for the same showing, it could not be had elsewhere. The large mineral claim withdraws from the public, in the aggregate, immense areas which often the locator does not need and does not really want. Under other conditions someone else might explore portions of these areas and find other veins. Remember that our law should be to promote the development of the mineral resources. The claim holder will look out for himself in dangerous situations. Since different districts naturally call for different-sized claims the only logical solution, it seems to me, is the small claim with the option of doing the work in one place for a group. This will protect the public and should satisfy the condition where a large area is required for economical operation (assessment work should be per acre anyway, not per claim). With D I like the hectare, and no one who has mined in Mexico seems to find fault with that claim unit. However, as a reasonable compromise, I strongly favor the 10-acre claim. Then there should be no limit to the number of locations allowed. Such abuse as this provision has provoked can be remedied by rigid requirements regarding notices and improvements.

As to the shape of claims, originally I favored strongly the 10-acre subdivision of sections because it is the only scheme which positively avoids conflicts. But the conditions brought out by E and F. S. Ross (*Journal*, Oct. 21, 1916)—and I know them to be only too true—have converted me from this plan. Now, having abandoned the regular subdivisions, I fail to see any substantial reason for adhering to the square form or even to right angles. J. Parke Channing (*Journal*, Oct. 21, 1916) shows the impracticability of this plan. Cardinal-point boundaries will only slightly help the looks of a mining-camp map, right angles will not help it at all, and both bring other difficulties. What is more to the point, both tend to promote the covering of ground that is not really wanted by the claimant and thus withdraws from the public ground that might be explored by others. Therefore my conclusion is that there should be no halfway provision in the shape of claims. Let us have the regular land-survey subdivisions, or let the locator choose his ten acres in any shape desired, with of course some maximum length, say 1,320 ft. It would seem to be well to allow the locator the choice of the two methods; then, where the section corners are readily found and the shape fairly satisfactory, he can have the advantage of patenting without the expense of a separate mineral survey.

The number of claims that may be located by one individual should not be limited. A limiting number may seem desirable in some localities, but is decidedly objectionable in others. I agree exactly with D.

I believe that discovery should not be required, certainly not until patent application. Separating surface and mineral titles goes a long way to dispose of the possible abuse of this privilege. The remarks of C, D and F (*Journal*, Oct. 14, 1916, pp. 721-2) are to the point.

I am emphatically against requiring a patent in seven years or any set time; a worse than useless requirement.

Denver, Colo., Oct. 27, 1916. Victor G. Hills.

Central States Silver, Copper, Lead and Zinc in 1915

According to the special chapter or Mines Report, prepared by J. P. Dunlop and B. S. Butler, for the "Mineral Resources of the United States, 1915," the production of silver in the Central States in 1915 was 647,553 fine ounces. At the average price of 50.7c. per fine ounce, the value was $328,309, as compared with $267,089 in 1914, when the average price was 4.6c. higher. Michigan produced 585,933 oz. (90.48% of the total) as a byproduct from copper ores. The desilverization of about 23% of the concentrates from southeastern Missouri lead ores and a small output from copper ores gave a recovery of 57,756 oz. (8.92% of the total) from Missouri. The fluorspar deposits of Kentucky and Illinois yield lead-zinc ore as a byproduct, and from the lead concentrates from Illinois 3,864 oz. of silver was recovered.

In 1915 Michigan produced 265,283,378 lb. of copper, valued at $46,424,591, as compared with 164,344,058 lb., valued at $21,857,759, in 1914. Missouri produced 402,160 lb., valued at $70,378, derived mainly from concentrates from southeastern Missouri lead ores, but partly from matte shipped from the smeltery of the Missouri Copper Mountain Mining Co. The total copper production from Michigan and Missouri was 101,286,717 lb. more than in 1914 and 31,550,000 lb. more than for any one year since 1907.

The mine production of lead in the Central States in 1915 was 222,548 short tons, valued at $20,919,512, as compared with 203,845 short tons, valued at $15,899,910, in 1914. Missouri produced 95% of the yield, and the recoverable lead content of concentrates mined in Missouri in 1915 was 41% of the refined primary lead recovered in the United States from domestic ore. Oklahoma production decreased from 7,556 tons in 1914 to 7,306 tons in 1915, the output being double that of Wisconsin and Kansas. The output from Illinois, Wisconsin and Kentucky was greater than in 1915 and that from Kansas about 200 tons less.

The zinc output in 1915 from mines in the Central States is the largest recorded. The total, based on mine returns with deduction for separating and smelting losses, was 215,889 short tons, valued at $53,540,472 when computed at the average reported sales price. Missouri was the largest producer in the United States, with 136,300 tons, as against 105,994 tons in 1914.

The feverish activity in mining in some of the Central States is typified by the conditions in northern Arkansas, which made necessary the rapid construction of a narrow-gage railway from Rush to Yellville.

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Hydro-Electric Plant Operation in Frigid Climates

In an article by Dr. Henry M. Payne in the *Sibley Journal of Engineering*, September, 1916, some interesting notes on the mining and handling of arctic frozen gravel are given. A particularly interesting point is the hydro-electric plant, situated 25 mi. distant from the treatment plant, in the North Fork of the Klondike River. Power is generated by two 3,000-kv.-a Westinghouse generators, driven by two 5,000-hp. Morris reactionary turbines, and the current is stepped up in water-cooled transformers from 22,000 to 33,000 volts for transmission. The plant is operated throughout the winter, during which the temperature is constantly below —50° F. and on some days below —60° F., by allowing the ditch to fill and freeze sufficiently to form a bridge at any point. The water is then dropped about a foot and maintained at that level. The intake pipe, 6 ft. 6 in. in diameter, is buried under 4 ft. 6 in. of gravel. Above this is an air space of 1 ft. 6 in., then a roof of poles, and a layer of 1 ft. of moss and 1 ft. of gravel respectively.

At intervals, along with this, transformers step the current down to 110 volts, and it is then passed through resistance coils of No. 8 iron telephone wires, which lie in the bottom of the ditch. These resistance coils serve as heaters and prevent a too great drop in the temperature.

The water current is 2 mi. per hr., and in a long-continued temperature averaging from —40° to —50° F., the system is said to give absolutely no trouble.

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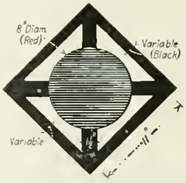
Detroit Mine Safety Meet

By R. Dawson Hall

The National Safety Council held its annual meeting at the Hotel Statler, Detroit, Mich., Oct. 17 to 20; 2,500 persons were present. The American Mine Safety Association has recently been affiliated with the Safety Council and incorporated as the Mining Section. About 100 persons interested in the work of accident prevention in mines were present. They came from some distance, as Detroit is not in a mining district and does not furnish, therefore, any particular local attraction for mining men.

The new chairman of the Mining Section is B. F. Tillson, of the New Jersey Zinc Co. Mr. Tillson served as vice-president during the past year. The third vice-president is William Connibear, safety inspector, of Pickands, Mather & Co. The other two vice-presidents, H. G. Davis and W. A. Luce, are representatives of the coal industry. The secretary of the section is Edward Steidle. H. M. Wolflin, now in California and likely to be domiciled there for some time, is not well enough to accept duties additional to those pertaining to his official position, so it was thought better to secure someone who could maintain the relation between the council and the United States Bureau of Mines and who would be able to give the organization the most active assistance.



UNIVERSAL DANGER SIGNAL

The council adopted in its general session a "Universal Danger Signal," which is illustrated herewith. The intention is to use this symbol much as the red cross is used and to copyright it so that it cannot be put to any purpose other than to declare the presence of danger. It is not the intention that it shall be surcharged with any letters or warnings. These should be printed below. The signal looms up satisfactorily in the semidarkness, the red appearing as black and the white clearly showing its diamond form. This signal was shown in connection with several others in light of varying intensity and, it seemed, was unanimously preferred.

At the session held Wednesday, Oct. 18, addresses were read by Albert H. Fay on "Accident Statistics," by D. J. Parker and Edward Steidle on "Mine Safety Signs and Signals," and by H. M. Wilson on "Workmen's Compensation and Its Effect on Safety in Mining."

Albert H. Fay said that the fatalities in metal mines, when put on a 300-day working basis, were less numerous per thousand employees than those in coal mines based on the same number of days' run. It was intimated that the showing would be still more favorable to the safety of metal mines if the actual time worked by the miners were considered in the comparison, as many of the coal miners worked far less than eight hours. But it was urged that it would probably be impossible to secure figures showing how long a period the coal miner actually works.

F. W. Sperr, professor of mining engineering at Michigan College of Mines, Houghton, Mich., declared that the main need in mining was to correlate accidents with the methods of mining in which they occurred, so that the relative dangers of the many different systems adopted might be compared.

On the evening of Wednesday the members of the Mining Section held a dinner-smoker in the rooms of the Board of Commerce. T. T. Read, now of the New Jersey Zinc Co., delivered an address on China. He said that Japan, the coal deposits of which are inferior and which needs iron most sorely for its industries, has secured a hold in China on the best deposits of both and has gained large quantities of these needed minerals in Chosen. It seems likely that no further demands on China will be made. This assumption, of course, is based on the idea that the aims of the Japanese are industrial and not imperialistic.

The wage of the common laborer in China, Mr. Read said, is 8c. per day. Given this rate of pay as a postulate, the Chinese are doing everything in the most economical way. At such a low wage earth could be moved in baskets in successful competition with the best steam-shovel practice. When Chinese capitalists feel that their possessions are secure from revolution and political graft, they will begin to invest their hoards of unutilized capital and will build up the industries of the nation. This will not necessarily cause the "yellow peril" to flood the United States with cheap products. When China becomes industrial and ceases to be wholly agricultural, as at present, the increased activity will raise wages and automatically dam the flood that otherwise would sweep the United States. In that day the labor of China will be cheap no longer.

In the second session O. P. Hood delivered a paper on "Safety in Hoisting and Slope Haulage"—a paper that was considered one of the best presented. A discussion followed on the use of flat and round ropes. B. F. Tillson, the chairman, stated that the sewing of flat ropes could be done only by men with experience, and such men could not be kept at small plants or even at large isolated mining camps. Professor Sperr explained that the advantage of the flat rope was found in places with scanty headroom where the fleet of the rope on the drum would exceed 1 in 100. O. P. Hood said that the breaking of the stitching that binds the flat ropes together serves as a sort of safety signal, showing that an excessive strain is being brought on the rope units thus connected.

Another important paper was one by C. E. Pettibone on the "Testing of Rescue Apparatus." Mr. Pettibone urged that it was impossible by the ordinary tests to ascertain if the breathing apparatus was tight. It was not advisable to plunge the respiratory equipment in water, because damage to the apparatus would result. Mr. Pettibone's method was to raise the pressure in the breathing bag to 5 in. of water-gage. No equipment would maintain that pressure indefinitely, but it would be retained without appreciable loss for one minute where there were no punctures. Edward Steidle regarded the smokehouse test as more important and desirable. He said, however, that Mr. Pettibone's test was a good one.

H. I. Smith suggested that the smokehouse test was one that determined the condition of the apparatus as actually worn. The tightness of the nose clip was a factor in the safety of the apparatus. No test of the equipment apart from the wearer could determine whether the latter would be safe. Mr. Pettibone declared that the pressure was higher than any that would arise in use and therefore better than any the smokehouse test would develop. Edward Steidle, on the other hand, thought that such a positive pressure could be obtained if the wearer exerted himself greatly.

The argument seems logically to be as follows: If the breathing apparatus maintains a positive pressure, gas cannot inleak in the smokeroom; so if the puncture is not enough to eliminate the positive pressure, the apparatus will not permit the entrance of noxious gases.

Should, however, a negative pressure or a neutral pressure be created, the gas will enter. The smokehouse test therefore determines whether the puncture is large enough to permit the pressure to fall below that of the atmosphere. The increased pressure under exertion would aid in proving the apparatus safe, and therefore under increased exertion the test would not be so efficacious. The Pettibone test is of the rate of loss of pressure, whereas the smokehouse test merely determines whether the outleakage is enough to lower the pressure to such a level that an inleakage of noxious gas is possible.

J. W. Paul said that the test of oxygen supplied was not so unimportant as Mr. Pettibone had suggested. The bypass valve provides the oxygen needed, but in times of excitement men may forget to use it, with consequent unfortunate results.

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Forfeiture of Mining Leases

By Arthur L. H. Street*

A recent decision of the United States Circuit Court of Appeals is instructive on the right of a lessor of mining property to forfeit the lease for inactivity of the lessee in development work. (Niles Land Co. vs. Chemung Iron Co., 234 Federal Reporter, 291.)

Complainant leased a tract of Minnesota iron-ore lands to defendant in 1902 for a term of 50 years, defendant agreeing to "work the mine or mines now or hereafter discovered on said land in a good workmanlike manner during the existence of this license." The lessee was also required to pay a tonnage royalty of 25c., $12,500 ground rent for the first year, and $18,750 annually thereafter, being credited, however, on such rental to the amount of royalties currently paid. By another clause of the lease, complainant, as lessor, was empowered to forfeit the lease on the lessee's failure to "work such mine or mines in a good, workmanlike manner," or "to pay the ground rent or royalty when due."

Claiming that the leased mine had not been worked by the lessee or its successor for ten years following the execution of the lease, except for exploration purposes, although the ground rent was duly paid and r[illegible] complainant without objection, suit was brought to forfeit the lease. The United States District Court for Minnesota decreed that, under the terms of the contract, there was no right to a forfeiture, and dismissed the suit. This determination has been affirmed by the Circuit Court of Appeals for the Eighth Circuit.

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*Attorney at law, 829 Security Building, Minneapolis, Minn.

In the opinion of the higher court the lease was not so worded as to require the lessee to begin development work within a reasonable time or to conduct such operations continuously, as claimed by the lessor, payment of annual ground rent being interpreted as standing in lieu of actual operations. The court recognizes the point, however, that if the payment of tonnage royalties had been the only consideration for the lease, a different decision would probably have resulted.

In reaching the conclusion, the court applies the general rules of law that forfeitures of leases will not be decreed unless the lessee establishes a clear right thereto, and that clauses of doubtful meaning are to be construed most strongly in favor of the lessee.

As an additional ground supporting the decision, it is decided that the complainant's receipt of payment of the annual ground rentals for several years, without objecting to the delay in beginning development of the mine, amounted to an acquiescence on complainant's part in the lessee's apparent interpretation of the lease as not requiring development so long as the ground rent was paid.

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Safety in Hoisting in Shafts and Slopes*

By O. P. Hood†

The practice of mining usually requires transportation of men and material in both horizontal and vertical directions. Man has pretty thoroughly accustomed himself to the means of horizontal transportation, and the risks of the road and the car are assumed naturally and without fear. Transportation in vertical directions, however, is far less ancient and general in the experience of mankind, and the dread and fear of falling is a primal instinct yielding but slowly to the experience of successful vertical transportation. A man who would never think of examining the coupling arrangements of a railroad train looks with suspicion on the 1½-in. steel rope that is to lower him a few hundred feet into a mine.

Safety in hoisting, as in most other activities, is dependent upon both men and mechanism. The division of the responsibility between these two is the object of this paper. The Bureau of Mines will issue shortly a study, by R. H. Kudlich, of shaft and slope accidents that have taken place in the coal mines of Pennsylvania, West Virginia, Ohio and Illinois in the 10-year period from 1904 to 1913. In this safety field, as in most others, the human factor is the most important. If man had succeeded in controlling himself as well as he has succeeded so far in controlling the mechanism of hoisting, shaft and slope accidents would have been one-third less. Of 1,726 accidents, 800 are so reported as to make it possible to establish the blame as between men and mechanism. Of these 800 accidents, 66% were due to human limitations and 34% to some failure of mechanism. In 35% of them the victim himself was responsible. It can be said that of three men injured in those accidents, one had himself only to blame, one suffered because of the failure of a fellow employee, and one suffered because of defective mechanism. The miner, therefore, who is using or who is about the hoisting facilities of a mine is equally interested in three factors—his own carefulness, the carefulness and ability of his mates and the adequacy of the company's equipment. The company interested in reducing shaft and slope accidents will find that there is twice as much need for revision of the habits, thoughts and practices of the men as there is of making any change in the equipment.

The accidents in which the injured man is himself more largely responsible are those such as the 10% injured in falling down shafts, the 6½% caught between the cage and shaft timbers, the 5% who fall off cages while riding and the 5% struck by slope or haulage ropes. The remedy for these accidents must be found in the general propaganda which teaches men to think of safety, together with the elimination of the habitually careless and of conditions that produce mental and physical subnormality. Accidents for which a fellow employee is largely responsible are those such as the 13% caught in overwinding accidents and the 7% injured by being struck by, or while riding on, runaway cars.

HUMAN SAFETY DEVELOPMENT MORE IMPORTANT THAN MECHANICAL

To entirely prevent these accidents requires infallible humanity or the development of accessory mechanism that will prevent the individual from doing the wrong thing and will supplement his ineffective effort. Here again the individual must be at his best physically and mentally. Anything that helps to produce a subnormal condition in a faithful and intelligent employee should receive careful study and be eliminated if possible. This leads the investigator into every field affecting the individual—health, wages, housing, normal pleasures, decent living, diet, the prohibition of artificial stimulants and drugs, etc. It may be too much to hope to produce ideal men and conditions, but it is necessary to face the fact that these human problems are the big end of the task. Overwinding devices are needed that are reliable and practical and that will not interfere with normal operation. Too often the devices provided are ineffective or are disconnected. In large hoists some of them may, when operated, even wreck the mechanism. Standard recording signal systems should be developed so that misunderstanding of signals will be impossible, and a permanent record made of the signals given.

THE ANALYSIS OF SLOPE ACCIDENTS

The accidents where mechanism is largely at fault are those such as runaway cars on slopes, accounting for 9% of the injuries; breaking of ropes, 7½%; being struck by slope or haulage ropes, 4½%. Most of these accidents are on slopes. Of accidents on slopes or haulageways 25% are charged to failure of equipment, while in shaft accidents less than 9% are so chargeable. This is probably due to the more severe conditions imposed on slope and haulage ropes and to the absence of means on slopes of something comparable to safety catches in vertical hoists. To reduce accidents from defective mechanism requires, first of all, frequent careful, orderly and formal inspection of all mechanism and, second, the development of standards of condition that can be imparted by one to another. This latter need becomes very evident to anyone attempting to obtain from practical men about a mine definite directions for condemning a hoisting rope. The practice in this respect is arbitrary and variable, and only once in my experience have I heard directions so clearly given that an intelligent assistant could inspect a rope and report whether it should or should not come off.

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*Published by permission of the Director of the U. S. Bureau of Mines.

†Chief mechanical engineer, U. S. Bureau of Mines.

In attempting to reduce shaft and slope accidents, it is useful to know the major problems which should demand first and greatest attention. These are shown to be human problems first and can be summed up in the phrase, "keeping good men fit." The problems of mechanism are more largely matters of efficient inspection than of design or material though these latter factors are strong minor subjects.

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United States Steel Corporation

The preliminary statement of the United States Steel Corporation for the quarter ended Sept. 30 shows that the profits were greater than those of any quarter in the company's history. The single month of September showed greater net earnings than those of any quarter in 1914. The condensed statement is as follows, the net earnings being the surplus over operating expenses, ordinary repairs and renewals:

	1914	1915	1916
July	$7,475,993	$12,048,218	$25,650,006
August	7,584,926	12,869,099	29,746,903
September	7,215,083	13,793,327	30,420,158
Net for quarter	$22,276,002	$38,710,644	$85,817,067
		1916	
Depreciation and reserve funds		$10,614,659	
Interest and sinking funds		5,601,233	
Total charges			16,215,892
Surplus for the quarter			$69,601,175

From this surplus the regular quarterly dividend of 1¾% on the preferred stock took $6,304,919, leaving a balance of $63,296,256, which is equivalent to 12.45% on the common stock. From this the directors declared the regular dividend of 1¼% and an extra of 1%, taking $11,436,806 and leaving an undivided surplus of $51,859,450 for the quarter.

For the nine months ended Sept. 30, the total net earnings were $227,656,739, or $148,538,231 more than in 1915. The net result over all charges was $180,820,307, or $140,990,525 more than in 1915. The net surplus over preferred dividends was $161,905,550, or 31.8% on the common stock.

Depreciation and repair charges were high this year, because the mills were operated at high pressure and up to full capacity.

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French Prisoners Work in German Mines

Two Swiss doctors, Blanchor and Speiser, delegated by the International Red Cross Society, have been permitted to visit the German prison camps more especially connected with employment in mines and shops, and to enter the underground workings. In their report, quoted by *l'Echo des Mines et de la Metallurgie*, of Paris, they state that in the region of the Seventh Army Corps—that is, the Werl-Semme-Minister-Friedrichsfeld district—more than 60 mines are employing French prisoners. Besides a minority of these who are miners by trade, there are many from other walks of life—farmers, accountants and merchants, but few students.

In writing to their families, the prisoners were not allowed to specify their actual places and nature of work, but had to date their letters from the main camps on which they depended. The first shift enters the mine at 6 a.m. and quits at 2 p.m., the second shift working from 2 to 10 p.m., which figures do not include the time spent in traveling between the mine and camp. Tuesdays and Fridays they work 10 hours to make up for Sunday. If, through fatigue, they refuse to work 10 hours, they are compelled to remain in the mine, where they rest on the coal. In the lignite mine at Alzendorf, Prussia, a prisoner who does not make up the fixed number of carloads is deprived of his evening soup.

In the iron-pyrites mine of Sachtleben, Westphalia, the last prisoner who had arrived at the mine bore the number 852, which by comparison with 487, the number of men then employed, showed that 365 had already been removed for some form of inability to work, such as accident, illness, feebleness or lack of skill.

At the Ehrhardt gun and munition works of Düsseldorf, prisoners refusing to handle war material proper are obliged to build or repair the machine tools used upon it.

The visitors somewhere found an order to the prisoners that they must work upon munitions, whatever their sentiments, and that they would be protected, upon return to France, by a certificate of the German government that they did it under compulsion. This was contradictory to a general military order, unknown to the prisoners, under which they could not have been forced to work on munitions against their will. At a Krupp plant in Rheinhausen, where railway material is made, 200 men of the night force refused to work and stood in the rain all night because they believed that the ingots were destined for ammunition work in another shop.

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Australian Metallurgical Developments

Melbourne Correspondence

The several metallurgical and smelting plants of the warring nations are alive with huge activity as a result of the European conflict. In Australia the great lead and zinc smelting and refining works of the Broken Hill Associated Smelters, Ltd., at Port Pirie (now the largest lead smeltery of the world, turning out about 130,000 tons of market lead per year), are undergoing extensive alteration and enlargement. Modern equipment and method is being installed throughout this plant by the new proprietors—a combination of the four important mining companies at the great Broken Hill camp in New South Wales. The Port Pirie plant, about 250 mi. to the southwest, on Spencer Gulf, was taken over from the former owner—the Broken Hill Proprietary Co.—in 1915: the new holders being the B. H. P. Co., the Zinc Corporation and the B. H. North and B. H. South companies.

Two American engineers are now at Port Pirie assisting in the expansion of smelting facilities. The reorganization and enlargement of the lead smeltery is under the guidance of Guy C. Riddell, formerly superintendent of the East Helena plant of the A. S. & R. Co., who has joined the staff of the Associated Smelters as consulting metallurgical engineer. Gilbert Rigg, until recently in charge of the research department of the New Jersey Zinc Co., has in hand the zinc program of the Broken Hill companies, which is undergoing extensive development at Port Pirie and in Tasmania. Charles M. Warner, of the Dwight-Lloyd company, has also been at Port Pirie recently, in connection with extension of the Dwight-Lloyd roasting equipment at that plant.

Gold Production in Russia

Some new and interesting facts regarding the gold production of Russia are given in the *Journal* of the Russian-American Chamber of Commerce for June. The statistics presented are more complete than any which have been recently accessible and constitute a fairly complete review of the progress of the industry.

The following table gives the figures for 11 years from official sources, the first column showing the poods of bullion delivered to the official laboratories, the second the fine gold obtained, the value being here given in dollars, instead of rubles as in the original:

	Bullion, Poods	Fine Gold, Value		Bullion, Poods	Fine Gold, Value
1904	2,669	$24,690,304	1910	3,886	$35,617,269
1905	2,385	22,372,856	1911	3,738	33,567,096
1906	2,609	24,458,581	1912	3,554	31,779,341
1907	2,655	25,106,299	1913	3,715	32,758,073
1908	3,053	28,115,507	1914	3,766	34,458,088
1909	3,467	32,351,039			

In converting into dollars the ruble is taken at its face value of 51.5 cents.

The quantity of pure gold reported shows different rates of variation in several years from that of the bullion delivered to the laboratories. This was to be expected. Thus in 1914 there was an increase over 1913 of 50 poods only in bullion delivered, but the increase in pure gold was 155.325 poods. The recovery of fine gold by districts was as follows for four years past, in poods:

	1911	1912	1913	1914
Urals	442.625	446.800	392.975	299.575
West Siberia	294.750	273.025	288.925	132.975
East Siberia	2,438.975	2,198.100	2,325.300	2,729.975
Total	3,176.350	2,917.925	3,007.200	3,162.525

Referring to the first table, it will be seen that there was a decrease in 1905, resulting from the events following the Japanese war. From 1906 onward there was an increase each year until 1910, when the maximum was reached. In 1911 and 1912 there was a decrease, due to a limitation of output in some districts of East Siberia and to the labor troubles in the Lena District. In 1913 and in 1914 there were considerable gains. The returns received for 1915, though not quite complete, indicate a production about equal to that of 1914, or possibly a little larger.

In former years it was customary, in estimating the gold production of Russia, to add 10% to the official reports, to cover gold not reported or delivered to the official laboratories to be refined. This gold, it is believed, was concealed or illicitly exported, especially in East Siberia. If this rule be applied to the production of 1914, it would bring the total up to $37,905,000. There is reason to believe, however, that recent administrative measures and the extended operation of mines by large and responsible companies have reduced considerably the percentage of illicit or unreported gold.

It is to be noted that the figures above put the gold output of Russia in recent years considerably higher than the estimates which have been published abroad. The figures here given are stated in detail and appear to present the real production of the Empire.

The most important event of 1915 in the mining industry was the Congress of Gold and Platinum Producers held at Petrograd in February. This body debated many questions and recommended several measures. Following this the Ministry of Trade and Industry made a detailed investigation which resulted at once in the beginning of the building of new roads and other improvements in transportation, and in the better division and adjustment of the mining districts in Siberia.

Other measures included the reduction of the land tax on gold fields; permission to import free of duty cyanide of potassium, zinc in sheets and some kinds of machinery; the prohibition to export gold abroad; the establishment of a special premium for gold delivered to the government; and, finally, the establishment of a permanent committee at the Ministry of Trade and Industry to handle matters concerning the gold industry and to investigate its conditions.

American Miners Murdered in Korea

According to an Associated Press dispatch, Oct. 11, from Seul, Fin Welhaven, who is believed to have been an American, has been killed and two other American mining engineers have been wounded in an encounter with armed bandits, who ambushed the party in northern Korea with the object of robbery.

The Americans and others connected with the Oriental Consolidated Mining Co. were returning to the mine on Oct. 6 carrying $75,000 in cash for operating expenses, when they were attacked from the brush by nine highwaymen. A policeman and the Chinese driver of the wagon in which the Americans were riding were shot dead, and Mr. Welhaven was so badly wounded that he died the following day. Two other Americans named Williams and Barstow were shot, though not dangerously. The bandits were driven off and the cash saved.

Mr. Welhaven was a brother of Alfred Welhaven, manager of the Oriental mine, which is about 60 miles from the nearest railroad. Once a month the output of bullion, which is about $150,000 is taken by an armed bullion party to the nearest station and thence to the mint at Osaka, Japan. On the return trip the party usually carries about $75,000 in cash for paying the mine expenses.

Upon communication with the New York office of the Oriental Consolidated Mining Co., the report of the death of Mr. Welhaven is confirmed, but no further information is available.

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The South African Diamond Yield for the first six months of 1916 is given in the July statistical report of the Mines Department of the Union of South Africa, quoted in the "South African Mining Review." The total production of the Union is put at just over a million carats, valued at £2,118,145. Of this the De Beers Consolidated Mines, Ltd., is responsible for 608,321 carats, valued at £1,260,469, while the alluvial diggers of Barkly West produced 36,811 carats, valued at £231,380. In the Transvaal the yield was 274,431 carats, valued at £375,180. Of the latter £111,605 was contributed from a dozen alluvial-bearing farms in the Klerksdorp district. Mines in the Pretoria district, virtually meaning the Premier, yielded 251,690 carats, valued at £261,378. This yield was almost entirely from tailings, 614,000 loads being washed; the diamondiferous ground washed up to the end of June being insignificant. There were in July 183 whites and 2,924 natives employed on diamond mines in the Pretoria district. The production in the Orange Free State was 82,171 carats, valued at £215,376

Editorials

The Prospects for the Metals

The future becomes somewhat clearer, or seems to. The war has now been going on so long that economic conditions are not quite so chaotic. The operation of immutable natural laws is not quite so obscure as it was a year ago. What will happen when comes the great readjustment following peace, nobody is yet wise enough to prophesy. Probably it will be exactly what ought to happen, just as following the outbreak of the war, but nobody will have clear enough perception to see it any more than they did in August, 1914. But while the war continues, we have learned certain marks to go by, and that it will continue into 1917 seems now to be as certain as anything can be.

The development of the war produced an extraordinary demand for all metals, which are the basis of nearly all war material other than food and clothing. The supplies of certain metals, especially zinc, were cut off by the isolation of Germany and Belgium. The new demand for other metals—such as aluminum—increased to proportions previously unheard of. These conditions led to advances in price to extravagant figures, in some instances to five times what they were before the war.

In most cases the shortage of supply wherewith to meet the new, urgent demand was not due to scarcity of raw material, but rather to insufficiency of plant for its conversion into useful form. The enormous margins that represented premium on smelting capacity naturally induced the provision of new capacity. Thus, about a year ago the erection of new zinc smelteries was proceeding fast and furiously. Such a movement had a series of logical results, viz.: It created an increased demand for structural material and labor and increased the price of them. As new capacity became available, there was increased demand for labor to operate it and the exaction by labor of higher terms and, incidentally, the exhibition by labor of less efficiency. Both of these things increased cost of production. On the other hand, it was inevitable that the new production would sooner or later equal the demand and that the price would decline. Furthermore, it was certain that in the end the industry would be found to be greatly overbuilt, with a large amount of capital locked up in useless plant. The last condition was likely to be intensified by the stimulus given to the development of new processes resulting in the permanent relegation to desuetude of some otherwise good plant.

In the zinc industry we have seen all these things happen except the last. Not yet has it become necessary to abandon plant to any great extent; indeed, plant building is still going on. We speak especially of the zinc industry, for the experience in it pictures exactly what is going on in others. The stress of conditions in zinc was more intense and more rapid than in other instances, for the world was suddenly confronted by a deprivation of a large part of its supply, which was not so with copper and lead. We are now witnessing in copper, and to a much less extent in lead, a delayed repetition of what happened in zinc. We may therefore attempt to forecast their future with reasonable confidence.

Assuming that the war is going to continue into 1917, there is going to be a continued large demand for the metals. Indeed, this is so well recognized that a large proportion of the expected production of copper in 1917 has already been contracted for. Producers have sold about all their expected output up to 1917. Belated consumers have to pay large premiums for near-by copper. Stocks do not exist. This is very reminiscent of zinc 12 or 18 months ago. Producers are straining themselves to increase capacity. There is a plethora of raw material—ore, matte, and blister copper—and there is a surplus that either cannot be smelted or be refined. The congestion is especially in the refining. Although new refining capacity is being provided it cannot be done fast enough. The phenomenal records of zinc-smelting construction cannot be matched, for a copper refinery is a more complicated construction, is dependent upon electrical machinery, and the manufacturers of the latter will not promise delivery inside of seven months. Yet nothing is more certain than that some day the requisite refining capacity will be available, stocks will begin to accumulate and price will begin to recede. Even now there are producers who are keen on entering into contracts for delivery nine months or a year ahead at prices materially less than the current. All of these things happened in zinc.

The same things will happen also in lead, but with modifications owing to peculiarities of the lead industry. The smelting and refining of lead is far more concentrated than that of copper and zinc. The market is better organized, in that a large part of the domestic consumption is filled on contracts settled on average prices. Consumers do not therefore become panic-stricken with fear that they may not get any lead. If they have contracts, they know that they will get what they need at the average price. We do not therefore see such sales running far ahead as we have of copper and zinc. We have seen on the other hand, a lead market fluctuating in moderation, barring one or two brief periods of extravagance, during the last two years. Nevertheless, the production of lead is increasing through stimulation of mining and additions of plant, and that will eventually produce the same result as in other metals. The output of lead in Utah and Missouri has increased largely during 1916.

Nickel has been even more orderly. The production of it in North America is practically in the hands of a monopoly. The fact that the mines are in Canada and the refinery in the United States has caused the production and sale of this metal to be conducted with great circumspection. Aluminum, which is also in the main the production of one company, has risen in price threefold, simply owing to the urgency of the demand for it. Of all the metals this is probably in the strongest position, the major part of the output of the Aluminum Company of America through the whole of 1917 being under contract. Strenuous efforts to increase aluminum production not only in the United States but also in Scandinavia, and being made, but this involves more tedious construction than even a copper refinery, including as it does both electrical machinery and hydro-electric development.

With some of the minor metals, such as antimony and tungsten, conditions were simplest. No elaborate plant for the beneficiation of their ores is necessary. They appreciated greatly in value at first, owing to scarcity of ores, which was not due so much to the stinginess of nature as to the previous absence of great demand for them. The first sharp rise in prices adjusted conditions, and by stimulating the production of ores, reduced the prices. There is no more reason to anticipate a renewal of extravagance in such markets than there is in zinc.

However, the factors that we have dwelt upon in this article have produced new conditions in production. The cost of materials and of labor have increased enormously; the efficiency of labor has decreased. Naturally this has been of the greatest influence in those branches of industry wherein labor is the most important factor. In zinc smelting, for example, it is the all-important factor. No matter how good a plant the engineer may build, no matter how efficiently the metallurgist may direct it, their efforts may be completely neutralized by bad furnacemen. The copper-smelting furnace, on the other hand, is more completely controlled from the office. In general, the industry of mining and smelting copper has been far more highly mechanicalized than other branches of mining and metallurgy, barring iron and steel. This exhibits itself in the cost sheets. The big copper producers are showing costs per pound of copper but little higher than in normal times. The zinc producers, whose industry is least mechanicalized, talk on the other hand of 7 or 8c. per lb. being no better than 5 or 5½c. before the war, and probably there is truth in their contention.

Assuming, then, that the war is going to continue through or well into 1917, there is reason to anticipate for the metals a continued large demand, which will be filled at gradually diminishing prices, while profits will contract even more sharply than prices, for the reason that costs will continue to rise. The copper producers will probably be pinched least, for the reason already advanced. It is conceivable that we may settle generally upon a plane of price 40 or 50% above normal, whereon nobody will realize any more profit than he used to in normal times, and we may move on such a plateau for a long time before the factors of further readjustment come into play.

In the intoxication of the moment people lose sight of adverse influences that are operating even now. The American crop failure has attracted very little attention, but it was a disaster of major character whereof more will be heard. The increasing cost of living, the unrest of labor, the riot of speculation, the growing extravagance of the people, the anchoring of capital in new plant which may be of but ephemeral usefulness—all these factors and others are operating toward the natural results.

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Total Output Ore Contracts

An interesting case involving an ore contract was recently decided in the United States District Court for the Southern District of New York, the Eustis Mining Co. being the plaintiff and Beer, Sondheimer & Co. the defendant. The Eustis Mining Co. mines pyrites in Canada, sells it to sulphuric-acid manufacturers on the Atlantic Seaboard, and takes back the cinder, which it has been selling to Beer, Sondheimer & Co. for smelting at Norfolk, Va. The contract between these concerns contained the clause: "It has been agreed between us that we (Beer, Sondheimer & Co.) purchase from you (Eustis Mining Co.) for the period of 10 years beginning July 1, 1914, and ending July 1, 1924, your total production of lump cinder estimated to be 12,000 tons per year, on the terms and conditions of our contract of Feb. 11, 1914." Later, the Eustis Mining Co. tendered a larger quantity than 12,000 tons a year, which Beer, Sondheimer & Co. refused to accept, wherefore the suit.

The controversy hinged upon the clause herein quoted and was reduced to simple terms. The plaintiff contended that the determinative provision was "total production." The defendant contended that the words "estimated to be 12.000 tons per year" was a determinative qualification. The court decided in favor of the plaintiff.

Inasmuch as the case is going to be appealed, it is useless to discuss the points involved. This is merely another one of those cases, whereof there have been several since the outbreak of the war, involving conditions that were mutually understood as long as everything was going along on even keel, but became uncertain when the boat began to rock. Ore contracts are apt to be rather uncertain documents. The moral is that there should be greater care in drawing them and greater safeguarding for both sides against extraordinary contingencies, impossible as they may appear at the time of contracting. The irregularities resulting from the war have been a lesson to a good many persons in that respect.

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Cost of Hydro-Electric Power

A correspondent asks us to give the readers of the *Journal* an explanation of why hydro-electric power is relatively so much cheaper in some foreign countries than in the United States. In the United States there is scarcely any hydro-electric power available at less than $20 per horsepower per year, while in Scandinavia there are large developments from which power is supplied at $7.50 per horsepower per year and even less. He says, "Is this owing to cheaper material, cheaper labor, etc., abroad?"

Less cost of construction probably plays a part, but the chief reason for the difference is that in Scandinavia it has been possible to develop water power from high heads and near points of use. The cost of developing water power is greatest when power is to be obtained from a large volume of water at relatively low head, as for example the power development from the Mississippi River at Keokuk, Iowa. The necessity for erecting a dam of enormous size leads especially to great capital outlay. The plant cost is least when power is developed from a relatively small flow of water from high head. When hydro-electric power can be developed close to its market, the cost of transmission lines also is less than when it is necessary to distribute over a wide area.

In brief, the chief determinative factor, which creates the difference between water power at $7.50 and $27.50, is overhead charges; that is, principally plant cost in the first place. Norway and Sweden are not the only countries that enjoy very cheap hydro-electric power. There are other countries that possess similar conditions; namely, large volumes of water at high head available close to seaports.

BY THE WAY

The 400,000 shares of the new Tennessee Copper and Chemical Co. will have no par value. Wall Street accepts such issues now as a matter, of course, says the *Evening Post*. It is even more surprised now when new companies do issue shares with a par value than when they do not. This change has been agitated for years. It is strange that it did not begin to be extensively adopted until a tax was accidentally laid on a percentage of the par value of shares traded in. Wall Street found it could avoid the tax simply by removing the par value, which was useless and misleading anyway. The plan is now being adopted on its merits. Still, old habit is strong. When some of the new stock issues begin to sell above 100, Wall Street will probably talk of them as "crossing par."

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Short-measuring gasoline pumps, according to an investigation by the Federal Bureau of Standards, are mulcting motorists of millions of dollars a year. In Illinois alone the loss is not less than $500,000 a year. Tests in many cities have confirmed previous conclusions, and actual tests of the types of pumps used by retailers at the bureau here have shown 80% of them to give short measure. "It is safe to say," says an announcement by the bureau, "that in all localities not under an efficient and competent weights-and-measures administration, and in a large majority of those which do have a relatively competent administration, the condition of measuring pumps is such that the motoring public is being subjected to regular and continuous shortage in its purchases of gasoline." We should like to know whether this is another indictment against the Standard Oil Co., or whether it has something to do with the "New Freedom."

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The miner who produces gold bullion has no difficulty in marketing his product. He deposits it with the Mint—or with the bank, the express company or refiner, as intermediary—and gets his money. It is not unnatural that he regards the disposition of his copper, lead and zinc as being an equally simple matter and is ignorant of the hard work of the experienced and expert sales agents two thousand miles away, who lie awake of nights in studying schemes to sell advantageously and in strenuous competition with each other the commodity whose proceeds must meet payrolls, supply bills and dividends. Now and then only is the troubled sales agent relieved by a "sellers market," when buyers hunt him up. Commonly it is the other way. It was the other way last July in the lead market—strange as it may seem in its present strength—and one producer that obtains a good deal of its supply from Idaho was very energetic in cutting prices for the simple reason that it wanted to sell its lead and get money for it. Other producers—not to be backward—met the competition, and the price for lead declined rather sharply, with the leading interest trying vainly to stay the decline, which it stoutly maintained to be unjustified by the statistical position. The idea of the selling of Idaho lead in such a way as to depress the market seems to have been unpopular in Idaho, judging from the remarks of local newspapers, which say that it was all a lie, anyway.

October Mining Dividends

Dividends disbursed in October, 1916, by 43 United States mining companies making public reports amount to $12,326,705, as compared with $5,911,791 paid by 31 companies in October, 1915. Iron, metallurgical and holding companies allied to mining paid $6,002,519, as compared with $3,315,158 a year ago. Canadian, Central American and Mexican companies paid $1,871,641, as compared with $1,359,588 in October, 1915.

United States Mining Copanies	Situation	Per Share	Total
Ahmeek, c	Mich.	$1 00	$800,000
Allouez, c	Mich.	2 50	250,000
Ariz. Commercial, c	Ariz.	50	132,500
Ariz. United Min., c	Ariz.	01	25,000
Bunker Hill Con., g	Calif.	02½	5,000
Bunker Hill & Sullivan, l s.	Ida.	25	81,750
Caledonia, l s.c	Ida.	03	78,150
Champion, c	Mich.	6 40	640,000
Cresson Cons., g	Colo.	10	122,000
Doctor Jackpot, g	Colo.	01	28,441
Empire Copper	Ida	05	50,000
Golden Cycle, g	Colo	02	30,000
Grand Central	Utah	04	20,000
Hecla, l.s	Ida.	15	150,000
Homestake, g	S. D.	65	163,254
Inspiration, c	Ariz.	2 00	2,303,934
Intermountain	Mont.	005	8,250
Iron Blossom, s.l.g	Utah	10	100,000
Isle Royale, c	Mich.	2 00	300,000
Judge Min. and Smelt., s.l	Utah	25	120,000
Midwest Sulphur	Wyo.	01	2,750
Missouri Zinc Fields, pfd		2 50	
Nat. Zinc and Lead, l.z	Mo.	02	10,000
New Idria, q	Calif.	1 00	100,000
New Jersey Zinc	U. S.	10 00	3,500,000
North Butte, c	Mont.	75	322,500
Osceola, c	Mich.	5 00	480,750
Pacific Mines Corp	Calif.	01	6,420
Pittsburgh-Idaho	Ida	04½	34,400
Portland, g	Colo.	03	90,000
Prince Cons., s l	Utah	02½	25,000
Shattuck Arizona, c	Ariz.	1 25	437,500
Silver King Coalition, s.l.z	Utah	15	187,500
Silver King Con., s.l.z	Utah	10	63,758
Superior, c	Mich.	1 00	100,000
Tonopah Belmont, g.s	Nev.	12½	187,504
Tonopah Extension, s	Nev.	15	190,920
Tonopah Min., s	Nev.	15	150,000
United Verde, c	Ariz.	75	225,000
Vindicator, g	Colo.	06	90,000
Wellington Mines, g	Colo.	02	200,000
West End Cons.	Nev.	05	89,424
Wolverine, c	Mich.	6 00	360,000
Yellow Aster	Calif.	05	5,000

Iron, Metallurgical and Holding Companies	Situation	Per Share	Total
Am. Smelters, pfd. A	U. S.	$1 50	$249,747
Am. Smelters, pfd. B	Mex.	1 25	375,000
Bethlehem Steel, com	U. S.	7 50	1,114,650
Bethlehem Steel, pfd	U. S.	1 75	260,890
Brier Hill Steel, com	U. S.	1 50	182,010
Brier Hill Steel, pfd	U. S.	1 75	87,500
California Explor	U. S.	12	28,139
Cambria Iron	U. S.	1 00	169,360
Cleveland-Cliffs, i	U. S.	2 50	184,253
Crucible Steel, pfd	U. S.	1 25	312,500
Dominion I. & S., pfd	Can.	7 00	350,000
Eagle-Picher Lead, pfd	U. S.	1 50	15,000
Gulf State's Steel, 1st pfd	U. S.	1 75	22,050
Republic Iron & Steel, pfd	U. S.	5 75	1,437,500
St. Mary's Min. Land	Mich.	2 00	320,000
Sloss-Sheffield, pfd	U. S.	1 75	117,250
U. S. Smelting, com	U. S.	1 00	351,115
U. S. Smelting, pfd	Mex.	87½	425,555

Canadian, Central American and Mexican Companies	Situation	Per Share	Total
Butters Salvador, g	C. A.	$0 25	$47,500
Can. Min Corp	Ont	18	275,243
Cons. Min. & Sm. Co., c z	B. C.	2 50	209,830
Hollinger, g	Ont.	05	120,000
La Rose, s	Ont	05	74,931
Lucky Tiger	Mex.	09	64,380
McKinley-Darragh-Savage, s	Ont	.03	67,431
N. Y. & Hond. Rosario	C. A.	.50	100,000
Nipissing, s	Ont	50	600,000
North Amer. Magnesite	Que	5 00	9,330
Peterson Lake, s	Ont	01½	42,032
Porcupine Crown, s	Ont	03	60,000
Seneca-Superior, s	Ont	20	95,777
Standard Silver Lead, s.l	B. C.	02½	50,000
Tough-Oakes, s	Ont	12½	65,187

The dividends by Superior Copper, Arizona Commercial, Arizona United and Intermountain were initial payments. Missouri Zinc Fields, Ltd., payment was on account of accumulated back dividends.

The totals for the first ten months of the year are as follows: Mining companies, $147,323,020, as against $57,311,674 in 1915; iron, metallurgical and holding companies, $94,996,663, as against $65,441,802 in 1915; Canadian, Central American and Mexican mines, $17,309,881, as against $7,441,708.

Personals

B. B. Thayer left for Montana on Oct. 31.

Frank A. Foote has gone from Delta, Utah, to Butte, Mont.

H. C. Klaus has gone from Berkeley, Calif., to Leadville, Colo.

C. P. Peterson, recently at Sudbury, Ont., is now at Duluth.

O. G. Engelder has gone from Houghton, Mich., to Jerome, Ariz.

George Watkin Evans has returned to Seattle, Wash., from Alaska.

C. T. Carnahan, recently at Los Angeles, Calif., is now in New York.

Allen W. Jackson, recently at Temagami, Ont., is now at Buffalo, N. Y.

John Smeddle, recently at Detroit, Mich., is now at Oatman, Ariz.

Vaughan Huneke, recently at Sutter Creek, Calif., is now at Hedley, B. C.

Corey C. Brayton, of San Francisco, has gone to Idaho and Utah on examination work.

Arthur Jarman, recently at the Waihi mine, in New Zealand, is now at Sunderland, England.

John L. Malm, of the Malm-Wolf Co., Denver, Colo., is in Chicago on professional business.

Fred L. Lowell, deputy mine inspector of California, is making an official visit in Mariposa.

Donald M. Liddell is traveling on professional business through the Illinois and Oklahoma oil fields.

R. E. Chase, Jr., recently at Tacoma, Wash., is now with the Chile Exploration Co. at Chuquicamata, Chile.

R. J. Flaherty has returned from an exploration of the Hudson Bay region, where he spent fifteen months.

F. W. Bradley is back from his usual summer sojourn at his mines in Alaska, and is now at the Bunker Hill & Sullivan.

R. E. Lewis, general superintendent of the Lehigh plant of the Bethlehem Steel Co., has been elected a director of the company.

L. D. Huntoon recently examined the Bullion Mine at Keystone, S. D. He expects to return in the spring to do some drilling.

A. G. Burrows, of the Ontario Bureau of Mines, has made a geological examination of the country along the Canadian Northern Ry. in western Ontario.

J. W. Gebb, deputy mine inspector of California, is making official visits in Fresno and Madera counties, having recently completed work in Nevada County.

Percy E. Hopkins, assistant provincial geologist of Ontario, has returned to Toronto after making a geological reconnaisance of the Kowkash-Tashota gold area.

H. Foster Bain has resigned the editorship of the "Mining Magazine" of London and has been succeeded by **Edward Walker**, previously associate editor of the magazine.

Victor Barndt, of Tonopah, recently visited San Francisco on business connected with the installation of the Solvay process on the Pacific Borax Co. lands at Searles Lake, Calif.

G. Chester Brown, deputy mine inspector of California, has completed official visits in Plumas County, getting out just ahead of the first heavy snow, and is now working in the Oroville region.

Frank H. Sistermans, of El Paso, Tex., is leaving for the southern part of Mexico on behalf of Eastern interests and is expected to be gone some three weeks, after which he will return to his headquarters in El Paso.

W. H. Bischoff, recently at the Saucon Works of the Bethlehem Steel Co., has resigned to become superintendent of coke ovens, blast furnaces and openhearth furnaces of the Dominion Iron and Steel Co., Sydney, Nova Scotia.

J. M. Nelson, formerly with the Algomah Steel Co., Sault Ste. Marie, Ont., has been appointed superintendent of the openhearth department No. 2 Saucon plant of the Bethlehem Steel Co., in place of W. H. Bischoff, resigned.

M. Morino, engineer Imperial Steel Works, Japan, is now in this country to spend a few weeks visiting steel mills and other industrial establishments. He is on his way from London to Tokio, and leaves for Japan from the Pacific Coast on Nov. 24.

Francis P. Sinn, of the New Jersey Zinc Co., Palmerton, Penn., has been elected one of the directors of the National Safety Council, which recently held its fifth annual meeting in Detroit. The organization has created a new section, having to do with safety in copper, lead and zinc smelting.

C. S. Rice, chief mining engineer, and **H. M. Wolflin**, mining engineer, in charge of the Pittsburg station of the U. S. Bureau of Mines, are in San Francisco on a professional visit respecting the appointment of a chief mine inspector of California to succeed Edwin Higgins, whose resignation takes effect at the end of October.

Edwin Higgins, chief mine inspector of California, has returned to San Francisco from an extensive visit in Nevada County. This is his last official visit as inspector. On Nov. 1 he entered upon the duties of sanitary engineer in the employ of the large mines in the Mother Lode region, the Empire at Grass Valley and others.

Charles A. Lemmon has been appointed assistant to Frederick Laist, general manager of the Anaconda Copper Mining Co.'s metallurgical enterprises. He will have charge of all the company's interests in Anaconda, outside the reduction work and the foundry, the last named remaining under the guidance of Chief Engineer Wallace N. Tanner. Mr. Lemmon has been in the company's employ for many years as a civil engineer.

Elliot C. Bacon and **S. W. Eccles** resigned as directors at a recent meeting of the Kennecott Copper Corporation and **John N. Steele** as director and member of the executive committee. Their places were filled by the election of **William C. Potter**, **H. F. Guggenheim** and **E. A. Guggenheim** as directors, and **William C. Potter** as a member of the executive committee. Mr. Potter was also elected chairman of the board of directors.

E. C. Hutchinson, president and general manager of the Kennedy Mining and Milling Co., and **Henry Malloch**, manager of the South Eureka and Oneida mines, have been almost constantly at the properties in Amador County, California, during the idle period brought on by the labor strike. Managers of other Mother Lode mines affected by the strike are residents of the county or spend most of their time at the mines while in operation.

Edward B. Durham has been supervising the transfer of an aërial tramway from the U. S. Mines at Bingham, Utah, to the Stowell mine, near Kennett, Calif., for the Mammoth Copper Mining Co. The work included the dismantling and shipping of 100 tons of machinery and cables, the designing of new parts and new structures to suit the new site, the framing and erecting of 150,000 ft. of timber for towers and stations, the installing of the machinery and the starting of the plant in operation.

At meetings of the Braden Copper Co. and Braden Copper Mines Co., S. R. Guggenheim, Murry Guggenheim, E. L. Newhouse, J. E. Bamberger, Karl Eilers, Eugene Meyer, Jr., L. Frederick and G. F. Hilton resigned as directors. The vacancies were filled by the election of H. F. Guggenheim, E. A. Guggenheim, H. O. Havemeyer, Stephen Birch, William Pierson Hamilton, Thomas Cochran, Seward Prosser, S. S. Sorensen, and Samuel J. Clarke. William C. Potter was elected president and Stephen Birch and William Pierson Hamilton vice-presidents.

Obituary

Prof. F. H. Robinson, for more than a quarter of a century head of the civil engineering department of Delaware College, died Oct. 17 at his home in Wilmington, Del., aged 66 years. He resigned last spring and in June was elected professor emeritus. Some years ago he was connected with the Edge Moor Iron Works and was also at one time engaged in the engineering business in Wilmington, being a member of the firm of Canby & Robinson.

Societies

American Chemical Society—At a meeting of the New York Section, which will be held at the Chemists' Club, 50 E. 41st St., New York, Nov. 10, the public at large are invited. The program of this meeting will be on the relation of the chemist to our public welfare. The first paper will consist of a discussion of "The General Problem of Public Service Training," which will be handled by Prof. Charles A. Beard, of Columbia University, and of the Training School for Public Service. "The Status and Compensation of the Chemist in Public Service" will be the next paper, which will be presented by Prof. Frederick E. Breithut, of the College of the City of New York. Prof. Breithut, for a number of years, has made a study of the conditions existing in our manufacturing enterprises and will bring home very forcibly the importance of the chemist in public service. The third paper of the evening is "The Chemist in Public Service." This paper will be given by Dr. Harvey W. Wiley, formerly chief chemist, Bureau of Chemistry, U. S. Department of Agriculture. The title of the final paper of the evening will be "The Chemist in the Service of New York City," by Dr. Otto H. Klein, director, Central Testing Laboratory. Dr. Klein's address will be of great interest to people who do not realize to what extent chemistry is entering into the control and government of the city.

Industrial News

The Carbo Corporation has removed its principal office to the factory at Chicago Heights, Ill.

Lawrence E. Coffin, manufacturers' agent, 303 Jefferson County Bank Bldg., Birmingham, Ala., has been appointed agent for the Highland Chemical Co., the Flood City Mfg. Co. and the Dervar Mfg. Co.

New Patents

United States patent specifications listed below may be obtained from "The Engineering and Mining Journal" at 25c. each. British patents are supplied at 40c. each.

Cyaniding Tower. Albert F. Tanner, Greenfield, Wis., assignor to Ideal Continuous Cyaniding Process Co., Davenport, Iowa. (U. S. No. 1,201,386; Oct. 17, 1916.)

Drill Extractor. Harvey Keith MacKenzie, Kimberley, B. C. (U. S. No. 1,202,551; Oct. 24, 1916.)

Drilling—Throttle-Valve for Rock-Drilling Engines. Charles C. Hansen, Easton, Penn., assignor to Ingersoll-Rand Co., Jersey City, N. J. (U. S. No. 1,201,724; Oct. 17, 1916.)

Electro-Amalgamating Machine. John Ogden, Philadelphia, Penn. (U. S. No. 1,202,006; Oct. 17, 1916.)

Filtering Belt. John M. Callow, Salt Lake City, Utah, assignor to the General Engineering Co., Salt Lake City, Utah. (U. S. No. 1,201,021; Oct. 10, 1916.)

Flotation—Apparatus for Concentrating Ores. John M. Callow, Salt Lake City, Utah, assignor to Metals Recovery Co., Augusta, Me. (U. S. No. 1,201,934; Oct. 17, 1916.)

Hydrometallurgy of Copper. Edward Ray Weidlein, Thompson, Nev., assignor to Metals Research Co., New York, N. Y. (U. S. No. 1,201,899; Oct. 17, 1916.)

Signaling—Improvements in Mine-Shaft Signaling Apparatus. R. S. Scott and J. Wheatley, Dewsbury, Eng. (Brit. No. 3,393 of 1915.)

Slag Pocket for Furnaces. Ernest H. Holzworth, Lowellville, Ohio. (U. S. No. 1,200,839; Oct. 10, 1916.)

Sulphur Recovery—Process for Recovering Elemental Sulphur From Sulphur Gases. W. F. Lamoreaux and C. W. Renwick, Isabella, Tenn. (Brit. No. 2,834 of 1915.)

Sulphuric Acid—Improvements in the Process of Recovering Sulphuric Acid From the Waste Acid of Petroleum Factories. V. C. Coster van Voorhout, Holland. (Brit. No. 12,363 of 1915.)

Tunneling Machine. Olin S. Proctor, New York, N. Y., assignor to the Rock Tunnelling Machine Co., Inc., New York, N. Y. (U. S. No. 1,201,097; Oct. 10, 1916.)

Tuyere. Harry E. Zeigler, Carlisle, Penn., assignor of one-third to John H. Rupert and one-third to Benjamin H. Snyder, Carlisle, Penn. (U. S. No. 1,201,130; Oct. 10, 1916.)

Sintering Machine. Sophus P. C. Borsou, Salida, Colo. (U. S. No. 1,199,962; Oct. 3, 1916.)

Zinc-Gold Slimes—Improvements in the Treatment of Zinc-Gold Slimes. J. Penhale, Johannesburg, Transvaal, So. Afr. (Brit. No. 14,921 of 1915.)

Assessments

Company	Delinq.	Sale	Amt.
Alpha, Nev.	Oct. 25	Nov. 15	$0.03
Andes, Nev.	Oct. 11	Nov. 1	0.02
Big Cottonwood, Utah	Nov. 6	Nov. 24	0.01
Blue Bell, Ida.	Oct. 9	Nov. 9	0.002
Blue Bull, Nev.	Oct. 16	Nov. 20	0.01
Blue Star, Ida.	Sept. 25	Nov. 21	0.02
Cedar Creek, Ida.	Oct. 23	Nov. 23	0.01
Chief Cons. Ext., Utah	Oct. 10	Nov. 1	0.002
Columbus-Rexall, Utah	Oct. 27	Nov. 17	0.02
Confidence Silver, Nev.	Nov. 8	Nov. 29	0.10
Cornet, Ida.	Oct. 20	Nov. 20	0.00075
Consolidated Imperial, Nev.	Oct. 25	Nov. 15	0.01
Demijohn, Utah	Oct. 21	Nov. 10	0.005
Diam. Blk., Butte, Nev.	Oct. 12	Nov. 18	0.01
Diamondfield Bl'k B'tte, Nev.	Oct. 12	Nov. 18	0.01
Duluth, Ida.	Oct. 18	Nov. 18	0.001
Eagle Mountain, Ida.	Oct. 2	Nov. 4	0.001
Emerald, Utah	Oct. 16	Nov. 18	0.001
Emerald, Utah	Nov. 15	Dec. 9	0.001
Enterprise, Ida.	Oct. 19	Nov. 20	0.002
Four Timber, Ida.	Oct. 1	Nov. 1	0.002
Friend, Ida.	Oct. 21	Nov. 24	0.002
Giant, Ida.	Oct. 5	Nov. 9	0.003
Hale and Norcross, Nev.	Nov. 8	Nov. 29	0.03
Idaho & L. A., Ida.	Oct. 16	Nov. 17	0.005
Idaho Mont, Ida.	Oct. 30	Nov. 18	0.002
Independent, Ida.	Oct. 7	Nov. 7	0.005
Lehi Tintic, Utah	Nov. 8	Dec. 2	0.0025
Manhattan Cons., Nev.	Oct. 9	Nov. 8	0.01
Military, Ida.	Oct. 25	Nov. 25	0.00025
Mineral Range Gold, Utah	Oct. 16	Nov. 8	0.005
Monarch-Pgh., Nev.	Oct. 23	Nov. 27	0.01
Murray Copper, Utah	Oct. 9	Nov. 8	0.001
Naildriver, Utah	Nov. 4	Dec. 4	0.01
Native Silver, Mont.	Oct. 2	Nov. 4	0.005
Ninemile, Ida.	Nov. 2	Nov. 17	0.0015
Nonpareil, Ida.	Oct. 23	Nov. 22	0.001
North Clift, Utah	Oct. 10	Nov. 3	0.01
North Franklin, Ida.	June 19	Nov. 23	0.005
North Tintic, Utah	Oct. 10	Nov. 1	0.002
Ophir, Nev.	Oct. 25	Nov. 15	0.05
Raven, Ida.	Oct. 23	Nov. 20	0.001
Seg. Belcher & Midas, Nev.	Oct. 30	Nov. 24	0.02
Selma, Utah	Nov. 4	Nov. 23	0.005
Sierra Nevada, Nev.	Oct. 12	Nov. 2	0.10
Silver Mt., Ida.	Oct. 21	Nov. 24	0.002
Spearhead, Nev.	Oct. 2	Nov. 2	0.01
Tohar, Utah	Nov. 2	Nov. 23	0.002
Tyler, Ida.	Oct. 12	Nov. 13	0.0015
Utah Arizona, Ariz.	Oct. 31	Nov. 25	0.005
Utah Metals, Utah	Oct. 23	Nov. 18	0.002
Wasatch Marble, Utah	Sept. 26	Nov. 11	0.03
Zuma, Utah	Oct. 30	Nov. 30	0.005

Editorial Correspondence

SAN FRANCISCO—Oct. 28

Petroleum Production in California in September totaled 7,965,420 bbl. Shipments from the fields totaled 9,214,358 bbl. Crude stocks at Sept. 30 aggregated 48,469,257 bbl. Producing wells in 11 fields totaled 7,170, of which 1,859 were in Kern River and 1,659 in Midway-Sunset. All other fields had less than 1,000 wells. Coalinga had 925, Los Angeles and Salt Lake, 674, and Whittier-Fullerton, 647; the other 6 fields had less than 500 each.

First Snow of the Present Season fell in the Sierras at the beginning of October. The first precipitation was light on the ranges east and west of the Sierras, followed by rain and wind and extreme cold. Then a heavier snow fell in all the Sierra region and actual winter weather set in a month earlier than is usual in California. Light snow, followed by bright days and delightful traveling weather, is common in early October. The mines take advantage of October to put in their late supplies, make a general cleanup about the surface plants and set everything in order for the winter. During the past month of October, both the miners and the cattlemen believed there would be fine weather following the first flurry of snow. But the storm gave them no time for leisurely movement. Large amounts of mine supplies were stalled and thousands of cattle and horses were snowed in and many of them perished. Some compensation is found in the fact that an unusually large amount of snow packed into the gulches and cañons will provide water for power and other mining and agricultural purposes in the summer.

Randsburg is Recovering from the slump in gold mining, which followed the recent boom in tungsten when the three camps of Randsburg, Johannesburg and Atolia had an influx of additional population that totaled nearly 3,000, two-thirds of whom were settled in and about Atolia. New dwelling houses were built in both Atolia and Randsburg and hundreds of tents were pitched between and along the line of the scheelite deposits. Everyone was apparently making money, but only apparently. Everyone was busy and a few made a great deal of money, in comparison to the amounts invested and the labor performed. Three men made approximately $100,000 each. Others went broke. Numerous owners of tungsten ground are holding on until the industry becomes settled, and the prospects are good for reasonable profit upon development and operation. The decline in price of tungsten from $75 to $30 and the dullness of the market made the business unattractive and when the price went below $30, even high-graders and ore thieves, who flourished for a while and helped to keep the camps wide open, vamosed. During the period of the tungsten boom the gold miners and leasers, and even owners, neglected the gold mines. And when the bottom dropped out, the more industrious got back to work and the prospects are fair for the reopening of the gold properties and maintaining the reputation of Randsburg as the greatest gold camp in southern California. The Yellow Aster, of course, was unaffected by the tungsten boom. The Atolia Mining Co. was greatly benefited, and even since the slump has been running the mill one 8-hr. shift in 24 hr. and sinking a new shaft. There are still a few individual miners producing tungsten. So altogether the region is still alive and on the map.

Mother Lode Striking Miners in Amador County are still out and are likely to remain so awhile. Unwarranted disturbance and effort to prevent one of the engineers of the South Eureka from going to his work have deprived the strikers of what little sympathy they had from the public and the newspapers. Injunctions were granted by the U. S. District Court at San Francisco against 28 of the strikers, enjoining them from committing violence and interfering with men desirous of resuming work in the Argonaut, Kennedy, South Eureka, Central Eureka, Bunker Hill and Fremont mines. John A. Kelly, deputy state labor commissioner and former president of the San Francisco Labor Council and member of the Machinists' Union of San Francisco, was ordered to show cause why he should not be enjoined from interfering with the operation of the mines. The mine owners and operators have given out no statements for publicity regarding the present status of the strike or their attitude toward the strikers and other miners interested. But it is not at all improbable that all of the mines closed down would begin operating immediately if the miners who were not responsible for, and not directly engaged in the strike, would make application for work. There is one thing quite certain, that the demand made by the strikers will not be granted. It is stated on fairly good authority, but the statement has not been admitted by the mine owners, that it was the intention of the owners and operators of all the mines affected by this strike to have increased the wages in January, 1917. One thing should be held in mind in connection with the refusal to consider a present demand for increased wages—each of these mines has within the past year been making improvements for the betterment of the condition of the men and for increasing the capacity of the property. This means a larger total number of men to be employed in 1917 and greater protection and increased comfort for the men themselves. But many of the men who brought about the strike are not inclined to appreciate anything that is done for their benefit or that leads to the employment of additional men. It is claimed by the strikers that they do not demand recognition of the union, although they are asking for a meeting of mine owners with the union for the purpose of arbitrating, and are demanding that no discrimination be shown when members of the union report for work. While there is no chance that the employers will recognize the union as an organization, they will not reject men who belong to the union, provided their action not only in the present trouble but their position prior to the strike is satisfactory. In other words, it is well understood that the mine owners and operators on the Mother Lode in Amador County will not permit any labor union or any set of men to conduct their business for them.

BUTTE—Oct. 28

Davis-Daly Will Break Even on operations for the current quarter. The previous quarter showed the usual deficit, amounting to $8,117. The management hopes to have the new hoisting engine in place by the first of the year, when the output may be doubled.

North Butte Property looks better today than it has in some years. Some excellent orebodies have been opened in the northern section of the property and one vein is yielding ore assaying 10% copper and 30 oz. silver to the ton. Fair progress is also being made in the development work on the east side properties owned by the company, and the discovery of a large vein of sulphide ore in adjoining property is considered one of the very hopeful indications.

Anaconda Zinc Plant at Great Falls far exceeds in its results the estimated capacity. Two of the five units have been in operation for some time. They were built for a theoretical output of 50 tons of zinc per day, but the actual output has been 60 tons for the two units, and have been working with entire satisfaction. There has been an unexpected delay in the delivery of some of the heavy electrical machinery, but the manufacturers have promised to hurry the work and it expected that the entire plant will be equipped and in operation by the first of the coming year.

A Road from Darby to Mineral Hill is being urged for the Mineral Hill District of Ravalli County. Under leadership of I Freimuth, of Duluth, efforts are being made to induce county officials to put county road into shape for motor-truck transportation to permit profitable exploitation of many promising mines in that district. Mr. Freimuth and associates have developed the Lent mine, near Alta, to a point where shipments of rich copper ore may be started as soon as roads are in condition. It is planed to build a concentrator at the mine to treat the lower-grade ore, of which, it is reported, large bodies have been opened up. All this is dependent on the building of the road, as without satisfactory transportation facilities the working of the mines in the district would not be profitable.

Butte & Superior Production of mine and mill for the first half of October is considerably larger than for the corresponding period in September. If the last half of the month makes as good a showing, the total amount of ore taken out at the Blackrock for October will reach 55,000 tons as against a tonnage of 50,150 tons in September. The concentrates record will pass the 15,000-ton mark as against 13,650 tons in September, while the production of zinc in concentrates will go above 16,000,000 lb. as against a little less than 15,000,000 lb. last month. Work on the No. 2 shaft, the smaller of the new ones, has been suspended. This shaft has a depth from the surface of 675 ft. and it also has three raises of 100 ft. each complete from lower levels. Work there will depend on the waste requirements. When additional quantities of waste can be used, additional raising will be carried on. The No. 3 shaft, the large new one, is now awaiting equipment. It is completely timbered to the 1,500-ft. level and is being used with a small hoist for the lowering and raising of men and supplies. It will probably be Jan. 1 before the new equipment is on the ground and work of installing it begun.

In Elkhorn Mining District the arrival of the power line installed by East Butte company in connection with that of the Montana Power company is expected to make possible the profitable exploitation of many of the mines in the district that have lain idle for years, due to the absence of cheap power. The East Butte company, of Butte, is shipping from its mine in the Elkhorn district considerable iron ore to various smelteries, where it is used for fluxing. The ore is said to contain besides the iron considerable quantities of gold. At the Rothfuss-Dickmann properties, a 10-stamp mill will be operated by electric power within a short time, to treat the output from the Montana and Dalcoast claims, where big bodies of ore have been blocked out. It is reported that the old Elkhorn mine and three large tailings dumps, comprising 250,000 tons, assaying from $2.50 to $15 gold, have been sold to Walker interests of Salt Lake, who will commence operations by the first of the year. At the Elkhorn-Bulwer property, development work is under way, which has opened up a body of copper ore averaging from 10 to 15% copper. At the Calumet, Elkhorn Queen and Golden Moss claims, all in the same district, preparations are being made to resume operations, made possible by the introduction into the camp of electric power.

Results of "Safety-First" Work in Butte Mines are encouraging. The accident record in the mines of the Anaconda Copper Co. for the month of August was the best since the inauguration of this work. Of the company's 27 mines, 13 did not have a single accident. For a total number of 331,169 shifts, the total number of accidents was 23. Notwithstanding the fact that 21 men were suffocated in the Pennsylvania mine fire of Feb. 21, a reduction of 23% has been made in the fatal and serious accidents during the first half of 1916. One of the chief reasons for this reduction is the fact that the foremen and shiftbosses of the various mines are in hearty coöperation with the officials of the "safety-first" department and are making constant efforts to educate the men under their supervision in taking care of themselves as well as of their fellow workers. The general rule now is to do things the safest instead of the easiest way, as was the practice heretofore, with the result that as much work is accomplished with a minimum of accidents.

GARY, IND.—Oct. 28

The New $5,000,000 Tinplate Mill turned out its first product on Oct 16. Construction was begun only last December, which makes as good a record as the Donora construction. These mills employ 2,000 men and have a payroll of $10,000 per diem.

SALT LAKE CITY—Oct. 27

Utah Copper Stock at $100.50, as recorded by New York sales, constitutes a new high-price record. Dividends started in 1908 with $1 per share, increased to $2 in 1909, climbed to $3 in 1910 and staid there till 1915 when $4.50 per share was paid. In 1916 the dividend is $8.50 per share. Dividends paid to date total $16,476,000 on 1,624,490 shares outstanding. Distributions in 1916 total $13,809,000—truly a remarkable record.

The Utah Apex Mining Co., of Bingham, recently filed an answer to the suit brought against it by the Utah Lead and Copper Co. The plaintiff alleged that the defendant had wrongfully entered its Susquehanna and Venice North Extension lode mining claims, and extracted ore to the value of $10,000. The answer denies that the Utah Apex has ever wrongfully entered upon such property or that it has ever appropriated ore of great or little value, or that it has ever threatened to encroach upon the property of the plaintiff, or that it intends to do so.

Utah Agricultural College Experiments recently made to determine the possibility of obtaining potash in commercial quantity from the ash of sage brush have attracted considerable interest. The investigation has been carried on under the direction of Professor C. T. Hirst and Professor E. G. Carter. Experiments are reported to show that a ton of sage brush ash contains from 82 to 275 lb. of potassium salt. There is talk of building a plant to treat sage-brush ash in this section.

American Fork District Mines and prospects which are expected to continue operations throughout the winter are: The Pacific, working [illegible] men; Dutchman, 15 men; Miller Hill Exploration, 8 [illegible], Mineral Flat, Texan, Belerophon, Red Cloud, South Park, Bay State, Whirlwind, Earl [illegible], Gold Hill, Major Evans and Silver Dipper. [illegible] mines and prospects will work until the first [illegible]. Power lines have been strung up the cañon [illegible] as the Pacific, which will use electric power in both mine and mill. Telephone [illegible] been made with various mines. [illegible] activity in the camp th[illegible]

DULUTH, MINN.—Oct. 30

Oliver Iron Mining Co. has announced that the Missabe Mountain property at Virginia will be stripped immediately. Fee to this property is owned by the State of Minnesota. While the area is 160 acres, only 80 are underlain by ore.

Northern Pacific Ry. will build a 600-ft. addition to its dock at Superior, Wis. The addition will be constructed of steel and concrete. The ore yards adjacent to the dock will also be enlarged. The dock, which receives only Cuyuna Range ore, will handle about 400,000 tons this season but anticipates shipments of at least 1,000,000 tons next year.

SPOKANE, WASH.—Oct. 28

Snowstorm Mines Construction Work and development is inducing activity among other companies operating in the region surrounding Troy, Mont. The district is reported to be the center of greater operations than at any time in its history. A large number of men are employed at the different properties and supplies and equipment are being sent in by the train load. The attention of investors is being attracted to the district, and engineers are scouring the country in search of promising holdings for sale. The Togo company, Ralph Smith and Robert Larter, owners, has started a tunnel now in 200 ft., and will be continued 600 ft. to reach an orebody that is 2 ft. wide at the surface and contains high-grade silver-lead ore and no zinc. Some of the ore runs 400 oz. silver to the ton. The construction of a flume to carry water to drive a compressor is nearly completed. Cabins and a road are being built by the L. & V. Mining Co., a Spokane corporation, in preparation for development throughout the winter. The property is a northerly extension of the vein system of the Big Eight, owned by Harry L. Day, of Wallace, and of the Snowstorm. The Silver Tip company, owned by Robbins & Wright, of Spokane, has let a $9,000 contract for 900 ft. of crosscutting that is expected to reach the vein at a depth of 600 ft. The shoot contains silver, lead and zinc. J. H. Ehlers, identified with the Sylvanite, a gold property, 20 mi. north of Troy, reports that operations to be started this fall will proceed through the winter. The company has ordered a carload of horses to haul lumber for the establishment of a large camp. Winter quarters have been completed by the Montana Morning, and drifting is in progress. The property is comprised of 12 claims, traversed by three parallel leads opened by several hundred feet of tunnel and two shafts. All of the veins show good assays in silver, lead and zinc. Development is being directed by William Hogan, of Spokane, who, with Bud Woods, of Troy, is the chief owner. The Snowstorm railroad crosses the north end of the group.

PHILADELPHIA, PENN.—Oct. 30

Wharton Steel Co. Iron Ore Tract—about 5,000 acres at Wharton, N. J.—is reported by the "New York Times" bought by J. Leonard Replogle, vice-president of the American Vanadium Co. The deal was made by representatives of the estate of the late Joseph Wharton and by Ernest Hillman, of J. H. Hillman & Co., of Pittsburgh. The purchase involved $10,000,000 worth of capital stock, all owned by the Wharton estate. It is reported that a corps of engineers will soon begin drill testing of the tract at Wharton to determine the actual quantity of ore reputed to be about 60,000,000 tons of magnetite ore. It is reported that expenditures running into the millions are contemplated for additions and improvements to the company plants.

JOPLIN, MO.—Oct. 28

Regular Presidential Election Furor over the question of a zinc-ore tariff is now in evidence. Democrats argue that a high tariff not only is not consistent with ideas of a big trade with foreign nations, but also that it would not help this section materially. Republicans argue that it would help definitely and declare zinc-ore prices are likely to go very low unless we are protected from Mexican zinc ore importations..

TORONTO—Oct. 26

A Party of Investors, including about 25 Canadians and Americans, mining engineers and others, including Gordon Crean, president, and E. A. Snowman, a director of the Davidson mine, left Toronto recently on a trip of inspection to the Porcupine camp and more especially to examine the Davidson.

The University of Manitoba, at Winnipeg, recognizing the growing importance of the mining industries of the province, recently opened a course of lectures in connection with its department of geology and mineralogy for the benefit of prospectors and miners. The course will embrace lectures on minerals, mining and prospecting, with practical work on minerals and their determination and also on fire assaying for which a laboratory has been fitted up.

War Tax Effect on the Mines is still an unknown quantity, the only mine so far that has had the matter settled being the Seneca Superior, which paid $15,000. This mine has since been closed down. The uncertainty is having a detrimental effect upon investors and upon the mining stocks. The government is much at fault for allowing this uncertainty to continue, as it is doing a great deal of harm to the industry. The tax which affects all companies in Canada having a capital of $50,000 or over, calls for 25% of the profits over 7%; that is, 7% would be allowed on the capital and the tax would amount to 25% of the profits over that amount. In the case of mining companies, however, it was stated that on account of the dividends being paid from the real capital, special consideration would be given to this industry, but so far no definite announcement has been made. It is understood that in the case of precious metal mines, the capital will be computed on the basis of five years' profits, and that depreciation at the rate of 10% a year will be allowed, and this will be deducted from the yearly profits before allowing the 25% tax on excess profits. To take a concrete example, the Dome profits may be taken at roughly $1,000,000. Capital based on five years' profits would be $5,000,000. The depreciation would be $500,000 and the 7% allowed on the $5,000,000 capital would be $350,000, or a total deduction of $850,000 from the $1,000,000 profits. The tax would therefore be 25% of $150,000, or $37,500. If this is correct, it is believed no exception would be taken to it, and there would be no further reason for timidity by the American investor in Canadian mining ventures. Such a tax would be no hardship and would in fact be so small that it would hardly be felt. It is, however, high time that a definite official announcement was made by the government on this important question, and the mining companies should no longer be left in the state of uncertainty now existing.

LONDON, E. C.—Oct. 28

Stratton's Independence, Ltd., recently held an extraordinary general meeting in London at which a momentous decision was reached. A resolution submitted authorizing the directors to participate in a Russian mining enterprise was lost—26 votes against and 17 in favor of the resolution. Having sold its famous Cripple Creek, Colo., mine some time ago, the directors will now take the necessary steps to place the company in voluntary liquidation forthwith.

The Mining News

ALASKA

ALASKA MINES CORPORATION (Nome)—Drill testing begun on 222 acres newly added to 1,860-acre former holdings. Tests on latter reported developed 165,000,000 cu.yd. averaging 37c. per yd. Estimated dredging cost, 13c. per yd.

ARIZONA

Gila County

MIAMI CONSOLIDATED (Miami)—Company well financed preparatory to development campaign. Property includes 62 claims embracing over 200 contiguous acres. Two churn drills ordered; double-compartment shaft sinking.

Mohave County

ARIZONA BUTTE (Oatman)—Reported shipping concentrates averaging $125 per ton. Driving tunnel to cut vein at minimum depth of 600 ft.

CRESCENT (Oatman)—Tunnel driven 500 ft. into formation changed from andesite to calcite probably indicating approach of vein. George Peirce, manager.

TOM REED (Oatman)—Important strike made at 400-ft. depth on Bald Eagle claim believed to extend known length of Aztec-Black Eagle vein by 2,000 ft. Locally believed vein may develop into greater mine than original Tom Reed workings on Ben Harrison claim.

BIG JIM (Oatman)—Reported crosscut ore 29 ft. thick assaying $8 per ton on 240-ft. level. Six crosscuts on 400- and 465-ft. levels all show over 26-ft. width ore assaying over $7 per ton exclusive of high-grade streaks. Orebody now developed over 700 ft. long and estimated about 500,000 tons blocked out.

UNITED EASTERN (Oatman)—Two-hundred-ton mill under construction will have crushing capacity 400 tons, cyaniding capacity 200 tons daily. Capacity thus easily enlarged by addition to cyanide department. Crushing done by Marcy and pebble mills; cyaniding done with continuous counter-current system.

Pinal County

MAGMA COPPER (Superior)—Reported strike of 21-ft. width ore averaging 9.8% copper on 1,500-ft. level resulted in sensational performance of stock market. First unit of zinc concentrator about completed.

Yavapai County

UNITED VERDE (Jerome)—Reported that steam-shovel operations will be introduced to mine low-grade copper ore northwest old smelter site. Louis S. Cates, manager Ray Consolidated, recently visited Jerome at company invitation to advise preliminary engineering work.

ARIZONA EXTENSION RAILROAD recently incorporated, with James S. Douglas, president, and directorate including E. O. Ellis, James P. Boyle, H. W. Williams, and S. P. Applewhite. Proposes building railroad from Clarkdale to Mesa running down Verde Valley and connecting with Jerome by 7-mi. branch line.

CALIFORNIA

Amador County

MIDDLE BAR (Jackson)—Surveyor Downs making survey preparatory to reopening.

HARDENBERG (Jackson)—Unwatering shaft and stopes below 600 level. W. J. Loring, manager.

LUCKY STRIKE (Pine Grove)—This and the De Soto, recently bonded to L. E. Bedford by F. A. Kimball, said to have been sold to Herbert Carmichael, of San Francisco. New hoist and compressor will be installed at 120-ft. shaft.

PLYMOUTH CONSOLIDATED (Plymouth)—In September tons of ore milled, 6,900; value, $44,621; total working expense, $25,352; total development, $6,717; surplus, $12,552; other capital expended, $8,628. Continuous operation of mine since reopening has induced reopening of other properties and caused numerous improvements in town.

Calaveras County

ANGELS DEEP (Angels Camp)—Foundations completed for compressor.

SULLIVAN (Mokelumne Hill)—M. J. Windler, manager of Mokelumne group, has taken bond and started development.

Kern County

WERINGER MINES (Woody)—Construction started on 100-ton flotation mill. Installation will include 200-hp. Western gas engine, 125-kw. Electrical Machinery Co. generator, Hardinge mill and K. & K. flotation cells.

CONSOLIDATED (Randsburg)—Recent disclosure of new $40 ore encourages resumption of milling. Wedge shaft still producing water steadily, company disposing of about 1,000,000 gal per month. Seth Tyler, superintendent.

Mariposa County

MARIPOSA GRANT is again under inspection by mining engineers E. H. Benjamin and Fred L. Morris, who accompanied Alden Anderson, Herbert Fleishacker, Mark Gerstle, Dr. Washington Dodge, A. Abrahamson, of San Francisco, on recent visit.

Placer County

RAWHIDE (Dutch Flat)—Mine reopened after two years' idleness by Cañon Mines Co. H. J. Sisty, of San Francisco, consulting engineer; employs 15 men.

Plumas County

ENGELS COPPER (Keddie)—For first six months' operation in 1916, gross earnings, $475,578; operating expenses, $249,454. Net income equal to more than 30% of par value of stock issued and 10% of the market value estimated on annual basis. Proposed to increase stock from $1,500,000 to $2,000,000. Mine and mill employ 300 men. Sufficient ore blocked out to insure 500 tons a day.

San Bernardino County

ATOLIA (Atolia)—The 100-ton mill running one 8-hr. shift every 24 hr. Few individual operators are mining scheelite in the Atolia district.

AMERICAN TRONA (Trona)—New mill operating, using Solvay process for extraction of potash and other products from Searles Lake brine. Old mill stands on lands controlled by Pacific Borax Co., who, it is reported, will install new mill on old site and also adopt Solvay process. Lands of borax company have no part in litigation pending regarding ownership of Searles Lake deposits.

Shasta County

YANKEE JOHN (Redding)—Reported that single shot disclosed pocket producing $1,500.

MAMMOTH (Kennett)—Stowell aërial tram completed and first shipment of ore to smeltery made recently. Tram operated between the Stowell and the Balaklala. Ore transferred to Balaklala tram, thence to railroad at Coram for transportation to Kennett.

NOBLE ELECTRIC STEEL (Heroult)—Three smelting furnaces reported operating continually to capacity producing manganese, chrome and silica. Ore supplied from San Benito, Shasta, Alameda and Mendocino Counties. Company developing chromic iron in Siskiyou County. Contract reported for shipment East of 250 tons ferromanganese per month until next May. Company employs 120 men. W. W. Clark, superintendent.

Tuolumne County

CONFIDENCE GOLD (Sonora)—Reported to have purchased from Herbert L. Rothchild, of San Francisco, Confidence group of claims and mill site and other adjoining properties. Property recently redeemed from state tax. Edward W. Jassen, manager.

COLORADO

Boulder County

CASH (Magnolia)—Will be reopened and developed under leasing system. Air compressor and machine drills installed.

PRUSSIAN (Boulder)—Development resumed under management Frank Tarbet. Remodeled mill in operation on ore mined from development and low-grade in old stopes.

Clear Creek County

MIXELL MILL (Idaho Springs)—Plant leased by E. J. Jones and will be operated as custom mill.

WYOMING VALLEY (Idaho Springs)—Tunnel recently advanced 100 ft. will be advanced additional 100 ft. by contractors Chapman & Smith. Tunnel within 200 ft. of Niagara vein.

SILVER HORN (Idaho Springs)—Has been secured under bond and lease by F. B. Wall, of New York. New plant of mining machinery will be installed and systematic underground development pushed. F. B. Hall, Jr., superintendent.

PHILADELPHIA (Georgetown)—Will reopen Hamill property on north slope of McClelland Mountain. The crosscut tunnel now in 700 ft. will be advanced and additional development done. Additional mining equipment will be purchased.

DENBIGH SILVER-LEAD MINES (Georgetown)—New organization incorporated by B. C. Catron, Jr., E. J. Nichols and J. T. Garrett, with a capital of $1,000,000, divided into 200,000 shares of $5 par value. Company will acquire and develop mining properties in Clear Creek County.

San Miguel County

GERTRUDE (Telluride)—Being developed by King & Farrell, driving drift on Modena vein with air drills.

BLACK BEAR (Telluride)—The 450-ft. shaft being widened to increase capacity. Electrically operated skip will be installed. Ore transported to Smuggler-Union mills, where 20 stamps are kept busy.

San Juan County

MAYFLOWER (Silverton)—Large pocket high-grade gold ore struck by Slattery & Mears.

BIG THREE (Silverton)—Active development pushed under direction of owner, E. J. Holman.

GREEN MOUNTAIN (Silverton)—Flotation equipment being installed in Cunningham Gulch mill.

NORTH STAR (Silverton)—Mill completely overhauled under direction of L. O. Bastion and now operating.

TOM TURNER (Silverton)—Lease secured by B. B. Allen and C. Fattor, who are installing mining equipment.

ELK (Silverton)—Being developed under direction of J. J. Cusick and has struck body of low-grade copper.

DORA (Silverton)—Contract to sink main shaft awarded to Clay Johnson and work under way with three shifts. During October, 10 cars ore shipped to Durango smeltery. E. P. Ricker, manager.

KLONDIKE (Silverton)—Recently purchased from Peter Carlson by R. E. L. Townsend and associates. Several mine buildings erected and new mining equipment installed. Small force engaged underground in development will be increased soon. Peter Carlson, superintendent.

CONNECTICUT

LANTERN HILL (Norwich)—This old silex mine to be reopened by New York men. Old grinding mill at Essex will be rebuilt and railroad siding laid.

IDAHO

Shoshone County

CALEDONIA (Kellogg)—President Stanley A. Easton reports September earnings at about $100,000 or about $10,000 more than for August. Search for faulted orebody continued from Keating tunnel.

REX CONSOLIDATED (Wallace)—Mill operation delayed by nondelivery of aërial tramway buckets. Official report gives available tonnage sufficient for 12 months mill supply 200 tons daily.

HIGHLAND-SURPRISE (Kellogg)—Important new orebodies opened by development. Concentrator producing 20 to 22 tons daily high-grade concentrates. Will install additional equipment to increase output. W. W. Papesh, manager.

AMERICAN COMMANDER (Mullan)—Tunnel cut stringers thought to indicate approach to orebody. Surface exploration developed orebody 20 to 40 ft. wide, 135 ft. long in which orestreaks carried up to 60 oz. silver besides galena and carbonates.

HECLA (Burke)—Development east vein exposed orebody 850 ft. long thought continuous 1,500 ft. high. No. 3 tunnel proved length from which 600 ft. upraise made on ore. Latest strike of 4-ft. solid galena orebody made on 900 ft. level 900 ft. below tunnel thought same orebody. Mine reserves reported practically doubled.

MICHIGAN

Copper

MAYFLOWER (Calumet)—Diamond drill exploratory work attended by success. Bad faulting of lode has resulted in problems but lodes now correlated.

VICTORIA (Victoria)—Sinking at shaft will be resumed soon as second skipway completed. Extensive exploratory work, in addition to mining, being outlined.

CALUMET & HECLA (Calumet)—No. 1 regrinding plant, formerly equipped with old style chilean mills, is to have Hardinge mills for regrinding sands. Each conical mill installed will replace two chilean mills.

FRANKLIN (Demmon)—Operating costs reported reduced from 21c. per lb. copper last January to 15½c. recently. Monthly production about 270,000 lb. Production for first eight months 1916 exceeds by 665,000 lb. entire 1915 production.

NEW ARCADIAN (Houghton)—Development progressing and station cut at 1,500-ft. level; drifts will be pushed east and west. At No. 2 shaft, drifts working north and south on veins show mineralization, but have not penetrated lode far enough to give much data.

KEWEENAW COPPER (Phoenix)—One stamp head working rock from mine stock pile but no official statements made as to how rich rock will average. Mining to be resumed immediately, will consist of drifting at sixth, tenth, twelfth and fourteenth levels.

MISSOURI

Joplin, District

CLERMONT (Galena, Kan.)—Resumed operations after several months shutdown.

LANGFORD & SCAFE (Joplin)—Drilling five tracts near Cardin. W. J. Scafe, Joplin, manager.

GOLDEN ROD (Commerce, Okla.)—About completed erection old Cramer mill, formerly at Cave Springs, upon lease near Cardin.

DAISY BELL (Aurora)—This and Aurora Consolidated installing electric equipment. Red Wasp installing own electric lighting plant.

C. S. & P. (Joplin)—Sinking new shaft on lease near Belville and penetrated 15 ft. rich dirt in soft ground. LeRoy Clayton, Joplin, manager.

MISSOURI MINES (Joplin)—Having good success operating old Quick Seven property at Alba as openpit property. Developed face pay dirt 145 ft. thick.

32ND PROSPECTING (Lincolnville, Kan.)—Reports good drill strikes on old Mission tract at level lower than formerly mined. Will drill other holes and develop.

MONTANA

Beaverhead County

BOSTON & MONTANA DEVELOPMENT (Wise River)—Spain mine, in French Gulch, closed down for winter and 35 men laid off. Heavy snowfall prevents ore transportation to Washoe smeltery. Operations will be resumed later.

Jefferson County

BOSTON & CORBIN (Corbin)—Flotation results attracting attention. Unit treats tailings from concentrator, running about ¾% copper and makes concentrate carrying 13.1% copper and 9.9 oz. silver. Concentrator treated during October about 100 tons per day. Expected that further improvements will increase both capacity and recovery.

Lewis and Clark County

SCRATCH GRAVEL (Helena)—Announced strike made in shaft at depth of 250 ft. of vein from 8 to 30 in. wide, carrying 70% lead, 80 oz. silver and $12 gold per ton. Alongside of galena, oxide of iron occurs, carrying from 3 to 10 oz. gold. Ore being sacked for shipment to smeltery. Five distinct veins exposed, expected to merge into one at depth. Further strikes of high-grade ore, assaying hundreds of dollars per ton, have caused rush into district.

Mineral County

TARBOX (Saltese)—Will start ore shipments Jan. 1, 1917. Shaft down nearly 600 ft., where station will be cut, pumping equipment installed, and crosscut run about 180 ft. to strike vein. Power drills and compressor plant recently installed. Mine buildings under construction.

INTERMOUNTAIN MINING (Superior)—Operations netting about $17,000 per month. About 15 cars ore and concentrates shipped per month from which smelter returns amount to between $1,800 and $2,000 per car, while operating expenses approximate $6,000 per month. New oreshoots found which will materially add to company's ore reserves. Copper contents are from 2½ to 10% per ton.

Missoula County

ROYAL MINING CO. (Clinton)—Recently incorporated to work Charcoal mine near Clinton on Northern Pacific Ry. Machinery to be installed to sink to 100 level. Charcoal vein 4 ft. wide with 2 ft. paystreak, carrying high values in gold and silver.

Silver Bow County

BUTTE & SUPERIOR (Butte)—September report filed in compliance with orders incident to Minerals Separation Co. litigation shows flotation section of mill treated 18,810 tons, resulting in 12,694 tons concentrates, valued at $18.60 a ton; cost of flotation, $5.17 per ton concentrates.

GREAT BUTTE COPPER (Butte)—Completing surface plant preliminary to beginning active operations. Shaft unwatered to 230 ft. and timbers found in good condition. When completed, company expects to do considerable development on property, heretofore known as Butte & Bacorn holdings in northern section of district.

EAST BUTTE EXTENSION (Butte)—Leasers on company's property recently shipped car of 52 tons copper ore, netting $1,851. Ore assayed close to 10% copper. Another 50-ton shipment will soon be made assaying 6% copper. Company plans sinking No. 6 shaft from present bottom level at 240 ft. to 800 ft., where crosscutting will be started.

EAST BUTTE (Butte)—Recent shipment of 11 cars copper started rumors of dividend to be paid stockholders before end of year. Upon payment for shipment, company will have more than $1,500,000 cash which, it is expected, directors will consider ample to pay dividend and retain funds to carry on current work. September production showed slight falling off from preceding month, but total production for nine months amounted to 13,803,000 lb. copper.

NORTH BUTTE (Butte)—In quarter ended Sept. 30, produced 5,954,685 lb. copper or close to average of 2,000,000 lb. a month. Silver production amounted to 247,833 oz. and gold to 1,000 oz. Surplus and reserve Sept. 30, $4,789,360, showing increase over $900,000 in nine months, in addition to increase of dividend rate. Predicted that by Jan. 1 surplus will be above $5,000,000 mark. Profit for quarter was $587,421, for first nine months more than $1,600,000.

ANACONDA COPPER (Butte)—Recent development on 2,800 level of Leonard mine opened up high-grade ore, said to be 20 ft. wide and assaying 6¾% copper. Orebody, so far as known, not opened anywhere else in mine, so exploration on other levels may encounter new lead and add to ore reserves. From Douglas mine, in Coeur d'Alene district, Idaho, operated under lease and bond, reported that preparations being made for ore shipments to zinc plants at Anaconda and Great Falls. Large amounts zinc ore on dump and in mine ready to be stoped soon as shipments can be undertaken. To provide for heavy freight and ore traffic on Butte, Anaconda & Pacific Ry. six new electric engines and 200 steel dump cars ordered. Several old steam engines temporarily put in commission to take care of increased traffic.

NEVADA

Esmeralda County

LOU DILLON (Goldfield)—As result of core drilling west of Columbia Mountain fault, plans under way to reorganize company.

SPEARHEAD (Goldfield)—Shaft down 850 ft. New 1,400-ft. cable installed and sinking will continue to latite-shale contact. Northerly drift being run on 450-ft. level to get under ore exposed in old Wheeler lease.

BLUE BULL (Goldfield)—Drifting on veins encountered during past year's development has yielded encouraging assays but no ore in commercial quantity. Placing larger pump and water column at main shaft completed and driving east crosscut 700-ft. level resumed.

Humboldt County

HUMBOLDT COUNTY TUNGSTEN (Lovelock)—Expect new mill at Toulon in operation by Nov. 7, 90 days from construction start.

ROCHESTER MINES (Rochester)—Stated 6-ft. $50 ore recently encountered north end old Four J workings. Expect to start construction work on aerial tram early in November.

ADELAIDE MINE (Golconda)—Property recently taken over by Yerington Mountain Copper Co. Shipping car per week averaging about 5% copper, expect to increase shipments in near future.

Lincoln County

GROOM MINE (Pioche)—Now hauling to Indian Springs station with caterpillar tractor and trailers. Initial trip 23 tons. Expect to [illegible] tons with six trailers.

Mineral County

NEVADA CHAMPION COPPER (L[illegible])—Plans completed for construction of [illegible] by Charles P. McColm, vice-president, and John C. Skuse, consulting engineer, at [illegible] office. Holdings include 320 acres [illegible]

Parrot mine; owned for past five months during which reported shipped $45,000 worth ore paying for mine from proceeds.

Nye County

TONOPAH ORE PRODUCTION for week ended Oct. 21 was 9,864 tons valued at $193,492, compared with 8,855 for week previous. Producers were: Tonopah Belmont, 2,843 tons; Tonopah Extension, 2,380; Tonopah Mining, 2,100; Jim Butler, 1,150; West End, 731; Rescue-Eula, 241; Halifax, 157; North Star, 50; miscellaneous leases, 212 tons.

JIM BUTLER (Tonopah)—September profit was $37,107 from shipment of 3,552 tons to Belmont plant at Millers.

TONOPAH MINING (Tonopah) — September profit $62,770 from treatment of 8,095 tons averaging $17.25 per ton; 150,780 oz. bullion produced valued at $131,595.

TONOPAH BELMONT (Tonopah)—Profit for September was $93,036 from treatment of 11,304 tons ore. Bullion production 2,277.97 oz. gold, and 199,196.33 oz. silver.

TONOPAH DIVIDE (Tonopah) Control purchased by H. Cal Brougher. Claims lie about 8 mi. south of Tonopah near Goldfield road. Property intermittent producer since early days.

ROUND MOUNTAIN (Round Mountain)—During high water from Mar. 1 to July 1, 142,600 yd. of gravel hydraulicked yielding $48,176, or 33.8c. per yd. Estimated complete cleanup will bring total recovery for block to 50c. per yd. Gravel estimated $2.60 per yd. being hauled to sluices with teams and scrapers.

Storey County

ANDES (Gold Hill)—Saved 44 cars ore from development on 350 level.

UNION CONSOLIDATED (Virginia)—Extracted from 2,500 level 16 cars ore, averaging $18.43 and 21 cars, averaging $19.85.

OHIO

TRUMBULL STEEL CO. (Youngstown)—Announced contract let for five 100-ton openhearth furnaces, 40-in. blooming mill and bar mill, six sheet mills and two jobbing mills, all to be finished within one year.

SOUTH DAKOTA

Custer County

OLD MIKE (Custer)—Compressor plant being moved to Harr and Foye ground near Pringle. Expected regular mica shipments made to Chicago commencing Nov. 1.

Lawrence County

WASP NO. 2 (Flatiron)—Tungsten mill closed but gold mill running steadily.

GENERAL MERRITT (Galena)—Lessees taking out lead-zinc-silver ore shipped to Globe smeltery, at Denver.

REPUBLIC (Maitland)—Burns & Sanford, lessees, have added night shift to crew. Mine product shipped to Trojan mill.

MONARCH (Deadwood) — Lessees extracting satisfactory tonnage of $60 to $75 gold ore and piling milling-grade on dump.

NEW PURITAN (Deadwood)—Drifting at 160 ft. depth to intersect high-grade now in progress. Before starting milling new electric hoist will be installed.

CUSTER PEAK (Roubaix) — Shaft sinking started. Depth of 500 ft. will be attained before lateral work undertaken. Good copper prospects found at 250 ft.

ELK MOUNTAIN (Trojan)—Plant treating nearly 100 tons daily and leasers well satisfied with returns. Large orebody opened up and continued operations assured.

TWO JOHNS (Trojan)—Lessees have had electric power line constructed from Reliance mill substation to portal of tunnel. Power used to drive compressor and hoist.

Pennington County

HILL CITY PRODUCERS (Hill City)—Plant in operation on tin ore from Cowboy and adjoining leases. Tungsten ores will also be concentrated.

NEW GOLDEN WEST (Rochford)—Crosscut tunnel penetrated 177 ft. vein matter, a tremolite characteristic of surface ores. Drift started southerly, near footwall, and vein will be crosscut 150 ft. south of present tunnel.

TENNESSEE

Polk County

TENNESSEE COPPER (Copperhill)—Reported in reorganization plans published that over $2,500,000 has been spent since Jan. 1, 1915, for improvements and new construction exclusive of trinitrotoluol plant expenditures. Construction now largely completed.

UTAH

Beaver County

COMMONWEALTH (Milford)—Five feet ore carrying copper opened in drift north from Andes tunnel. Property adjoins Moscow on south. G. S. Wilkin, superintendent.

CREOLE (Milford)—Lessees working property during past season made good production. Company since reorganized and to be worked on company account. Larger force to be used. J. M. Reynolds, manager.

ANTELOPE STAR (Milford)—Iron and manganese carrying small amount lead opened in winze below tunnel level. Old shaft being cleaned out, will be carefully examined with view to continuing development.

UTAH LEASING (Newhouse)—Company handling large dump of Cactus tailings, treating between 625 and 650 tons daily will increase production within next month to 700 tons. Satisfactory saving made.

MOSCOW (Milford)—Zinc ore being shipped is coming from surface workings and levels extending as far down as 700. Three lots of 100 tons each shipped, averaging from 30 to 33%, since beginning shipments of ore of this character.

Juab County

SHIPMENTS for the week ended Oct. 20 amounted to 204 cars, compared with 197 cars in week preceding. Larger shipments of low-grade siliceous ores are received by smelteries, with resulting greater activity in Tintic section.

TINTIC STANDARD (Eureka)—Eight teams hauling ore—output about 30 tons daily. New shaft to be sunk to 1,300 level at point 1,700 ft. northeast of old shaft. E. J. Raddatz, manager.

MAMMOTH (Mammoth)—Production in neighborhood of 15 cars weekly, ore coming from 400, 600, and from as far down as 1,500 level. September shipments, 59 cars; 130 men employed and production being increased.

LEHI-TINTIC (Eureka)—New four drill compressor in successful operation. Electricity obtained from Utah Power and Light line at 5,000 volts. Two shifts working on lower tunnel, where low-grade silver-lead-iron ore opened.

ETNA (Tintic Junction)—Property in Erickson mining district in west Tintic taken over by Salt Lake men. Capitalization, 500,000 shares, par value 10c., 200,000 shares in treasury. J. H Manderfield, president. Ore showing galena exposed in old workings.

TINTIC MILLING (Silver City)—Installation of roasters to be completed by Nov. 1, and additions to tanks and leaching department finished shortly after. Expected to have capacity 350 tons a day. September cleanup brought about $18,000. George Dern, general manager.

Salt Lake County

ALTA CONSOLIDATED (Alta)—Two cars lead-silver ore shipped.

SILVER SHIELD (Bingham)—Lessees opened 2 ft. ore running well in lead and silver.

MICHIGAN-UTAH (Alta)—Despaine lease on Solitude tunnel workings shipped 60 tons ore.

COTTONWOOD KING (Salt Lake)—Copper-bearing rock opened by lessees. Vein from 3 to 5 ft. wide. Mine in Big Cottonwood.

EMMA COPPER (Alta)—Shaft from Bay City tunnel unwatered to depth of 35 ft. below 125-ft. level in week's pumping.

KARNS TUNNELING MACHINE (Salt Lake)—Annual metting held recently. J. R. Belcher elected president. Karns machine reported to be working successfully in Montana-Bingham tunnel at Bingham.

LUCKY SIX (Bingham)—Recently organized in Salt Lake to operate claims adjoining Utah Apex, Jay Gould, Alamo, and Quinn properties. New tunnel from Cottonwood Gulch in 150 ft. Fissure cut carrying copper.

OLD EMMA LEASING (Alta)—Incorporated recently with capitalization, $200,000. Organized by G. G. Rice and associates to take over 13 months lease on Old Emma at Alta. Incorporators are: N. P. Caffie, H. T. Farrow, C. M. Egner and T. L. Mitchell.

UNITED STATES SMELTING, R. & M. (Salt Lake)—Earnings for September fortnight and first half October running about 100% ahead of July and August, at rate of $800,000 and $900,000 per month as compared to about $400,000 monthly in the two summer months.

MIDVALE MINERALS (Midvale)—Mill recently erected to treat tailings from old United States wet concentrator has begun operating. Flotation used. Two cars lead-zinc concentrates shipped recently. George Sheldon, president; G. D. Hansen, vice-president and general manager.

CARDIFF (Salt Lake)—Arrangements made for winter work. In addition to modern boarding house, built separate bunk houses for each shift, so one set miners will not disturb another. Production kept at about 100 tons daily despite haulage difficulties. Ore hauled by motor trucks and teams. Mine in Big Cottonwood.

Summit County

PARK CITY shipments for the week ended Oct. 20 amounted to 2,295,320 lb. by five shippers, stormy weather being responsible for smaller shipments than previous week.

NEW QUINCY (Park City)—Ore in western workings widened out to 3 ft., and is making out into bedding of limestone.

SILVER KING CONSOLIDATED (Park City)—New tunnel in 600 ft., and daily progress of 8 ft. being made. New tramway sufficiently completed for hauling coal to mine, but ore not hauled yet. Remodelled 50-ton mill nearly ready for use.

Utah County

PACIFIC GOLD (American Fork)—New 60-ton concentrator expected operating Nov. 1 to handle lead-silver and silver-copper low-grade. Electric power line construction proceeding rapidly.

WISCONSIN

SUPERIOR—Effort will be made to have legislature pass tonnage tax on iron ore. Bill calls for 10c. a ton, with additional charge of 2c. per ton on ore shipped through Ashland and Superior. This would give Superior about $400,000 a year and Ashland about $100,000. It is believed state lacks power to tax ore in transit and fight will be made against passage. Bill will be introduced by Senator F. A. Baxter, of Superior. Tonnage tax which was passed several years ago in Minnesota was vetoed by governor. He maintained legislature did not have power to levy both ad valorem and specific taxes on same property.

WYOMING

Park County

MIDWEST SULPHUR (Cody)—Reported discovery sulphur cave confirmed. Estimated 75 to 100 tons pure sulphur in sight. Real value of find thought to be in chance of connecting with other caves.

CANADA

British Columbia

FLORENCE SILVER (Ainsworth)—New 300-ton concentrator expected finished 60 days.

Ontario

ORE SHIPMENTS OVER THE T. & N. O. RY. for September, 1916, were: From Cobalt, Beaver, 35 tons; Coniagas, 79; Cobalt Comet, 31; Crown Reserve, 46; Hudson Bay, 30; Kerr Lake, 47; La Rose, 91; Mining Corporation of Canada, 38; McKinley-Darragh, 130; Nipissing, 615; O'Brien, 33; Penn. Canadian, 83; Right-of-Way, 20; Temiskaming, 41; Trethewey, 44 tons; total, 1,368 tons. From New Liskeard, Casey Cobalt 27 tons. From Elk Lake, Miller-Lake-O'Brien, 20 tons. Total silver ore shipments, 1,415 tons. From Porquis Junction, Alex (nickel), 384 tons.

PLATT (Porcupine)—Under option to Coniagas, reports satisfactory development.

ADANAC (Cobalt) — Raise completed; shaft down 325 ft. will be sunk 100 ft. further.

COBALT LAKE (Cobalt)—Taking out practically pure silver from new discovery in fault.

CROWN RESERVE (Cobalt)—Struck 3-in. vein on 250-ft. level stated to carry about 2,500 oz. silver per ton.

WRIGHT-HARGRAVES (Kirkland Lake)—Vein 10 ft. wide found on surface reported to assay $50 per ton.

NIPISSING (Cobalt)—Recently made two important discoveries, one in vicinity of Meyer shaft, other in Cobalt Lake fault.

MAIDENS MACDONALD (Porcupine)—Underground work stopped pending installation of plant. Property under option to La Rose.

DOME (Porcupine)—New main working shaft in operation. Despite reports to contrary, open cuts will be operated throughout winter.

LAKE SHORE (Kirkland Lake)—Construction 50-ton mill postponed. Mine developed to 300-ft. level with fair grade ore continuously.

CALUMET & MONTANA (Cobalt)—Promising vein cut in east drift at 60-ft. level. At 90-ft. level, 210 ft. crosscutting done toward vein extension of Nova Scotia.

TOUGH OAKES (Kirkland Lake)—Action to decide legality of present board of directors to be taken in Haileybury soon. Profits for last quarter practically twice dividend requirements.

PORCUPINE CROWN (Timmins) — Diamond drilling being done on 500-ft. level to pick up vein running in from Dominion. Large ore tonnage being blocked out on 900-ft. level.

DOME LAKE (Porcupine)—Mill will be completed in week. When running may make expenses but cannot be expected to do much more. Reported that stock market is manipulated and company should be viewed with considerable suspicion.

HAMILTON MOLYBDENUM ALLOYS (Norland)—No. 2 mine in Halburton County will be developed on large scale. James Harrison, managing director, superintending machinery installation. Reported refinery will be erected.

McKANE (Kirkland Lake)—Shaft sunk to 400-ft. level where station being cut. Dump contains 500 tons ore averaging about $10 per ton. Management estimates about $300,000 ore blocked out. A 10-drill compressor being installed and a new boiler will be put in.

HOLLINGER (Porcupine) — Stated to have evolved a double-tray Dorr thickener giving entire satisfaction. Found impossible to so construct former tanks that they would carry weight. New tanks have opening in bottom of top tray and hydrostatic pressure takes care of weight. Found that thickened material in top tray descends into lower tray in form of a cone without disturbing solutions, and possible to take clear solution from bottom section of tank as well as from top section. Capacity of this type practically 100% greater than that of tanks having single trays.

The Market Report

Metal Markets

NEW YORK—Nov. 1

A very large business, estimated at 85,000,000 lb., was done in copper, the market position of which became stronger. Good business was done in lead and zinc, without much change in price, but zinc was stronger.

Copper, Tin, Lead and Zinc

Copper—A very large business was done, sales by producers being estimated at 85,000,000 lb., compared with about 30,000,000 in the previous week. There was a little export business done, but the great bulk was done with domestic manufacturers—both wire drawers and brass makers figuring largely in the market. Indeed, most of the principal manufacturers appear to have been buyers. The major business was for delivery in January, February and March, and was done at first at 27½c., r.t., then at 27¾c., r.t. On Nov. 1, one of the largest sellers raised its asking price. Scarcely any business for November-December delivery was done, supplies being practically unavailable. January copper is also becoming scarcer. Quotations for special deliveries are about as follows: November, 28¾@29c.; December, 28½@28¾c.; January, 28@28¼c.; all regular terms. Early in the week a round lot for January delivery was sold at 28c., r t., but later that position became stronger, as did all others.

A noteworthy feature of the week was rather large sales for deliveries far ahead in 1917, even to the end of the year. Manufacturers arranged for such supplies by outright purchase and also for deliveries to be settled for at average quotations.

Copper Exports from New York up to Oct. 28 were reported at the Custom House at 21,750 gross tons.

Copper Exports from Baltimore for the week included 4,912,309 lb. copper to Great Britain; 250 tons brass plate and disks to Italy.

Copper Sheets, base price, nominally 37½c. for hot rolled and 38½c. for cold rolled for delivery at mill convenience. Earlier deliveries mainly on toll basis. Wire 32@32½c., nominal.

Tin—This market was rather quiet, spot tin at the opening was 42c., and at the close, 41⅞c. Futures were 41½c., at the opening, and 41c. at the close.

Lead—A good business was done at unchanged prices. Canada continued to be a buyer, but otherwise, no special export business was reported.

Spelter—A fair volume of business in common spelter was done, there being buying from miscellaneous quarters, including more or less by speculators, but not much demand from galvanizers. The demand was chiefly for early deliveries, producers finding it difficult to place as much as they would like for forward delivery. A large business was done in brass special at about 10½c., this being for metal guaranteed 99.4% zinc. It is noteworthy that the differential between prices for common spelter and brass special has now contracted to what is only a little more than has often prevailed in normal times. A similar contraction in the differential between common spelter and high-grade is to be noticed. On Oct. 26 a lot of 878,000 lb. of metal guaranteed 99.9% zinc was publicly offered to the Government at 15c., delivered at Eastern navy yards.

A consumer of spelter offered the interesting explanation that he was buying because zinc shares were going up in Wall St. In Wall St. they said that zinc shares were going up because spelter was rising.

L. Vogelstein & Co. sent the following letter to the trade under date of Oct. 26: "In view of the car shortage condition existing throughout this country and the movement on the part of the various railroad companies to increase the minimum carlot from 50,000 to 60,000 lb. for spelter and presumably for copper and lead, we will in future make sales in 30-ton lots instead of 25 as heretofore. However, we are perfectly willing to sell you 25-ton lots with the understanding that in the event of the railroads charging any additional freight on account of our shipping less than the minimum of 60,000 lb. you will assume this extra freight. We are advising you of this change at this time because the railroads have the right to ask the Interstate Commerce Commission for permission to publish the new minimum carload rate upon giving five days' notice and it lies within the jurisdiction of that Commission to grant such request."

Zinc Sheets—The base price was advanced 1c on Oct. 26 to $16 per 100 lb., f.o.b. Peru, Ill., less 8% discount.

Other Metals

NEW YORK—Nov. 1

Aluminum—Demand continues good and supplies small. Quotations are 64½@66c. per lb. for No. 1 ingots, New York.

Antimony—This market remained unchanged at 13@14c. Sellers are firm and it is noteworthy that importers are holding for higher prices.

Quicksilver—Market steady at $80 per flask. San Francisco reports, by telegraph, $75@76, market dull.

Nickel—Market steady and unchanged at 45@50c. per lb. for ordinary forms; with 5c. premium for electrolytic metal.

Exports from Baltimore for the week included 67,591 lb. shot nickel to Liverpool; 31,946 lb. cupronickel to Italy.

Gold, Silver and Platinum

NEW YORK—Nov. 1

Gold—Gold shipments continue to come to New York from Ottawa. The largest consignment received in one day was on Oct. 27, when $15,000,000 arrived in bars. Other large arrivals were reported every day in the week.

Platinum—Market was a little firmer. On Nov. 1 the U. S. Assay Office was reported as selling 600 oz., at about $90.50. We quote $90@91, but some important refiners are asking more.

Silver has advanced ¼d. in the last few days, owing to an improvement in the Eastern Exchanges. China has been buying via San Francisco. As an indication of the increase of circulation of silver in some of the European countries and reduction of volume in their respective treasuries, it is pointed out that silver in Bank of France July 30, 1914, was £25,000,000; Sept. 28, 1916, £13,473,000; in Bank of Germany, Aug. 31, 1914, £4,114,000; Aug 31, 1916, £1,263,000. No silver coin is held for security of notes of Bank of England.

Mexican Dollars were quoted in New York Oct. 26 and 27 at 51⅞@54⅛c.; Oct. 28 and 30 at 52@55c.; Oct. 31 at 52¼@55¼c.; Nov. 1 at 52½@55½c. Supplies only moderate.

Zinc and Lead Ore Markets

Platteville, Wis., Oct. 28—Quotations of the district are, according to the following figures: Base price per 2,000-lb. ton for material assaying 60% zinc is $65 for premium ore down to $63 for medium grades. For material assaying 80% lead ore the base price per 2,000-lb. ton is $80@82. Shipments for the week were 2,804 tons of zinc ore, 70 tons of lead ore, and 925 tons of sulphur ore. For the year to date, the figures are 106,726 tons of zinc ore, 3,648 tons of lead ore, and 26,206 tons of sulphur ore. Shipped during the week to separating plants, 2,901 tons of zinc ore.

Joplin, Mo., Oct. 28—Price quotations per 2,000 lb.: Blende, high, $77.40, 60% zinc, premium ore, $75.50; medium grades, $71@70; low, $68. Calamine, per ton, 40% zinc, $15@38. Average selling price, all grades of zinc, $62.48 per ton, lower on account of heavy calamine shipment. Lead, high prices, $87; base, $87@80. Average selling price, all grades of lead, $82.47 per ton. Shipments of the week: Blende, 7,542 tons; calamine, 1,085 tons; lead, 1,300 tons. Value, all ores the week, $647,250; ten months, $30,733,610.

Final merger of Granby into American Zinc has been locally effected, ending with the month the existence of Granby as a separate entity. With the last five weeks of Granby existence, 5,000 tons of ore were purchased under that name, and it was purchased before the advances brought the market up to the present level—was what is termed a "good buy."

The local electrical company has restricted the use of 5,000 hp. on account of the low water stage in the streams from which power is derived, and lack of water for concentration, and an unusual shortage of coal cars is working against an increase in ore production. It is estimated by some to have lowered production 1[illegible]. Heavy shipments of calamine were made and heavy shipments will be made next week, practically wiping out the surplus of this grade of ore.

Other Ores

Manganese Ore is still quoted at 70@75c. per unit at Tidewater, for Indian and Brazilian ore.

British Imports of Manganese Ore, nine months ended Sept. 30, were 209,814 gross tons in 1915, and 348,394 in 1916; increase, 138,580 tons.

Pyrites Imports in Great Britain, nine months ended Sept. 30, were 659,695 tons in 1915, and 761,210 tons in 1916; increase, 101,515 tons.

Molybdenite—Charles Hardy reports as follows: "The position of molybdenite becomes more and more interesting on account of the increasing demand, and the new buyers of the ore who have appeared of late in this market. Contracts for ferromolybdenum have been closed to cover the

SILVER AND STERLING EXCHANGE

Oct.	Sterling Exchange	Silver New York, Cents	Silver London, Pence	Oct. Nov.	Sterling Exchange	Silver New York, Cents	Silver London, Pence
26	4.7569	67⅛	32⅛	30	4.7569	67⅞	32⅜
27	4.7569	67⅛	32⅛	31	4.7569	68⅛	32½
28	4.7569	67⅛	32⅛	1	4.7569	68⅛	32½

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine.

DAILY PRICES OF METALS IN NEW YORK

Oct. Nov.	Copper Electrolytic	Tin Spot.	Lead N. Y.	Lead St. L.	Zinc St. L.
26	27 @27¼	42	7.00	6.90 @6.92½	9.87½ @10.00
27	27 @27¼	42	7.00	6.90 @6.92½	9.87½ @10.00
28	27¼ @27½	42	7.00	6.90 @6.92½	9.87½ @10.00
30	27¼ @27½	42	7.00	6.90 @6.92½	9.87½ @10.00
31	27¼ @27½	41.90	7.00	6.90 @6.92½	10.00 @10.25
1	27¼ @27¾	41¾	7.00	6.90 @6.92½	10.00 @10.25

The quotations herein are our appraisal of the average markets for copper, lead, spelter and tin based on wholesale contracts for the ordinary deliveries of the trade as made by producers and agencies; and represent, to the best of our judgment, the prevailing values of the metals, reduced to basis of New York, cash, except where St. Louis is basing point.

The quotations for electrolytic copper are for cakes, ingots and wirebars. Electrolytic copper is commonly sold at prices including delivery to the consumers and is subject to discounts, etc. The price quoted for copper on "regular terms" (r.t.) is the gross price including freight to the buyer's works and is subject to a discount for cash. The difference between the price delivered and the New York cash equivalent is at present about 0.25c. on domestic business. The price of electrolytic cathodes is 0.05 to 0.10c. below that of electrolytic. Quotations for lead represent wholesale transactions in the open market for good ordinary brands. Quotations for spelter are for ordinary Prime Western brands. Only St. Louis price is given, St. Louis being basing market. We quote New York price at 17c. per 100 lb. above St. Louis.

Some current freight rates on metals per 100 lb. are: St. Louis-New York 17c., St. Louis-Chicago, 6.3c.; St. Louis-Pittsburgh, 13.1 cents.

LONDON

Oct. Nov.	Copper Standard Spot	Copper Standard 3 Mos.	Copper Electrolytic	Tin Spot	Tin 3 Mos.	Lead Spot	Zinc Spot
26	124½	119½	144	182½	183½	30½	54
27	124½	119½	143	181½	182½	30½	54
28							
30	125	120	143	181½	183	30[illegible]	[illegible]
31	124	119½	142½	180½	182	30[illegible]	[illegible]
1	124	119½	142½	180½	181½	30[illegible]	[illegible]

The above table gives the closing q[illegible] London Metal Exchange. All pri[illegible] ar[illegible] sterling per ton of 2,240 lb. Copper [illegible] electrolytic are subject to 3% discount. [illegible] ience in comparison of London pri[illegible], [illegible] sterling per 2,240 lb., with American pri[illegible] per pound the following approximate r[illegible] reckoning exchange at 4.8[illegible] £15 [illegible] 4.29c.; £30 = 6.43c.; £40 = 8.57 [illegible] Variations, £1 = 0.21½c. [illegible] whole of 1917, and if an adequate supply of ore can be guaranteed, a further very large quantity could be booked far ahead into 1917. Ferromolybdenum has changed hands during this week at $4 per lb. of molybdenum contained. The ore remains at the nominal price of $1.70@1.80 per lb. MoS_2."

Tungsten Ore—A rather large business was done at $16@17, the lower price for ordinary material, and the higher price for the better grade.

Charles Hardy, under date of Oct. 31, reports as follows: "The business during October has been on a very large scale and the stocks in New York and Pittsburgh have been reduced considerably. As a consequence, some of the largest interests have advanced their prices to $18, and though no business has as yet been done at that figure, which came into force on Oct. 30, the prospects are that before long that price will be readily paid. I understand that snow interferes already with the production in the West to some extent, and as practically all the tungsten now afloat from abroad has been sold prior to its arrival, there is little fear that the quantities which are expected during this and the coming week will depress our market. The inquiry from abroad for ore and ferro continues and again several contracts have been closed for shipment."

Iron Trade Review

NEW YORK—Nov. 1

The statement of the Steel Corporation on another page shows the great expansion of the steel trade during the present year in a striking way.

The main point in the present week is the runaway market in pig iron. All sorts of advances are now asked, and buyers seem to be more anxious about securing the metal they want than about the prices they pay for it.

It is anounced that J. L. Replogle of the Vanadium Steel Co. has arranged to buy from the Wharton Estate the stock of the Wharton Steel Co The property covered includes extensive holdings of iron ore property in New Jersey, coal lands in Pennsylvania and Ohoi and some blast furnace capacity.

PITTSBURGH—Oct. 31

An unprecedentedly sharp rise has occurred in pig iron, bessemer, basic and foundry being up $2 a ton in the week, with some sellers quoting further advances. Billets and sheet bars are quotably higher after two months of practically stationary prices. Finished steel prices are distinctly higher in many instances, but market prices are not quotable as sharply as formerly as mills are reserved about selling and frequently quote different prices on orders that would usually be regarded as of equal acceptability.

The whole steel market is in the throes of another general and large advance, apparently, similar to that which occurred in the first three months of this year. The mills realize that the market is in a dangerous position, on account of the high prices, but that has been the case since early in the year.

Outputs in October have been very large at all the mills, and the majority have broken their best month's record. Car shortages this week are the worst yet experienced and are curtailing shipments.

Pig Iron—Sales of fair-sized tonnages of bessemer, basic and foundry iron have been made at $2 a ton above minimum quotations of a week ago and the market is higher by that amount, with some sellers asking further advances. We quote: Bessemer, $26@27; basic, $22@23; foundry and malleable, $23@24; forge, $22.50@23, f.o.b. Valley furnaces, 95c. higher delivered Pittsburgh.

Snyder October Valley averages bessemer, $23.6576, basic, $20.3086; average foundry, $20.56.

Steel—The whole trade, merchants and consumers, has been thoroughly canvassed of late for soft steel billets and sheet bars, and everything below $50 for billets and $52 for sheet bars has been absorbed, so that the market is quotable at these prices as minimum.

Ferroalloys

Exports of spiegeleisen, ferromanganese and ferrosilicon from Great Britain, nine months ended Sept. 30, were 73,284 gross tons in 1915, and 99,206 tons in 1916; increase, 25,922 tons.

Imports at Baltimore for the week included 1,982 tons ferromanganese from Great Britain.

Ferrosilicon is quoted at $98@100 per ton for 50%. Bessemer ferrosilicon is from $33 for 10% up to $43 for 16%, at furnace.

Spiegeleisen is higher, 20% being quoted at $45@50 per ton at furnace.

Ferromanganese—Sellers are now quite firm at $164 for imported and $165 for domestic on contract, bids at lower prices being turned down. There is a fair demand.

Foreign Iron

German Steel Production in August is reported by the German Iron and Steel Union at 1,412,326 metric tons. For the eight months ended Aug. 31 the make was: Converter, 5,156,847; open-hearth, 4,474,397; direct castings, 706,165; crucible, 72,612; electric, 117,347; total, 10,538,660 tons. This is 2,095,876 tons more than in 1915, but 1,025,602 tons less than in 1914.

STOCK QUOTATIONS

N. Y. EXCH.†	Oct. 31
Alaska Gold M.	12¼
Alaska Juneau	7
Am.Sm.&Ref.,com.	112
Am. Sm. & Ref., pf.	116½
Am. Sm. Sec., pf. A	99½
Am. Sm. Sec., pf. B.	92
Am. Zinc	52¾
Am. Zinc, pf.	81
Anaconda	95
Batopilas Min.	1¾
Bethlehem Steel	640
Bethlehem Steel, pf.	135
Butte & Superior	65¾
Chile Cop.	23
Chino	61
Colo.Fuel & Iron	52⅞
Crucible Steel	89⅞
Dome Mines	24½
Federal M. & S.	16
Federal M. & S., pf.	42
Great Nor., ore ctf.	43¼
Greene Cananea	51¼
Homestake	130
Inspiration Con	66¾
International Nickel	50½
Kennecott	53¾
Lackawanna Steel	88½
Miami Copper	40¼
Nat'l Lead, com.	68½
National Lead, pf.	113¼
Nev. Consol.	23⅞
Ontario Min	6
Quicksilver	2½
Quicksilver, pf.	3½
Ray Con.	26⅞
Republic I.&S.,com.	77⅞
Republic I. & S. pf.	114
Sloss-Sheffield	61
Tennessee Copper	23¼
U. S. Steel, com.	118⅞
U. S. Steel, pf.	121½
Utah Copper	106¼
Va. Iron C. & C.	56½

N. Y. CURB†	Oct. 31
Buffalo Mines	1
Butte & N. Y.	1¼
Butte C. & Z.	9
Caledonia	.46
Can. Cop. Corpn.	2 1/16
Cashboy	.05
Cerro de Pasco	42
Con. Ariz. Sm	2½
Con. Coppermines	2⅞
Con. Nev.-Utah	‡.25
Crystal Cop	.75
First Nat. Cop.	4½
Florence	70
Goldfield Con	.58
Goldfield Merger	‡ 08
Granite	.40
Hecla Min	7⅞
Howe Sound	5½
Jerome Verde	1 13/16
Joplin Ore & Spel	45
Kerr Lake	4¼
Magma	47
Majestic	.55
McKinley-Dar-Sa.	.58
Mother Lode	.37
Nevada Hills	.18
N. Y. & Hond	14½
Nipissing Mines	8½
Oro	.04
Ray Hercules	4¼
Rochester Mines	.58
St. Joseph Lead	19½
Standard S. L.	1½
Stewart	‡ 3/16
Success	.36
Tonopah	5⅞
Tonopah Ex.	5¼
Tribullion	.31¼
United Zinc	4¼
White Knob, pf.	2½
White Oaks	4⅞
Yukon Gold	2¼

SAN FRAN.*	Oct. 31
Alta	.04
Andes	.10
Best & Belcher	.05
Bullion	.01
Caledonia	.30
Challenge Con.	‡.05
Confidence	.10
Cons. Imperial	.01
Con Virginia	.10
Gould & Curry	.03
Hale & Norcross	05
Jacket-Cr. Pt.	‡.03
Mexican	13
Occidental	‡ 65
Ophir	.23
Overman	.03
Savage	.10
Seg Belcher	.03
Sierra Nevada	.28
Union Con	.57
Utah Con	01
Belmont	4.25
Jim Butler	.90
MacNamara	.11
Midway	.25
Mont.-Tonopah	.20
North Star	.16
Rescue Eula	.24
West End Con	.70
Atlanta	09
Booth	.10
C.O.D. Con	.03
Comb. Frac	05
D'field B.B.	07
D'field Daisy	‡ 05
Jumbo Extension	.33
Round Mountain	36
Sandstorm Kendall	‡ 04
Silver Pick	.18
Central Eureka	‡ 05
Argo	.06
Ariz. Central	.10
Big Jim	1.18¾
Lazy Boy	.06
Oatman No. Star	‡.14
Tom Reed	2.20
United Eastern	3.90
United Western	.04

BOSTON EXCH.*	Oct. 31
Adventure	3½
Ahmeek	105
Algomah	.99
Allouez	69
Ariz. Com., ctfs.	14
Bonanza	.40
Butte-Ballaklava	2¼
Calumet & Ariz.	78½
Calumet & Hecla	575
Centennial	21
Copper Range	70½
Daly West	2½
East Butte	15½
Franklin	8½
Granby	89
Hancock	13½
Helvetia	.25
Indiana	3
Island Cr'k, com.	57
Island Cr'k, pfd.	92¾
Isle Royale	33¼
Keweenaw	5½
Lake	13½
La Salle	4¼
Mason Valley	5
Mass.	15¼
Mayflower	3
Michigan	4
Mohawk	95
New Arcadian	6
New Idria	13
North Butte	21¾
North Lake	1½
Ojibway	1¼
Old Colony	1¾
Old Dominion	72
Osceola	91
Quincy	91⅞
St. Mary's M. L.	88
Santa Fe	2⅞
Shannon	9
Shattuck-Ariz.	29
So. Lake	5½
So. Utah	.25
Superior	15¼
Superior & Bost.	8 1/16
Tamarack	44
Trinity	6⅞
Tuolumne	.69
U. S. Smelting	70½
U. S. Smelt'g, pf.	50½
Utah Apex	3½
Utah Con	14⅞
Utah Metal	6¼
Victoria	6
Winona	4¾
Wolverine	44
Wyandot	1⅞

BOSTON CURB*	Oct. 31
Alaska Mines Corp.	.85
Bingham Mines	9½
Boston Ely	.65
Boston & Mont	.80
Butte & Lon'n Dev.	.53
Calaveras	5½
Calumet-Corbin	.02½
Chief Con	2
Cortez	.30
Crown Reserve	.45
Davis-Daly	3 1/16
Eagle & Blue Bell	1⅞
Houghton Copper	1¼
Iron Cap Cop., pf.	5¼
Mexican Metals	.48
Mines of America	2¼
Mojave Tungsten	3¾
Nat. Zinc & Lead	.55
Nevada-Douglas	1 13/16
New Baltic	2⅞
New Cornelia	17¼
Ohio Copper	.25
Oneco	80
Rex Cons	.29
Rilla	.11
United Verde Ext.	39½

SALT LAKE*	Oct. 31
Big Four	1 10
Black Jack	07
Cardiff	6.90
Colorado Mining	.18
Crown Point	.05½
Daly-Judge	8.00
Emma Cop	2.50
Gold Chain	10
Grand Central	60
Iron Blossom	1 65
Lower Mammoth	05
May Day	12½
Opohongo	‡ 01¼
Prince Con	1 32½
Seven Troughs	‡ 03
Silver-King Coal'n	2 90
Silver King Con	3.70
Sioux Con	15½
So. Hecla	1.75
Uncle Sam	.06
Wilbert	09½
Yankee	16

TORONTO*	Oct. 31
Bailey	07½
Beaver Con	39
Chambers Ferland	.11
Conlagas	4 75
La Rose	.55
Peterson Lake	18
Right of Way	05
Seneca Superior	09
T. & Hudson Bay	73.00
Temiskaming	.59
Wettlaufer-Lor.	.10
Dome Exten	.30
Dome Lake	.53
Foley O'Brien	.70
Hollinger	6.65
Jupiter	.26
McIntyre	1.65
Newray	.76
Porcu. Crown	.72
Vipond	.35
West Dome	.28½

STOCK QUOTATIONS—Continued

COLO. SPRINGS	Oct. 31
Doctor Jack Pot	.09
Elkton Con	.10
El Paso	.40
Findlay	.03
Gold Sovereign	.04½
Golden Cycle	2.43
Granite	.67
Isabella	.22¼
Jack Pot	‡.05
Mary McKinney	.32
Portland	1.93
Vindicator	1.75½

LONDON	Oct. 16
Alaska Mexican	£0 15s0d
Alaska Tre'dwell	3 0 0
Burma Corp.	4 6 3
Cam & Motor	0 11 6
Camp Bird	0 7 6
El Oro	0 8 9
Esperanza	0 11 0
Mexico Mines	3 17 6
Nechi, pfd.	0 13 6
Oroville	0 16 6
Santa Gert'dis	0 11 3
Tomboy	1 1 0

* Bid prices. † Closing prices. ‡ Last Quotations.

MONTHLY AVERAGE PRICES OF METALS

Silver	New York			London		
	1914	1915	1916	1914	1915	1916
January	56.572	48.855	56.775	26.553	22.731	26.960
February	57.506	48.477	56.755	26.573	22.753	26.975
March	58.067	50.241	57.935	26.788	23.708	27.597
April	58.519	50.250	64.415	26.958	23.709	30.662
May	58.175	49.915	74.269	26.704	23.570	35.477
June	56.471	49.034	65.024	25.948	23.267	31.060
July	54.678	47.519	62.940	25.219	22.597	30 000
August	54.344	47.163	66.083	25.979	22.780	31.498
September	53.290	48.680	68.515	24.260	23.591	32.584
October	50.654	49.385	67.855	23.199	23.925	32.361
November	49.082	51.714	......	22.703	25.094	......
Dec.	49.375	54.971	.....	22.900	26.373	......
Year	54.811	49 684	....	25.314	23.675	......

New York quotations cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

Copper	New York		London			
	Electrolytic		Standard		Electrolytic	
	1915	1916	1915	1916	1915	1916
Jan.	13.641	24.008	60.756	88.083	65.719	116.167
Feb.	14.394	26.440	63.494	102.667	*	133.167
Mar.	14.787	26.310	66.152	107.714	*	136.000
April	16.811	27.895	75.096	124.319	*	137.389
May	18.506	28.625	77.600	135.457	*	152.522
June	19.477	26.601	82.574	112.432	95.333	137.455
July	18.796	23.865	76.011	95.119	91.409	125.500
Aug.	16.941	26.120	68.673	110.283	82.333	126.304
Sept.	17.502	26.855	68.915	113.905	85.250	134.071
Oct.	17.686	27.193	72.601	122.750	88.000	142.523
Nov.	18.627	......	77.744	....	93.273	....
Dec.	20.133	......	80.773	....	100.430	....
Year	17.275	......	72.532	....	....	....

Tin	New York		London	
	1915	1916	1915	1916
January	34.260	41.825	156.550	175.548
February	37.415	42.717	176.925	181.107
March	48.426	50.741	180.141	193.609
April	47.884	51.230	166.225	199.736
May	38.790	49.125	162.675	196.511
June	40.288	42.231	167.636	179.466
July	37.423	38.510	167.080	168.357
August	34.389	38.565	151.440	169.870
September	33.125	38.830	152.625	171.345
October	33.080	41.241	151.554	179.307
November	39.224	....	167.670	....
December	38.779	....	167.000	....
Av. year	38.590	....	163.960	....

Lead	New York		St. Louis		London	
	1915	1916	1915	1916	1915	1916
January	3.729	5.921	3.548	5.826	18.606	31.167
February	3.827	6.246	3.718	6.164	19.122	31.988
March	4.053	7.136	3.997	7.375	21.883	34.440
April	4.221	7.630	4.142	7.655	21.094	34.368
May	4.274	7.463	4.182	7.332	20.347	32.967
June	5.932	6.936	5.836	6.749	25.170	31.011
July	5.659	6.352	5.531	6.185	24.611	28.137
August	4.656	6.244	4.520	6.088	21.946	29.734
September	4 610	6.810	4.490	6.699	23.151	30.786
October	4 600	7.000	4.499	6.898	23.994	30.716
November	5.155	.....	5.078	......	26.278	......
December	5.355	......	5.266	......	28.807	......
Year	4 673	......	4.567	......	22.917	......

Spelter	New York		St. Louis		London	
	1915	1916	1915	1916	1915	1916
Jan.	6.386	16.915	6.211	16.745	30.844	89.810
Feb	8.436	18.420	8.255	18.260	39.819	97.762
Mar	8.541	16.846	8.360	16.676	44.141	95.048
April	10.012	16.695	9.837	16.525	49.888	99.056
May	14.781	14.276	14.610	14.106	68.100	94.217
June	21.208	11.752	21.038	11.582	100.614	68.591
July	19.026	8.925	18.856	8.755	97.250	50.750
Aug.	12.781	8.730	12.611	8.560	67.786	51.587
Sept	13.440	8.990	13.270	8.820	67.841	52.095
Oct.	12.800	9.829	12.596	9.659	66.536	54.159
Nov.	15.962	......	15.792	......	88.409	......
Dec.	15 391	......	15.221	......	89.400	......
Year	13.230	......	13.054	......	67.553	......

New York and St. Louis quotations, cents per pound. London, pounds sterling per long ton. * Not reported.

Pig Iron, Pitts.	Bessemer‡		Basic‡		No. 2 Foundry	
	1915	1916	1915	1916	1915	1916
January	$14.59	$21.60	$13.45	$18.78	$13.90	$19.70
February	14.55	21.16	13.45	18.93	13.90	19.51
March	14.55	21.81	13.45	19.20	13.95	19.45
April	14.55	21.65	13.45	18.95	13.95	19.45
May	14.61	21.78	13.60	19.11	13.83	19.58
June	14.70	21.95	13.67	18.95	13.77	19.34
July	14.94	21.95	13.91	18.95	13.68	19.20
August	16.01	21.95	15.31	18.95	14.75	19.25
September	16.86	22.88	15.95	19.58	15.70	19.53
October	16.95	24.61	15.96	21.26	15.80	21.51
November	17.57	......	16.47	......	17.20	......
December	19.97	......	18.44	.....	18.95	......
Year	$15 82	......	$14 76	......	$14.95	......

‡ As reported by W. P. Snyder & Co.

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A Trip Through Honduras

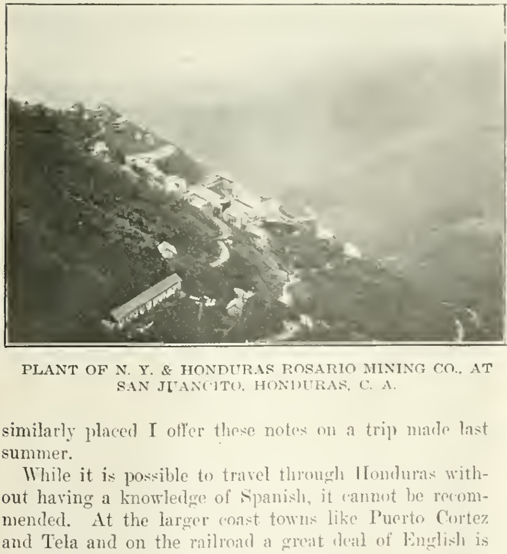
By D. McBride*

SYNOPSIS—Country may be entered from either coast, with part of the journey by automobile or train. Interior districts accessible only by muleback, and outfit should conform to such conditions. Best route for mining men to see country is via Puerto Cortez, railroad to Potrerillos, thence by mule trails. Mining resources comparatively undeveloped. New York & Honduras Rosario the principal operation, producing about $100,000 in silver and gold per month. Lack of transport facilities retards other mineral development.

Having occasion to make a trip through the Republic of Honduras, C. A., I sought information on the subject of traveling in that country, but was unable to find anything of practical value. For the guidance of others similarly placed I offer these notes on a trip made last summer.

While it is possible to travel through Honduras without having a knowledge of Spanish, it cannot be recommended. At the larger coast towns like Puerto Cortez and Tela and on the railroad a great deal of English is spoken, but in the interior, practically none. As in many Latin-American countries, the foreigner who does not speak Spanish is a mark for the jesting and easy-money making proclivities of the natives; it seems as if "soak the gringo" were the slogan whenever a foreigner appears. Hence to anyone contemplating an extended trip or residence in the country, a slight knowledge of Spanish is a necessity.

Honduras may be entered from the Pacific coast through the port of Amapala, there being a service of steamships from San Francisco. Since the outbreak of the European War this service has been irregular, but there are steamers at two- to four-week intervals. If one's destination be the capital, Tegucigalpa, and comfort of traveling be an important consideration, then this would be the best route, as the inland journey to Tegucigalpa is made in two comparatively easy stages—a short trip in a gasoline launch to San Lorenzo and from this place to the capital in automobile. At San Lorenzo one can find a good hotel and meals and at Sabana Grande a short stop is made, about noon, for lunch. The automobile trip costs 30 to 35 pesos ($12 to $14 U. S. currency) per person, which includes a moderate amount of luggage. Automobiles can be hired at San Lorenzo or from Tegucigalpa, by the hour or for the trip. The tariff is variable, and an agreement should be reached before hiring.



PLANT OF N. Y. & HONDURAS ROSARIO MINING CO., AT SAN JUANCITO, HONDURAS, C. A.

REST-STATION AND FARMING SETTLEMENT AT PROTECCION, HONDURAS, C. A.

The journey from the coast to the capital occupies one day, and despite the fact that the road is bad and one is jolted about mercilessly, it is a most interesting ride. From the eastern United States one can take advantage of this short cut to the capital by taking the United Fruit Co.'s steamer to Puerto Barrios, Guatemala; thence by rail to the Pacific port of San José and by steamer to Amapala. In traveling by this route one [illegible] over at Guatemala City until the steamer [illegible] at San José, as the latter port, like most P[illegible] is hot and mosquito-infested, and good accommodations are unobtainable. It is also possible to travel from eastern United States to Colon by steamer, across to Panama, then by Pacific Mail to Amapala. While such a roundabout route involves more time and expense, it offers many attractions of an educational nature.

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*Mineral Point Zinc Co., Depue, Ill.

To the mining man who wishes to see something of the country, the best route is undoubtedly that through Puerto Cortez. The United Fruit Co. has a weekly service from New Orleans to Puerto Cortez, the steamers being comfortable and the food and service good. The fare is $35. From New York one could take the United Fruit Co.'s steamer to Puerto Cortez, the fare being $100; but traveling by rail to New Orleans (fare and Pullman cost $39.55), leaving Pennsylvania Station, New York, at 4:35 p.m. Tuesday, one arrives in New Orleans on Thursday morning. The steamer sails at 11 o'clock Thursday forenoon and arrives at Puerto Cortez the following Wednesday. From New Orleans there is also the Hubbard, Zemurray Line, the fare being $30. While not catering especially to the passenger trade and therefore not so comfortable as the United Fruit steamers, yet they are good.

Outfitting and General Advice

In outfitting for a trip through Honduras it should be remembered that all travel in the interior is by muleback and that all the trails are bad. The pack for an animal should not exceed 200 lb. and should be divided in two pieces of equal size and weight. Steamer cabin trunks not over 33 in. long are best, and it is a good thing, especially in the wet season, to take a piece of canvas or oilcloth large enough to cover the entire pack. One blanket, a hammock, soap, towel and razor should be wrapped together in oilcloth and this, along with the provision sack, should be placed on top so as to be accessible without disturbing the pack. In the wet season a pommel slicker is indispensable. Only light-weight clothing should be taken. Khaki is most serviceable. Boots are preferable to leggings as they keep one's feet dry in crossing rivers and withstand the rough trail if one does any walking. An occasional walk down hill rests both rider and animal. Pullman drinking envelopes are more convenient than a drinking cup.[1]

In Puerto Cortez there are two hotels that can be recommended—the Laferbre, the oldest, and the Palm. The latter is quieter, cleaner and the food is good. The charges are the same—six pesos per day.

Upon entering Honduras the customs authorities examine one's luggage, but usually this examination is perfunctory. Also an immigration tax of one peso per person and 25 centavos for each piece of baggage is charged. There is no transfer service, but there are men on the dock who will take the luggage to the hotel, unloading it on the way at the customs house. A bargain should be made before allowing the luggage to be removed, the usual charge being one peso per trunk and 50 centavos for a suit case.

From Puerto Cortez one may telegraph to Tegucigalpa for mules to be sent to Potrerillos, the terminus of the railroad, or may take the chance of hiring mules at Potrerillos on arrival there. The rate from Potrerillos to Tegucigalpa is about 30 pesos per mule plus 30 pesos for a *mozo*, and it is the same whether one hires them at Potrerillos or by telegraph from Tegucigalpa. The largest mule-hiring agency in Tegucigalpa is that of Jersey Brooks. On leaving Puerto Cortez, enough canned goods to last for, say, about seven meals should be taken. Sardines (with keys) are good, also preserves in small cans, enough for one meal, and a tablet or two of plain chocolate. A large assortment of canned goods is available at Puerto Cortez, and this is the best place to stock up on them, as farther inland they are scarce and cost more. Some travelers take crackers, but it will be found better to buy bread enough for two days at a time; as it is more satisfying and less bulky.

Before leaving the port one should obtain enough silver money to cover all expenses on the trail, as no bills are accepted outside of the large towns. Pesos, tostones (50 centavos) and pesetas (25 centavos) are accepted everywhere, and from Potrerillos to Miambar one-real pieces (12½ centavos) are accepted. From Miambar onward 10 centavo pieces of Nicaragua and two-centavo coppers of Honduras pass. The expenses on the trail will run from 35 to 50 pesos, not including hire of mules and *mozo*. The train from Puerto Cortez to Potrerillos leaves on Monday, Wednesday, Friday and Sunday mornings and generally arrives at Potrerillos about three or four o'clock. The fare is 4.75 pesos. Usually the train stops long enough at San Pedro Sula for one to go up town and have lunch. Arrived at Potrerillos, the traveler will find but one hotel, and as likely as not he will have to share his room with a fellow tourist. The meals are fair as a rule, though one notices that more in coming in from the trail that when starting out. Rates are about 3 pesos a day.

If the trip is made during the dry season, say from January to April, a slicker may not be needed and the rivers will be low and easily forded. At this time of the year on no account forget a hammock. You may do so and live through the journey in the wet season, but not in the dry season, when the tenacious and omnipresent *garrapata* is doing business. If you are so unlucky as to have an intimate acquaintance with this tick forced upon you, apply the glowing end of a cigarette to his person; he will thus give up the ghost with little trouble to yourself, but if you forcibly detach him he will leave behind a souvenir that will keep you in misery for two or three weeks. It will pay to look into the feeding of the animals on the trail, as the natives appear to think that anything beyond what the mules can find by grazing at night is unnecessary. A measure of corn (costing 2 or 3 reales) each morning while saddling will make quite a difference in the endurance of the animals. The cost of hire of mules includes pasturage (*potrero*) on the way.

Route from Potrerillos to Tegucigalpa

The first day's journey from Potrerillos to Tegucigalpa is one of 10 leagues to Santa Cruz through flat country infested with mosquitoes and with little shade from a scorching sun. Arrived at Santa Cruz, one can find two places where travelers are provided with bed and board in return for 3.50 to 4 pesos a night. Here also there is a store where a fair selection of canned goods is on hand. Bread can be had as a rule, though it should be remembered that at no place can one be sure of getting it.

From Santa Cruz to Miambar, another 10 leagues, constitutes the second day's journey, and the trail is hilly and much broken up. There is no inn or hotel now before Comayagua is reached, so the traveler has to stay at some house where he slings a hammock and sleeps as well as he may. From Miambar to Cuevas (sometimes called Trinidad) is four leagues, and many make this their stopping place for the day, but one can go on to Sabana Larga, making the day's journey eighteen leagues.

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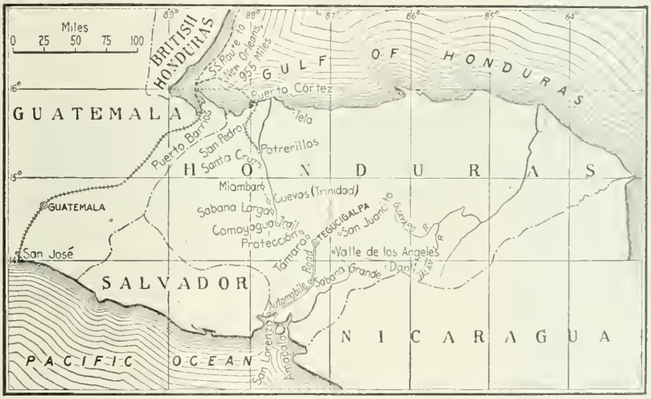
[1] The point regarding boots is debatable. For a drinking cup, many tropical prospectors carry a large horn spoon on a rawhide loop, hung on the pommel of the saddle.—Editor.

The third day's journey is to Comayagua, a distance of 10 leagues from Cuevas or six leagues from Sabana Larga. Of the 10 leagues about two are flat and the remainder hilly. In the wet season the River Omuya (sometimes called the Comayagua as it goes near the town of that name) will have to be crossed in a canoe. The boatman lives in a house commanding a view of the trail and appears on the scene when the traveler reaches the bank of the river. Pack, saddles, etc., are taken in the canoe, and the animals swim across. The charge when the river is low is two reales for each person, pack or animal, and when the river is high, double that amount.

At Comayagua the traveler finds the first town since leaving San Pedro Sula, and if he seeks diligently, he will find lots of stores of various kinds. There are two hotels, the lesser evil of the two being the New York. Four or five pesos per day is charged, but I have heard of an American who could not speak Spanish being held up for 10 pesos and only being saved through the intervention of his *mozo*. For putting on two horseshoes, the shoes *not* included, the local blacksmith wanted three pesos. If one has any work of that kind, it is better to let the *mozo* get it done; for the sight of a gringo is enough to dissipate any little sense of commercial decency that the native may possess. Speaking of horseshoes, it would seem to be a good thing to take a few horseshoe nails along, for blacksmiths are scarce and an animal without a shoe soon goes lame traveling over the stony trails which are the usual thing in Honduras.



OUTLINE MAP OF HONDURAS, SHOWING ROUTES FROM COAST PORTS TO CAPITAL

The end of the fourth day should find one in Protección, distant 12 leagues from Comayagua, the first six of which lie in the valley of Comayagua and are quite flat and the latter six mostly uphill over a twisting, rocky trail. At Protección one can always find a place to sleep and something to eat.

The fifth day's journey takes one into Tegucigalpa, another 12 leagues, four of which are flat and the rest hilly. On the way the *mozo* will be sure to point out the rock from which the bandits shot at the gringo some two years ago. The result of the shooting was 2—0 in favor of the gringo. A year before that another gringo was attacked not far from the same place, but he was badly wounded; his *mozo*, however, escaped with the pack (which was the real object of the attack) and then returned and brought the injured man to a house. Since that time soldiers pass over the trail at frequent intervals. It should also be noted that the trail from Tegucigalpa to and including Támaro has the reputation of being unsafe for the pasturing of animals on account of horse thieves.

Mining Resources Slightly Developed

Tegucigalpa has two large hotels and is the center of a rich but comparatively undeveloped mining district. The town owed its foundation to the discovery of mines near-by and indeed first bore the name of "Minas de Tegucigalpa," by which it was known until the latter half of the Eighteenth Century. At present there is only one large producer, the New York and Honduras Rosario Co., with properties at San Juancito, where a modern mill and cyanide plant produce silver and gold bullion at the rate of $100,000 a month. At Valle de los Angeles are situated the Socorro mine with mill and cyanide plant (until lately a small but rich producer), and the Animas mine, said to contain a large body of low grade ore. Other mines near the capital are the Aurora with small mill and cyanide plant, and the Quemazones with a small concentrating plant. In the Sabana Grande district is an important development, and it is known that the *antiguas* of this district were rich and extensive. Another district is Danlé, some distance from the capital, having many promising veins, but at present little work is being done there. Prospecting is being carried on by an American company in the Chile mountains with encouraging results.

Placer Gold and Native Copper

Most of the rivers of Honduras contain gold in greater or less quantity, and the Guayapo River is especially mentioned as having yielded large amounts of the precious metal in ancient times. Prospecting in the mountains is not attended with any difficulty, but on the coast the reverse is true, as the dense vegetation renders observation and progress extremely slow and difficult and the insects render life almost unbearable. There is good reason for believing that there are old mines of native copper somewhere on the Atlantic coast; but, so far as I know, all are idle. The lack of means of communication is a [illegible] handicap to the development of the mineral resources of Honduras, but the fact that the country is rich in minerals cannot be questioned. Among the metals known to occur are silver, gold, copper, lead, zinc, mercury [illegible]

The mining laws of Honduras are liberal. All mining machinery and supplies for mines are admitted [illegible] duty. The annual tax on a mineral zone is only [illegible] centavos per hectare (2.461 acres), and on mines, three pesos per hectare. The export tax on gold and silver bars is 5% ad valorem and on precipitates, 10 pesos per ton. In addition to the tax, the law in force since July 1, 1916, provides that mines must be worked to be held, and any mine becomes forfeit if left unworked for a period of one year or if it remains idle for a total of 400 days in any two years even if no continuous suspension should amount to one year. To fulfill the terms of the law, at least four men must be employed and they must be employed in actual development work of the mine, inside or out. However, if a mine has been worked continuously for two years, it can be held without working for a further period of two years by payment of a tax of 10 pesos monthly. Furthermore, the forfeiture clause does not apply if suspension of work is the result of war, famine, pest or absolute lack of workmen in the district where the mine is located. The limit for a mining zone is 200 hectares. It has been estimated that about 68,000 hectares have been held without working by the payment of the small tax, and it is the intention of the new law that this holding of mining land for speculative purposes shall cease. As many of the *antiguas* and rich but unworked mines were held in this way, the new law should operate in favor of the prospector and small investor by throwing many properties open for denouncement.

PALM HOTEL, PUERTO CORTEZ, HONDURAS

Binary Alloys of Aluminum

In a recent paper by H. Schirmeister in *Stahl und Eisen*, Vol. 35, pp. 648, 873 and 996 (abstr. *Journ.* Soc. Chem. Ind., May 31, 1916), the author studies the influence of the 20 most important technical metals on aluminum, particularly with regard to the rolling properties, tensile strength, elongation and hardness of the resulting alloys. The alloys with a density below 3 are especially considered, owing to their use in airship building.

Zinc-Aluminum—The greatest technical improvement of aluminum is produced by the addition of zinc, and among low-density alloys those containing Zn 12 to 14% are the most important technically. These alloys give nearly the same elongation as pure aluminum, with a tensile strength of 20 kg. per sq. mm. Alloys with Zn 25 to 30% are much stronger, but have a lower elongation and are too heavy. Zinc alloys do not appear to be suitable for making castings. Magnesium-aluminum alloys with Mg less than 3 and over 10% resist atmospheric attack relatively well; with Mg 6% the resistance is least; with Mg above 6 to 7% rolling is impossible; shrinkage is least pronounced with between 3 and 4% Mg; for castings the magnesium should be between 8 and 12%, the alloys richer in magnesium becoming too brittle.

Copper-aluminum alloys resist atmospheric corrosion well, this being the most important practical advantage of adding copper to aluminum; they can be rolled hot with up to 12% Cu, the most advantageous percentage of copper for rolling purposes being between 3 and 4; for castings, richer alloys with 10 to 15% Cu are preferable. Nickel-aluminum—Manufacturing considerations impose a limit of 16 to 18% Ni; alloys with up to 11 to 12% Ni roll easily when hot, those with about 4% Ni being generally employed; alloys with Ni 10 to 12% are used for castings. Cobalt-aluminum alloys offer no advantages over the nickel alloys. Rolling is not possible with over 12% Co. Iron-aluminum alloys have no technical importance, but an addition of 2 to 3% Fe has no harmful effects; it is even advantageous to add up to 4% Fe to aluminum for castings. Antimony-aluminum—The addition of antimony to aluminum does not confer any increased strength, and alloys with more than 6% Sb offer little resistance to atmospheric corrosion.

Silicon-aluminum—The addition of silicon is favorable as the specific gravity of the alloys is nearly the same as that of pure aluminum. The best proportions are 5 to 7% Si for rolled objects and 10 to 12% Si for castings. Alloys with under 8% Si suffer less corrosion in water than pure aluminum; annealing renders the alloys more susceptible to corrosion. Cadmium-aluminum alloys have no technical interest. Tin-aluminum alloys resist atmospheric corrosion relatively well. They can be cold-rolled easily, but crack when rolled hot. The elastic properties are, however, prejudicially affected by the addition of tin. Lead-aluminum—It is not possible to alloy more than 4% Pb with aluminum, and while such additions have no bad effects, they do not confer any technical advantages. Bismuth-aluminum alloys have no technical value.

Chromium-aluminum—Among the rarer metals, chromium is the only one that has a well-marked favorable influence. The maximum amount of chromium attainable in alloys in practice is 5 to 6%. Rolling can be carried out at 500° C. with up to 4 to 5% Cr, but for rolling purposes not more than 1% Cr is added, and up to 3% for castings. Manganese-aluminum—Up to 5% Mn can be added, and the alloys roll easily. The addition of manganese confers little practical advantage as regards the elastic properties. It can be added, nevertheless, to the extent of 1 to 2% for rolled objects and 3 to 5% for castings. Tungsten-aluminum—Tungsten is more soluble in aluminum than are chromium and manganese, but it affects the properties of aluminum very little. (The tungsten used in the investigation was, however, impure, especially as regards phosphorus.) Molybdenum-aluminum alloys have no particular technical importance, the most useful containing 0.5 to 1% Mo. Vanadium-aluminum alloys roll easily at 500° C. The addition of 1 to 2% V has a certain utility, and castings may contain 3 to 4% V. Titanium-aluminum alloys are easily prepared with up to 5% Ti, and are easy to roll, but appear to have no special technical advantages. The elastic properties are improved somewhat by the titanium. Zirconium-aluminum alloys are very similar to the titanium-aluminum alloys. Tantalum-aluminum alloys have no technical utility.

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Unsafe Communication Between Mine Levels

By Arthur L. H. Street*

A machine man employed on one level in defendant's mine was required, in the performance of his duties, to carry a drill to another level for repairs, and while walking along lagging on which there was no guard or rail, he slipped and fell 20 ft., sustaining severe injuries. He brought suit for damages on the ground that the defendant had negligently failed to provide him with a reasonably safe means of passing through the mine, a ladder in a manway not being available for his use on account of a break which had occurred two or three days previously. The trial resulted in a judgment in his favor, which has been affirmed by the United States Circuit Court of Appeals, Ninth Circuit (Johnson vs. Gold Hunter Mining and Smelting Co., 234 Federal Reporter, 849).

The higher court holds that defendant was bound to use reasonable care to keep the ladder in safe condition; that plaintiff was under no obligation to repair the ladder himself; and that, since the means he took of passing from one level to another was the only practical way open to him, he did not assume the risk of being injured through its defective condition, especially since the defect had been drawn to the attention of the plaintiff's superior, who had assured him that they would be remedied.

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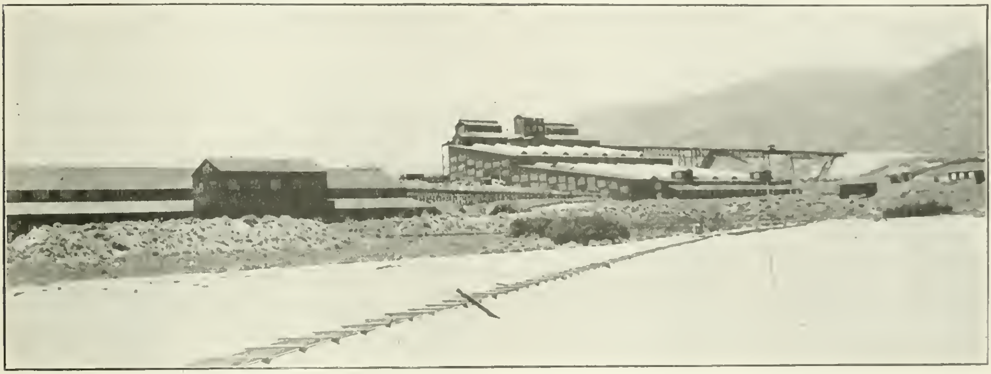
Ohio Copper Concentrator

By George O. Deshler*

The Ohio Copper concentrator, situated at Lark, Salt Lake County, Utah, and now being worked under lease by the General Exploration Co. of Salt Lake City, is treating an average of 2,100 tons of ore per day. The concentrator consists of two parts—the mill proper, in which the crushing, grinding and sand concentrating is done, and the slimes plant, situated about 600 ft. east of the mill and treating slimes only. The mill, as well as the slimes plant, is composed of three units, although the coarse-crushing plant, having a capacity great enough for all three units, is centralized in unit No. 2.



CONCENTRATOR AND SLIMES PLANT, OHIO COPPER PROPERTY, AT LARK, UTAH

Description of the Flow

The ore is dumped from the mine cars into bins over units Nos. 1 and 3. From the bins it is fed by revolving drum feeders, each driven by an eccentric through a ratchet and pawl, giving an intermittent movement to a steel pan conveyor. These conveyors meet over unit No. 2 and drop the rock on a grizzly. The oversize drops into a 24x16-in. Blake crusher. The throughs from the crusher unite with the throughs from the grizzly and drop into a set of 60x24-in. Garfield rolls. This roll product goes to a 36-in. elevator, 91 ft. high, discharging on 12 stationary screens set at an angle of 45°. The oversize from these stationary screens drops to two sets of Garfield rolls. The roll product returns to the 36-in. elevator and is returned to the stationary screens forming a closed circuit. The throughs from the screens drop on a 24-in. belt conveyor, 57 ft. long, and are [illegible] into the fine-ore bins. The final product from the coarse-crushing plant is approximately 3/8 in. in diameter and under.

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*Attorney at law, 829 Security Building, Minneapolis, Minn.

*Assistant superintendent, Lark, Utah.

A description of one of the three units in the fine-crushing and concentrating plants will answer all purposes, as the units are identical, except that in No. 2 a Hardinge mill is being used in place of chilean mills.

From the fine-ore bins the pulp is fed by challenge feeders into two 20-in. elevators, discharging on four sets (of two each) of Colorado impact screens. The oversize drops to four 42x16-in. rolls. The product of these rolls goes to the elevators and is returned to the screens. The screens here are of 8- and 10-mesh. Water is added to the throughs, and they are run to two-spigot hydraulic classifiers. The spigot discharge is run to roughing tables. The tails from the tables treating the second-spigot product are run to waste. The concentrates from all tables are sent to the finishing tables. The tails from the tables treating the first-spigot product are run to an elevator that discharges into a trommel screen having a 2-mm. opening. The throughs of the trommel unite with the overflow of the classifiers and are run to a Kennedy pulp distributor. The oversize of the trommels drops to four chilean mills having 2-mm. screens, the discharge of which is also run to the pulp distributor. The pulp is distributed to six rows (of nine each) Wilfley tables. The tables are arranged in pairs, and at the head of each pair is a head box receiving the pulp.

On unit No. 3 four-spigot classifiers take the place of the head boxes, used on units 1 and 2. At one end of these head boxes is a hydraulic classifier, giving feed to table 1. Table 2 takes its feed from the other end of the head box. Concentrates are all sent to the concentrates re-treating department. The middlings are sent to the middlings re-treating tables. The tails from table 1 of each pair are sent to waste. The tails from table 2 are sent to the slimes plant. The overflow of the head boxes also goes to the slimes plant.

In the concentrates re-treating department all concentrates are received in hydraulic classifiers having three spigots and an overflow. The spigot-discharges are fed to Wilfley tables and the overflow is settled in tanks, the thickened product going to tables and the overflow to concentrate bins. Concentrates from these tables are sent to concentrate bins, the tailings to waste and the middlings to a three-spigot classifier, the product of which is treated on Wilfleys. The concentrates from the re-treating plant are sent to an elevator discharging into a trommel, the oversize from which is jigged to recover coarse mineral. The tails are sent to the chilean mills and the concentrates to the concentrate-bins.

Slimes Plant and Water Recovery

In the slimes plant the pulp is thickened in Callow tanks, the underflow going to Deister slime tables and the overflow to a centrifugal pump which returns the water to the mill proper. The Deister tables makes a slimes product, the concentrates going to a concentrate bin, the tails to waste and the middlings to elevator and returning to tables.

The general tails are all sent to the tailings pond and settled, the clean water being returned by 12x12-in. Aldrich triplex pumps to the mill proper and used again. Extensive flotation experiments, with every indication of success, are being conducted on both the sands and slimes.

Recent Uses of Utah Elaterite

By Elihu Palmer[*]

Elaterite, or "mineral rubber," occurs in vast beds in eastern Utah, associated with other hydrocarbons. Recent tests show it to be a useful agent in the world of industry, when brought into commercial form, in solution, and used as a coating or paint. When spread over surfaces of wood, iron, steel, tin, leather, rubber, cork, concrete or other substances the solvents evaporate, leaving an intensely close-grained luminous ebony-black veneer which is practically poreless. This coating is more than 99% pure carbon and is said to be proof against acid, alkali, water, electricity, oxygen and nitrogen. It is serving with conspicuous efficiency as a coating for tanks and other containers designed for holding solutions used in galvanizing and recovery of gold and silver from low-grade ores.

Experiments extending over the last four years have demonstrated that underground pipes of both wood and metal, when coated with elaterite solution, were not in the least affected by decomposing elements of the soil, complete prevention of rot and rust having been accomplished. In iron pipes and steel superstructure which were coated with elaterite solution, electrolysis was completely frustrated. Telegraph and telephone poles and fence-posts, the lower ends of which had been immersed in elaterite solution before burial in the ground, were found to have remained sound and their elaterite covering was entirely unaffected by the soil.

In its utility as a coating for marine craft, where lead-and-oil-paints have had but brief lives, elaterite has thus far proved itself to be a successful agent to protect hulls from the deteriorating influences of fresh and salt water.

The secret of these unusual powers possessed by elaterite is that the refining process eliminates 11.19% hydrogen, 4.78% oxygen, 0.17% nitrogen and 0.24% sulphur which the characteristic crude product contains, after which contraction of the substance becomes so acute as to prevent the passage of water or air through the coating.

The permeating of the elaterite solution into the minute pores of substances to which it is applied constitutes a series of thread-like supports of the coating; hence it does not crack or peel. The qualities of the crude product, suggesting the name of "mineral rubber," are largely retained; and therefore as a coating solution it adjusts itself readily to gutta percha products, preserving these effectively from degeneration by nitrogen and oxygen. Elaterite solution also performs similar service on leather, making a coating thereon which does not crack or peel, and imparting to such articles as automobile upholstery a permanent black gloss, waterproof and almost indestructible.

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Philippine Iron Ores are found chiefly in Luzon and Mindanao according to a recent paper by Wallace E. Pratt, of the Bureau of Science at Manila. It is now recognized that the iron-ore deposits in the eastern Cordilla of Luzon constitute, not a continuous belt, but a series of widely separated deposits, including a half dozen ore bodies within a distance of 10 miles in Bulacan Province, a single outcrop at Santa Inez, Rizal Province, farther south, and three deposits around the margin of the Mambulao-Paracale gold mining district in Camarines Province, 100 miles farther to the east-southeast. Other unimportant occurrences of magnetite-hematite ores are known, but the foregoing, together with the lateritic ores in Surigao Province, Mindanao, contain the economically important iron ore reserves of the Philippines.

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[*] 310 Boston Building, Salt Lake City, Utah.

Estimating Construction Costs

By Frederick W. Foote*

SYNOPSIS—A general consideration of the present status of estimating with examples from practice based on the ratio of labor and material that enter into the work. When possible, figures are given that show the general trend of the work of construction and indicate the relative importance of labor and material for the different parts of modern plant construction.

For the sake of convenience the subject of estimates will be divided into two classes. The first class will be the estimates of a preliminary character which are arrived at by hasty methods of comparison with previous construction of similar nature. These are usually given in costs per unit of capacity of the finished plant. They are prepared previously to a detailed review of the project and are usually incorporated in it for purposes of estimating the necessary amortization. The second class of estimates are made after the plans and specifications of the proposed work have been prepared. These construction estimates are given more in detail and are based on the bills of material and plans. They are used to determine the required appropriations and, to a certain degree, the subsequent accomplishment of the construction engineers.

It is the purpose in this paper to give some idea of the limitations of estimating, the methods of getting results and some general useful factors arrived at in practice in different localities.

Preliminary estimates are usually based on the capacity of the plant when completed. If the undertaking is purely one of mining, the estimate must include the cost of the following divisions: The headworks and ore bins, the power plant, the offices and dwellings and the industrial system. If milling is to be undertaken, to these must be added the crushing plant, milling plant and tailings disposal or retaining plant. In the case of smelteries, the pretreatment plant (roaster, crusher, etc.), the smelting plant proper, the stack and other minor parts must be considered. Properly under the province of the mining engineer, preliminary estimates must be given on refineries, acid plants, industrial towns, dredges and numerous other projects.

Some Examples of Unit Plant Costs

The following mine-plant unit costs give an idea of the range of costs to be expected: Nipissing, $1 per ton of annual capacity; Arizona power plant, $1.12 per ton; Arizona surface plant, $0.87 per ton. Roughly, $1 a ton should cover the mine plant proper and $1 a ton for the power-plant requirements. To the mine-plant costs must be added the following, if milling is contemplated: Joplin concentrating mill (50,000 tons cheapest) 12 @ 16c. per ton annual capacity; gold mills, $1.25 per ton; cyanide mills, $1.50 per ton; flotation plants, $1.25 per ton; miscellaneous, $3 per ton. The average of several assorted types of mills in Liddell's handbook is $1.50 per ton.

The costs of several different milling plants are given in Table 1, taken from articles recently published.

For smelting works $5 a ton is a good round figure, as an average of six smelteries of copper, lead and zinc was $5.13. Acid plants in connection with smelteries cost about $7 per ton of acid produced annually. About 10% of the plant cost should be allowed for the townsite construction work, 7% for the industrial system and 5% for the engineering expense.

TABLE 1 COSTS OF MILLING PLANTS

Mill	Type	Daily Capacity, Tons	Total Cost	Cost per Ton of Annual Capacity
Uwarra, Candor, N. C...	Cyanide	50	$12,796	$2.85
Tough Oakes, Ontario..	Cyanide	100	121,820	4.07
Nipissing, Ontario	Cyanide	240	254,839	3.54
Belmont, Nevada ...	Stamp	500	465,189	3.51
Boston Con., Utah......	Conc.	3,300	....	1.50
Garfield, Utah	Conc.	7,300	....	1.85

The foregoing figures together with the experience and judgment of the engineer should enable the estimator to give a preliminary estimate quickly and within reasonable accuracy. In other words, an idea of the cost of the proposed plant can be gained without going into detail.

Final Construction Estimates

The final construction estimates are prepared from the finished plans and specifications of the plant to be built. The first object of these estimates is to provide a basis for the apportionment of the appropriation, and the second object is to have some basis for gaging the efficiency of the work in the field. If the work is in the form of an addition to the capacity of an existing plant, the estimating is comparatively simple. It consists merely in using the old cost data and applying any changes that have occurred in material prices or in the wage scale.

In the case of new work, however, more care and judgment must be shown. If possible, there should be a separate estimating department to which the plans are given by the engineering department. The current wage scale in the locality where construction is to be undertaken is obtained for all classes of labor used. This includes the types of labor given in Table 2.

TABLE 2. CLASSES OF LABOR IN CONSTRUCTION WORK

Blacksmiths
Blacksmiths' helpers
Boilermaker boss
Boilermakers
Boilermakers' layer-out
Boilermakers' helpers
Brick masons
Brick tenders
Carpenter boss
Carpenter
Carpenter helpers
Cart drivers
Cement finisher boss
Concrete boss
Concrete mixers
Corral boss
Corral men
Drillers
Electrician boss
Electrician
Electrician helpers
Engineers, locomotive
Engineers, compressors
Engineers, stationary
Janitors
Labor bosses
Laborers
Lead burners
Machine-shop boss (outside)
Machinist
Machinist helpers
Miners, underground
Miners, surface
Pipe fitter boss
Pipe fitter
Pipe fitter helpers
Plasterers
Plumbers
Plumbers' helpers
Rigger boss
Rigger
Rigger helpers
Stone mason boss
Steam fitters
Steam fitters helpers
Tinners
Tinners' helpers
Toolroom man
Tool sharpeners
Track boss
Water boys
Warehouse help

It is well to find out if the types required are available in the locality and if not, an additional charge must be added for their importation.

The material question is next considered. Table 3 contains the main basic materials from which plants are constructed.

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*Mining engineer, editorial staff, "Engineering and Mining Journal."

Any other material required for specific parts should be added. The prices of this material, in different bulks, should be ascertained at the nearest available point in quantities sufficient for the requirements of the project. The prices of iron and steel, metals, piping and shop supplies at different centers can be found in the weekly issues of the *American Machinist*. In addition to these *Engineering News*, in the first issue of each month, publishes a list which contains the prices of cement, sand, brick, lumber, pipe, etc., at the principal centers. In the absence of quotations from dealers these figures are convenient to be used. Freight rates to the site should be investigated and added to the cost of material. These may be obtained by writing to the railroad over whose lines transportation is contemplated.

RATIO OF LABOR AND MATERIAL IN CONSTRUCTION

The estimator now has the cost of material and labor at the plant site. The next step in the procedure consists in calculating the several bills of material from the plans. I have found, from experience on several projects, that it is advisable, after these bills of material are calculated, to segregate them into the basic component materials and add these together. The following several paragraphs are devoted to a partial list from my note books, which will give an idea of the material considered. The sum of these several material lists and the necessary fractional additions for waste, extras, etc., will give a convenient figure for the purchasing department to use in its endeavor to get favorable bids for the requirements. It is a well-known fact that more favorable prices are obtained when purchasing is done in bulk initially instead of in small quantities from time to time.

TABLE 3. BASIC MATERIALS OF CONSTRUCTION

- Asbestos sheets
- Brick, red standard
- Brick, magnesite straights
- Brick, special shapes
- Bolts, carriage
- Bolts, machine
- Belting, conveyor rubber
- Castings, rough iron
- Cement
- Clay, fire
- Conduit, galvanized
- Glass
- Iron, corrugated
- Iron, galvanized
- Iron, round and square, base
- Iron, flat, base
- Iron sheets
- Lumber, common
- Lumber, T. & G. flooring
- Lead, white
- Lime, burnt
- Nails, common, base
- Oil, linseed
- Paint
- Pipe, black, 1-8-in.
- Pipe, sewer, 6-, 12- and 24-in.
- Rails
- Rope, manila, base
- Sand and gravel
- Shafting
- Steel, structural
- Ties
- Tile
- Valves, gate
- Wire, weatherproof
- Wire, heavy double-braid stranded
- Wire, galvanized

A knowledge of the ratio of material cost to labor cost is most desirable in the making of estimates, as it is the means of connecting the bill of materials (which can be computed within small limits) with the final cost of the several projects. It has been my experience that the ratio of labor and material for the different types of work varies within well-defined limits. If material prices increase, a wage increase usually follows within a short time. Similarly, for instance, the ratio of labor and material is pretty nearly a fixed value irrespective of locality. Table 4 is based on construction experience in Arizona, Ontario and Virginia, together with estimates for work in other localities, so that I feel that it is fairly representative of American conditions. Data on foreign construction are lacking at the present time.

TABLE 4. RATIO OF LABOR AND MATERIAL

	% Material	% Labor
Asphalt work	48	52
Brickwork	45	55
Brickwork, special shapes	80	20
Belting, conveyor	88	12
Belting, transmission	82	18
Concrete	54	46
Electrical inside wiring	49	51
Electrical outside wiring	65	35
Electrical equipment	88	12
Timberwork	67–50	33–50
Millwork	67–50	33–50
Pipefitting	67	33
Pipelaying	50	50
Painting	44	56
Rails, laying	80	20
Steelwork	82–63	18–37
Tanks, steel	68	32
Tanks, wooden	50	50
Machinery	95–65	5–35

BRICKWORK, BELTING AND CONCRETE ESTIMATIONS

Having applied these ratios to the several bills of material, their sums represent the estimated cost of the plant. However, this is not complete. Provision for housing the men during construction must be added, as well as superintendence and engineering, cost of field offices and force and all general charges. These can be found within reasonable accuracy. The final sum of these several quantities should be used as a check and the construction work held to within 20% of the estimate. Enough of each type of work will now be taken up with what data are pertinent to give an idea of the subject. Brickwork will first be considered. Table 5 gives some figures from which deductions can be made.

TABLE 5. RATIO OF MATERIAL AND LABOR IN BRICKWORK

	% Material	% Labor
Virginia, average	47.5	52.5
Arizona, average	47	53
Miscellaneous, average	43.7	56.3
General, average	46.1	53.9
Arizona, special shapes	79.2	20.8

The table of brickwork ratios shows that the sum of the cost of the brick, cement and sand is about 45% of the total, while the cost of laying is 55%. For ordinary estimations 19 bricks, 9x4½x2½ in. should be allowed per cubic foot. This includes the space filled by the cement. Table 6 is useful in estimating cement and sand requirements.

TABLE 6. SAND AND CEMENT FOR BRICKWORK
(Exact quantities. Waste must be added)

Kind	Size	Cu.In. Each	No. per Cu.Ft.	Mortar, Cu.Ft. per M Bricks	Cement, Cu.Yd. per M Bricks	Cement, Bbl. per M Bricks	Sand, Cu.Yd. per M Bricks
Acid	8¼x3¼x2¼	69.5	22	0.50	0.125	0.89	0.375
	8¼x4 x2¼	74.2	21	0.53	0.133	0.94	0.399
H. B. shale	8¼x4 x2¼	74.2	17½	0.68	0.17	1.21	0.51
	8¼x4 x2	66.0	20	0.60	0.15	1.07	0.45
Red	8 x4 x2	64.0	19	0.68	0.17	1.21	0.51
	8¼x4 x2¼	74.2	16½	0.80	0.20	1.42	0.60
Fire	9 x4½x2½	101.0	17				
	9 x4½x2	81.0	21				

Choice should be applied to the factors according to the following rules of brickwork: Large, even runs, as in walls, chimneys, etc., are laid more quickly so that low labor percentages should be used. Small foundation piers, manholes, etc., are made with more delays so that higher labor percentages are used. Special shapes for furnaces, etc., are expensive so that the material percentage should be high. They are not any harder to lay, but are worth more. In asphalt painting, the material runs 48% and the labor 52%.

The following data give an idea of the ratio of labor and material in the installation of belts for conveying and driving machinery. An average of five conveyor-belt installations gave 88% for material and 12% for labor. In the case of drive belts with the necessary pulleys and shafting, material is 82% and labor 18%.

There is such a mass of data available on concrete costs that no attempt will be made at citations. An average seems to be material 54%, labor 46%. A good figure for total cost per cubic yard is $10.

Electrical work falls naturally into three classes—wiring, inside and out, and electrical-equipment installation. Table 7 gives average figures applicable to estimating work.

TABLE 7. RATIO OF LABOR AND MATERIAL IN ELECTRICAL WORK

Type of Work	Location	% Materials	% Labor
Inside wiring	Arizona	48.5	51.5
Inside wiring	Virginia	49.2	50.8
Inside wiring	Average	49.0	51.0
Outside wiring	Virginia	65.0	35.0
Outside wiring	Ontario	62.0	38.0
Outside wiring	Arizona	69.6	30.4
Outside wiring	Massachusetts	63.5	36.5
Outside wiring	Average	65.0	35.0
Equipment installation	Arizona	86.8	13.2
Equipment installation	Ontario	88.2	11.8
Equipment installation	Average	88.5	12.0

The work performed by carpenters can be divided into timberwork and millwork. Timberwork consists of the necessary framing, siding, roofing, flooring, etc., while the millwork consists in setting the window frames, door frames, hanging doors, etc. In estimating this work, the ratio will have to be worked out for the given locality. In Arizona lumber costs $26 per M ft. b.m., while in British Columbia it costs $9 per M. Carpenters receive $4.50 per day in Arizona against $3.75 in British Columbia. The data at hand show that in regions where timber is high (around $25 per M) labor is 33% and material 67%, while in the Northwest and in other localities where timber is plentiful they run about 50% each. In timber estimates about 5% should be allowed for waste in cutting, matching, etc. In Virginia a rough figure for labor of $6 to $7 per M for siding, $8 to $10 for framing and $10 total per opening for doors and windows was usually justified. This is about the 33% labor basis. There is less difference in millwork. Virginia averages were 35% for labor, Arizona 31% and Ontario 50%. In connection with timberwork 20 lb. of nails per M ft. b.m., is a good figure to use.

PIPEWORK, PAINTING, STEELWORK AND TANKS

Pipefitting will be used to apply to all iron pipes used in construction work having flange or threaded joints to distinguish from iron water pipes, which have bell-and-spigot calked joints. Pipefitting runs about 33% each for labor, pipe and fittings.

Pipelaying consists in the work of laying and calking bell-and-spigot pipe. This may be either iron or terra cotta. In laying iron water pipe about 50% is chargeable for labor and 50% for material, while in the case of terra cotta pipelines, 33% is spent for labor and 67% for material.

Painting results are quite uniform, being about 56% for labor and 44% for material for a good average for estimating purposes. One gallon covers 125 sq.ft. in two-coat work on smooth runs.

For the plant industrial railroad system, excluding the necessary excavation, which is variable, 20% should be allowed for labor and 80% for material.

Steelwork is usually let out on contract for supplying material and erecting and for this reason data on the subject are scarce. In Arizona steelwork was erected by contract of which the labor cost is estimated at 37% of the total. A Michigan headframe[1] cost 18.8% for labor. A Bisbee headframe[2] cost $1,400, of which 20.5% was for labor in erection. A general value of 25% for labor should meet requirements where specific data are lacking.

Tanks can be divided into steel and wooden. A contract for steel tanks in Ontario was based on 32% for labor and 68% for material. In erecting wooden tanks about 50% each should be allowed for labor and material. Cypress costs more for material than pine. In a specific instance a cypress tank ran 18% for labor and a pine tank ran 55% for labor.

The bill of materials for machinery should contain the list of the weights of the several parts. The labor cost per ton of weight is a useful factor for estimating total cost. The heavier the parts the lower the labor cost and the lower the labor percentage. Table 8 will give an idea of the range to be expected.

TABLE 8. LABOR AND MATERIAL RATIO IN MACHINERY ERECTION

Location	Type	Material	Labor	Total Cost per Cwt
Ontario	Boilers	63.1	36.8	
Ontario	Crusher machinery	76.4	23.6	
Ontario	Cyanide machinery	82.8	17.2	
Arizona	1—Engine machinery	95.5	4.5	$1[illegible].59
Arizona	2—Heavy	90.3	9.7	10.03
Arizona	3—Massive	95.5	4.5	12.7[illegible]

Excavation has not been considered, as the preliminary plans do not show how much is necessary. It should be figured in cubic yards, for which it should be divided into rock and earthwork. A good round figure for earthwork is $0.50 a cu.yd. and for rockwork a figure of $1.50 is convenient. So many variables enter into this calculation, it is advisable to work out each detail with care.

The foregoing percentages are not given so much for actual use as to show the method of estimating and to give an idea of the relative value of the factors entering into the consideration. If engineers keep their cost data in this form they will find that at the end of a few years they have figures that are surprisingly uniform and the use of which gives very fair estimates. Table 9 gives a random list of some percentages that practice has proved to be applicable for estimates.

TABLE 9. SOME MISCELLANEOUS RATIOS

Type of Work	% Material	% Labor
Small wooden building, field offices, bunks, etc.	75	25
Water system, including excavation	62	38
100,000-gal. reservoir	40	60
Pumphouse	32	68
Average of several large wooden buildings	52	47
Sewer system	35	65
Concrete roads	60	40
Crusher station	70	30
Cyanide plant	73	27
Mine plant shop	63	37
Boiler house	59	41
Heating system	88	12

It might not be amiss to give a few ideas on the carrying out of construction work based on estimates. It is due the subject of estimating to give some reasons why estimates often fail and to show the causes. The cost of a project in Arizona, we will say, is estimated by the home office in Boston. The estimators are provided with a list of current material prices and the current wage scale, they calculate the probable cost of the finished project, and an appropriation is authorized to cover this. At the completion of construction this appropriation was found to have been exceeded by 20%. Of course there were two possible explanations. The estimate was too low or the construction costs too high. An investigation of the question showed that additional work and changes had been made. The work had been delayed until bad weather, which materially increased the costs, without [illegible] to the engineer. A recalculation showed that the cost of the work as originally called for was 10% [illegible] the estimate. The changes, additions and extra [illegible] to weather conditions brought the final expenditure up to 15% over the estimate. Of course, here it is obvious that 25% for changes, additions and extras argues faulty original design.

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[1] "The Steel Headframe at No. 9 Shaft, Republic Mine, Vulcan, Mich.," by Floyd L. Burr, "Eng. and Min. Journ.," Vol. 100, p. 434.

[2] "A Bisbee Headframe," by P. E. Barbour, "Eng. and Min. Journ.," Vol. 99, p. 330.

USING ESTIMATES TO CHECK CONSTRUCTION

In the actual construction work it is advisable to keep the estimated cost expressed in percentage in view and arrange to have occasional checks during the progress of the work. See how much it costs to lay $10 worth of brick or to frame $10 worth of timber and see if the resulting percentage agrees with the estimate within reasonable limits. If it is consistently different, send in new figures for a revised estimate and take steps to get an additional appropriation. If the results are intermittently irregular, it suggests that the work is not proceeding in the most expeditious manner.

TIME-FACTOR VALUE OF ESTIMATES

To show the value of estimates, I will cite a case that occurred recently. An additional unit in an already operating plant was required by a certain date. Cost data in the hands of the construction engineers enabled them to calculate the number of hours of each type of labor required for the completion of the additional unit. It was thus easy to calculate the necessary working force. A percentage progress diagram, plotted weekly, showed at a glance whether the work was proceeding slower or faster than necessary and hence whether men should be hired or fired. The unit was completed upon the day set originally. This illustrates the time-factor value of percentage estimating. With these few hints, I feel that some may realize more the value of estimates, both initially and as aids during construction.

Frequent reference has been made to various published data from which figures were obtained for the purposes of amplification of my notes. I wish to express my thanks for data obtained from "Unit Construction Costs," by E. Horton Jones, Trans. A.I.M.E., Vol. XLIX; "Building the Tough Oakes Mill," by John A. Baker, *Engineering and Mining Journal*, Vol. 100, pp. 869-874, 915-918; "Cost of Mill Construction," by H. T. Curran, *Engineering and Mining Journal*, Vol. 100, pp. 345-347; and from other scattered sources.

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Repairing a Spoiled Tracing

It sometimes transpires that, after several hours or even days have been spent in preparing an elaborate tracing—usually in the cases where circumstances require that the finished drawing be worked up on the tracing cloth itself—by some unpreventable accident, or by eccentricity of motion on the part of tired fingers, a catastrophe occurs which cannot be remedied by ordinary erasure. It may be a large blot or a jagged line where no line should appear. Again, the title of the drawing may have to be changed, for reasons best known to the boss.

The highest ideals demand that an entirely new tracing be prepared. But perhaps the press of other duties will not permit this, or else a shortage of material in a remote camp makes it impracticable. Select an area to censor, usually of rectangular shape. With an old safety-razor blade cut out the objectionable part. Then, from a scrap of similar material cut out a piece of concentric shape and large enough to overlap at least 2 mm. each way. Place it over the eliminated area, in proper alignment, and put a weight on it to hold it there. Next take a tiny dab of glue or china cement on a chisel-shaped piece of wood, such as a sharpened toothpick, and glue a short section of the patch. Be careful not to get any glue beyond the edge of the patch, and press each section down firmly so that it dries without a wrinkle. Proceed, section by section, until the entire joint is completed. When all is dry, ink a line on the patch to conceal the cut edge of the tracing. When this is dry, the whole tracing is turned over and a line is inked to conceal the edge of the patch. The job being finished, proceed with the new title, bill of materials or whatever may be required. The neat double line conceals all evidence of patching in the final print and furnishes a neat border. Before adapting this method to unauthorized collaborations, it is well to study the local statutes concerning constructive forgery.

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American Mining Congress

The nineteenth annual convention of the American Mining Congress opens at the Hotel La Salle, Chicago, Nov. 13, 1916, and the general as well as the section meetings will be of unusual interest and value to mining men in all branches of the industry. All meetings of the congress are open to the public, and mining men especially are invited to attend and to assist in the discussions.

The general sessions will be held during the morning hours. Each afternoon there will be three great section meetings, covering the metalliferous field, oil and gas and coal.

The opening topic on Tuesday, Nov. 14, will be "The Record of Mine Safety Work," led by Albert H. Fay of the United States Bureau of Mines. This will be followed with addresses on "State Mine-Rescue Methods," by Dr. H. H. Stock, of the University of Illinois, and "Safety Work as an Investment," by Dr. C. W. Goodale, of Butte, Mont. The important discussion of the day will be on the subject, "The Responsibilities of the Operator, of the Miner and of the Public."

On Wednesday in the general meeting, Van. H. Manning, director of the United States Bureau of Mines, will speak on "Federal Aid to Mining Efficiency" and Chairman E. N. Hurley, of the Federal Trade Commission, will address the convention on "The Federal Trade Commission and the Mining Industry." The report of the committee on "Relations with the Federal Trade Commission," by Chairman Charles M. Moderwell, will be open for discussion.

On Thursday, which will be devoted to the general topic, "Conservation," there will be addresses by Dr. W. R. Whitney, chief of laboratory work of the General Electric Co., who will call for Federal aid in research work, and "The New Things in Science," by Dr. F. G. Cottrell, of the United States Bureau of Mines. The topic for discussion will be "Waste in the Mining Industry—in Mining, in Distribution, in Use." This will be led by the leading experts in the industry.

At the banquet, Thursday evening, Carl Scholz, of Chicago, president of the congress, will speak on "Coöperation the Basis of Safety, Efficiency and Conservation in the Use of the Nation's Mineral Resources."

Col. George Pope, of Hartford, Conn., president of the National Association of Manufacturers, will speak on "Organized Capital and Organized Labor and Their Relation to Efficiency, Conservation, Better Wages, Better Living Conditions, Lawlessness, Strike Disorders and Industrial Freedom."

On Friday the visiting mining men will be taken on an excursion to the Gary steel plant. There will be several evening sessions, all open to the public, at which industrial moving pictures will be shown. Among these will be films showing the Mexican oil fields near Tampico, including a view of the famous Cerro Azul Gusher and others covering mining in the arctic regions of Alaska and Siberia.

Van. H. Manning, director of the United States Bureau of Mines, will attend the sessions of the congress, and with him will come the leading experts of the bureau. Mr. Manning has notified J. F. Callbreath, secretary of the congress, that the Government exhibit at the convention will surpass any display yet made by the bureau. There will be a collection of 175 underground coal-mining safety pictures, arranged in series, and a group covering the same idea in metal mining. In mine-rescue and first-aid display there will be a set of Fleuss-Proto apparatus, the Bureau of Mines oxygen inhalator, the Bureau of Mines first-aid cabinet, the Bureau of Mines surgeon's emergency chest and a floor plan of one of the new steel cars.

The "Public Lands" conference, which is to be held at Chicago in conjunction with the convention, will have as delegates the West's most representative men, including a group of Senators and Representatives, who promise to bear the message of the gathering direct to the halls of Congress. The men who have been chosen as delegates are determined to formulate a Western policy on this question, which will give to every state the power to develop the vast resources which have, in a way, been locked up by Federal regulations and enactment.

The letters received from the governors give a clear idea of the general trend of the conference. For instance, one governor says that "there is even in the West a group of men that proceeds on the assumption that the state is not fit to care for the resources God has given it, and that the only administration of them which can be equitable to public interest must be centralized in Washington."

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Flotation Case in Supreme Court

WASHINGTON CORRESPONDENCE

Concentration of ore by the flotation method took place on Nov. 1 in the historic room occupied by the Supreme Court of the United States. The courtroom was crowded with noted counsel and many persons interested in the argument of the case of the Minerals Separation, Ltd., of London, and the Minerals Separation American Syndicate, Ltd., the petitioners, vs. James M. Hyde, of Butte, Mont., and Palo Alto, Calif. This is the hearing on writ of certirori, of the appeal from the decision in favor of Hyde before the United States Court of Appeals at San Francisco.

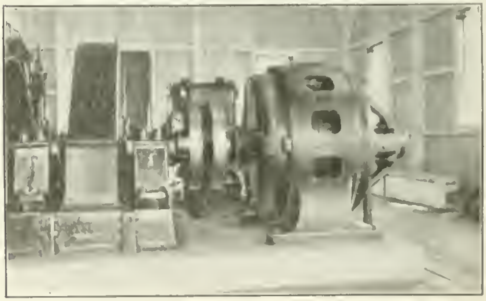
The following noteworthy array of attorneys appeared in the case: Lindley M. Garrison, Henry D. Williams, F. D. McKenney, John H. Miller, O. W. McConnell, William H. Kenyon, Thomas F. Sheridan, George L. Wilkinson, Walter A. Scott, K. R. Babbitt and J. Bruch Kremer.

Electric Drive at Empire Mine

The Empire mine is situated at Grass Valley, California. As greater depths were reached, it became necessary to install a larger hoist and to redesign the mill. Electric operation was decided upon, and the Westinghouse Electric and Manufacturing Co., of East Pittsburgh, Penn., received the contract to install a 500-hp. electric hoist and to equip the mill with motor drive. Noteworthy features of the hoist installation include herringbone gears, liquid rheostat-control and electrical safety devices.

The hoist is of the double-drum type, made by the Wellman-Seaver-Morgan Co., and embodies several features unique in California mining practice. The most important is that the hoist drums are geared by a single-reduction herringbone gear to a comparatively high-speed phase-wound induction motor having a gear ratio of 11 to 100, the motor running at a full-load speed of 535 r.p.m. With two layers of rope on the drum, this gives a hoisting speed of 1,200 ft. per min. in the shaft when all resistance is cut out of the controller.

The hoist drums are 6 ft. diameter and have a capacity of 8,000 ft. of rope per drum. They are to handle 4 tons of ore at a rate of 1,200 ft. per min. from a depth of 7,500 ft. The gears have a 11-in. face, are inclosed in a sheet-iron case lagged to deaden the sound, and run so quietly that they cannot be heard from the opposite end of the hoistroom. By employing this type of gear connection the efficiency of the hoist is increased and the poor power factor of a low-speed motor direct-connected to the drum of the hoist is avoided.



WESTINGHOUSE 500-HP., THREE-PHASE, 60-CYCLE, 1,010-VOLT, PHASE-WOUND INDUCTION MOTOR OPERATING HOIST AT EMPIRE MINE, GRASS VALLEY, CALIF

ALL BRAKES CONTROLLED BY AIR

The hoist mechanism is controlled from the main operating platform, all brakes being controlled by air. Air for operating the valves is obtained directly from a main compressor line that furnishes air for the mine. There is, however, a small motor-driven compressor installed, which works in parallel with the main line, and in case the pressure falls below a certain limit in the reservoir, this small compressor cuts in and maintains sufficient air pressure to operate the brakes at all times.

The hoist motor is a 500-hp., three-phase, 60-cycle, 1,010-volt Westinghouse motor, operating at [illegible] at full load. This motor is connected to the [illegible] the hoist through wire-link flexible couplings. The [illegible] has been designed so that plugging and regenerative braking are possible. This means that when the operator wants to stop the skips by reversing the current in the motor while running, this will not overstrain the windings or cause any electrical trouble. This feature is one of the latest developments in alternating-current hoist motors. The motor is controlled by a liquid rheostat. The resistance in the secondary of the motor is regulated by the height of water on the plates on the upper tank of the rheostat. The height of water on the plates is governed by a weir in the tank. The weir is motor-operated and is controlled from the operator's platform.

The liquid controller is so adjusted that the operator can hoist men or an empty skip from any point in the mine at a speed not to exceed 500 ft. per min. On test this speed was greatly reduced, demonstration being made that the control equipment would allow a reduction of speed so that a skip containing one man could be raised from the bottom of the mine to within 200 ft. of the collar of the shaft slowly enough to allow an inspection of the shaft. The advantages of this type of control include the wide range of speed that can be obtained under low-load conditions, the economy of space as compared with the grid type of resistance, the low cost of upkeep, the insurance against fire due to short circuits in the secondary resistance, and the ease with which it handles the load, there being no jerks or sudden strains put upon the equipment between the time of starting and full-load speed of the motor.

Although at the present time the mine is at a depth of only 6,000 ft. the hoisting equipment has been installed to handle to a depth of 7,500 ft. The equipment, working at a depth of 7,500 ft., will handle an equivalent of 30 tons an hour. The present output per shift is 150 tons. The shifts consist of three 8-hr. periods, and the hoist works approximately six hours in each shift.

Safety Device Prevents Overwinding

In connection with the hoisting equipment several safety devices have been utilized, one of which is a geared limit-switch. This switch is operated by bevel-gear drive from the shaft and operates the indicator. It is set so that the engineer must have his hoist under control when the skip reaches a point 200 ft. from the collar of the shaft. If he does not, the switch trips the circuit-breaker on the motor equipment and automatically sets the air brakes, bringing the skip to rest by the time it reaches the collar of the shaft. An additional equipment has been installed to prevent the operator from allowing his skip to come into the dump at too high a speed, thereby tending to rack the headframe. This equipment is similar in operation to the one already described.

The ore is moved from the ore chute to the mill by a 3½-ton Westinghouse mining locomotive, which handles six 3½-ton cars. A 60-stamp mill is installed, divided into six batteries of 10 stamps each. Each battery is driven by a special back-geared, 35-hp. three-phase 60-cycle 440-volt 850-r.p.m. Westinghouse motor belted to the bullwheel, which is mounted on the camshaft operating the stamps. The gears have a reduction of 5¾ to 1. The stamps are considerably heavier than those ordinarily used, being 1,360-lb. each. Each stamp handles five tons of ore per day. The motors are set back from the mill as much as possible, on separate concrete foundations, in order to reduce the vibration due to the operation of the stamps. They are of squirrel-cage construction and are operated by auto starters equipped with low-voltage and overload-release coils. This type of drive has several advantages over the older method of driving an entire mill of 20 to 40 stamps by a single motor. One of the most obvious of these is the fact that any 10 stamps can be hung up during a clean-up. Thus, when anything arises whereby the operator needs to make adjustments or any changes in a particular battery, it can be shut down and the work done without any chance of the operator being injured.

In former times the important feature was to obtain an installation that was mechanically right, and nothing else seemed to matter. Now, however, efficiency is taken into account, and it can easily be shown that different types of drives, whereby a 1- or 2-% increase in efficiency can be obtained, will warrant their installation. For example, the saving of 1% in a stamp-mill drive would mean a saving in a year's operation of this particular mill of approximately $120. In this particular instance it is estimated that a saving of about 5% was made when the mill was changed to this character of drive.

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Norwegian Copper and Pyrites

A review of the copper and pyrites industry of Norway since the beginning of the European War is published by *L'Echo des Mines.* The Sulitjelma mine, in spite of many difficulties, produced a little more in 1914 than in 1913; the output being 125,600 metric tons of pyrites of export grade, 12,960 tons of smelting ore and 13,380 tons of Elmore flotation concentrates carrying 7.11% of copper; or a total production of 151,940 tons. There were smelted locally 27,075 tons of pyrites and concentrates, yielding 1,475 tons of bessemer copper. The new installations, as well as the works of modernization, are about completed; the mineralization in the mine is still good; and further increase of production contemplated. The number of employees in 1914 was about 1,667, of whom 632 worked underground. In 1915 the exploitation was about normal, with an output of 139,445 tons of export pyrites, 12,325 tons of smelting ore, and 14,719 tons of Elmore flotation concentrates carrying 7.43% copper; or a total output of about 166,489 tons. There were smelted 11,370 tons of pyrites and 13,611 tons of concentrates, which gave 1,434 tons of bessemer copper. There were 1,690 workmen employed in 1915, of whom 757 worked underground.

The Bossmo mines were shut down provisionally about the end of July, 1914, on account of the war; but reopened on a small scale in November, 1914, with about 100 workers. There was a production of 15,000 tons in 1914 and 21,000 tons in 1915 of export pyrites, or nearly the normal output of 25,000 tons.

The Birtavarre mine, situated at Lyngen, began producing in 1910. It yielded about 450 tons of bessemer copper in 1914 and 486 tons in 1915.

The Lökken mines (Orkla Mine Co.) exported in 1914 about 69,370 tons of washed pyrites, 64,827 tons of pyritic lump ore and 5,925 tons of copper ore; while in 1915 there were produced and exported 68,822 tons of washed pyrites and 108,611 tons of pyritic lump ore, or a total of 175,433 tons with 580 workers. Additions are being made to the plant, in order to increase production.

The Röros Kobberverk (organized in 1644 A. D.) increased its production from 493 tons of fine copper and 7,700 tons of export pyrites in 1914, to 625 tons of copper and 8,500 tons of pyrites in 1915.

The Röstvangen Gruber produced 18,025 tons of export-grade pyrites in 1914, of which 10,609 tons were exported. The average content was 2.75% Cu and 43% S. The concentrator having been completed, the production in 1915 was 8,244 tons of lump pyrites, 5,124 tons of washed pyrites and 620 tons of high-grade lump. From 500 to 550 men are employed.

The Foldal Copper & Sulphur Co., Ltd., produced 68,000 tons of pyrites in 1914 with 124 employees; and it is believed that the 1915 production was much larger. The Killingdal mine in Aalen (operated under lease by the Bede Metal & Chemical Co., Ltd.), produced about 17,568 tons of export pyrites in 1914 and presumably the same quantity, or slightly more, in 1915. The Kjöli mines, formerly worked by Belgian capital, suspended operations immediately after the outbreak of the European War; but will be taken over and operated by other interests. The Grong mines, operated by French capital, continued exploration and development work; but the transportation question has not yet been solved.

The Stordö mines produced in 1914 about 58,255 tons of crude pyrites yielding, after concentration, 26,400 tons of export grade; nearly half of which was exported. In 1915 the yield was 36,281 tons of export pyrites, with a force of 170 employees. The Svano mines produced about 8,000 tons of pyrites annually in 1914 and 1915, with 70 men; and at the Karmo, Rödfjeld, Fosdalen, Undal and Meraker mines there was a slight production during 1915. At the Björkaasen mines some tonnage of pyrites has been blocked out and work has been conducted on a small scale, but on account of the war the projected plant was not constructed.

The total copper production of Norway in 1914 is placed at 2,860 tons of fine metal, including 400 tons produced at the Christiansaand nickel refinery; while that of 1915 is estimated as 2,850 tons, being about 100 tons more than in 1913.

The 1914 pyrites production was about 420,000 tons, of which 360,000 tons were exported and the remainder consumed in Norway. In 1915 the pyrites production amounted to 525,000 tons, of which 460,000 tons were exported. Since the beginning of the European War nearly half of the Norwegian pyrites production has been exported to Sweden—probably 200,000 tons annually—chiefly because of the difficulty of moving the usual supply of Spanish pyrites to Sweden.

The total value of copper and pyrites production, at Norwegian ports, amounted to about $4,000,000 in 1914 and about $7,000,000 in 1915; the selling price being higher during the latter year.

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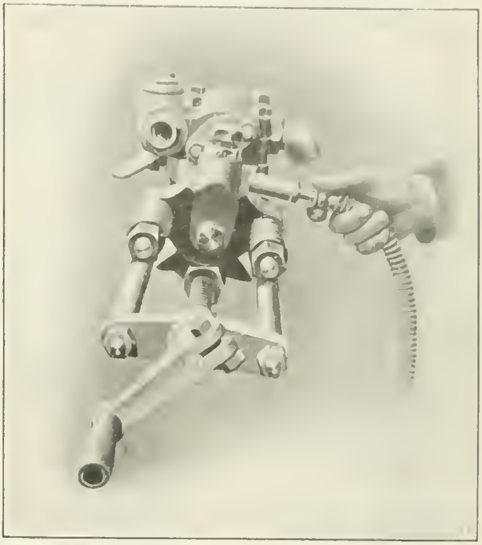
Calcium Carbide Manufacture in Norway is attracting American capital, according to Maurice P. Dunlap, the American consul in the district of Stavanger. A large plant is being built at Saude by the Electric Furnace Products Co., Ltd., a Canadian corporation with an officer of the Union Carbide Co electric power available close to the seacoast being 40,000 hp By carrying the tail water nearly 5 mi. through the mountains another 40,000 to 45,000 hp. may be generated by the fall into the fjord. A new village is being made in the valley at the end of the fjord near the factory. Although 70 mi. from the sea, the water of the fjord is so deep that large ocean steamers can come direct to the docks at the factory. Rails, locomotives, cars, cranes and steelwork which cannot be obtained in Norway have been ordered from the United States.

Holman Hammer Drill

By E. M. Weston*

A large number of drills have recently been designed on the lines of the Leyner drill. The drawing shows the one made by Messrs. Holman, of Cornwall. The chief feature of interest to American miners and designers is the simple and strong valve action in which the valve is always thrown over with live air. Another feature is the neat manner in which the water hose is attached, by a kind of setscrew, to the machine.



HOLMAN HAMMER DRILL

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Prospecting for Potash in Texas

Washington Correspondence

Drilling will begin in a few days on the well being sunk by the United States Geological Survey in Collingsworth County, Texas, to prospect for potash. The drilling is being done near Clifford, about 75 mi. east of Amarillo. Last year the well was drilled to a depth of 562 ft., when it became necessary to suspend the work, owing to the exhaustion of the appropriation.

Since the new appropriation became available, great difficulty has been experienced in securing pipe and other equipment. There is now approximately $10,000 available for the prosecution of the drilling. Over the Red Beds series, in which it is hoped to find potash layers, there is a capping of Tertiary and Triassic formations. There still is assumed to be about 100 ft. of capping to be penetrated before salt-bearing formations may be expected. The work is being done by churn drill. Owing to the correspondence in character of this area with that in which the German potash deposits are laid down, there are hopes that this prospect may develop the presence of potash in soluble form.

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*The Randfontein Central Gold Min[illegible] Transvaal, South Africa.

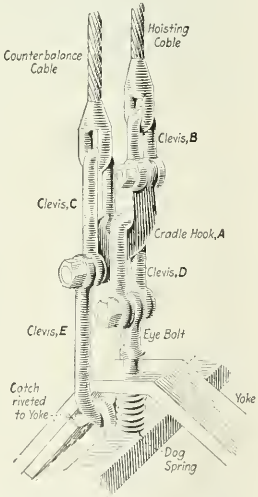
Details of Practical Mining

Safety Device for Cages

By A. S. Livingston*

Most cage safety devices are of the dog-on-guide type, depending for their action on a coiled spring around the eye-bolt, which is held compressed by tension in the hoisting cable and is released in case the cable breaks. Such appliances have positive action when only the hoisting cable is attached to the eye-bolt, but when a counterbalance rope is also attached thereto, in case the hoisting cable breaks, tension in the counterbalance cable will prevent quick and positive action of the dogs. If the counterbalance cable is attached to the yoke of the cage, independent of the eye-bolt, insufficient tension in the hoisting cable may allow the dogs to catch on the guides, unless the spring is made very weak, and hence not of positive action.

The device here shown was developed by G. M. Robison to meet this difficulty. It is simple, consisting of the cradle hook *A* to one end of which the hoisting cable is attached by the clevis *B* and to the other is attached counterbalance cable by the clevis *C*. A third clevis *D* hangs in the cradle hook, and from it the cage is suspended in the usual manner. A fourth long clevis *E* is attached to the same bolt that holds the clevis *C* and hangs down around the yoke of the cage, engaging a hook, with about an inch free play vertically. If the hoisting rope breaks, the cradle hook turns over, putting the weight of cage, through the clevis *E*, entirely on the counterbalance cable, at the same time releasing the dog spring and allowing the dogs to grip the guide. If the counterbalance cable breaks first, the weight goes on the hoisting cable direct, still holding the dog spring compressed. If the hoisting cable now breaks from the suddenly added strain, the dogs are free to work in the usual manner. At the same time the whole weight of the cage is effective to hold the dog springs at all times compressed.



A POSITIVE-ACTING SAFETY DEVICE FOR CAGES

When the cage is empty, it is nearly in balance and the cradle hook takes an angle of slightly less than 45° from the horizontal; when loaded, it assumes the upright position shown in the drawing. The device has been in operation for some weeks and has been repeatedly tested by putting a trip in the hoisting cable and then suddenly severing connections. Action has always been quick and positive, the maximum free drop of the cage before it was caught and held by the dogs being 2 in. Tests were made with a loaded car on the cage, probably weighing from 2,800 to 3,000 lb.

Reducing Air-Drill Repair Costs

By Frank Ayer*

Important factors in repairing air drills are speed and economy. The average company has too few extra drills, so that speed on the part of the repair man is necessary to keep the drills underground. If he has extra parts on hand, he has only to replace a broken or worn piece with a good one and the drill can be quickly returned to the mine. When all the drills have left the shop, he can repair the disabled parts so that corresponding new parts will be unnecessary for machines that come in later.

The following repairs and replacements can be made to good advantage. Observe the comparison of prices of side rods and bolts:

	Size	Cost, Each	Cost of Machine Bolts, Same Size
No. 18 Leyner through bolts......	⅝x25-in.	$1.00	$0.11
C-110 piston-drill through bolts..	⅝x20-in.	.48	.10
BC-21 feed-cylinder bolts and nuts	⅝x 9-in.	.90	.045
BC-21 front-head bolts and nuts..	⅝x 6-in.	.86	.04

The drills mentioned are Ingersoll-Rand. The worn or broken Leyner through bolts may be rethreaded and used as C-110 through bolts. The worn C-110 through bolts are made over into BC-21 feed-cylinder bolts, which finally are made over into BC-21 front-head bolts.

In some mines, with the proper ratio of Leyner No. 18 drills to the other types mentioned, the number of Leyner through bolts broken is sufficient to keep the other drills supplied. In case there are not enough of the Leyner bolts, common machine bolts may be bought at the prices given. They do not wear quite as long as the corresponding bolt sold by the drill company, but have been found more economical.

Repairing a Rotation Sleeve

The rotation sleeve, which holds and turns the drill, wears rapidly. When it is badly worn, the steel enters the sleeve diagonally and in turning, the shank end of the steel has an eccentric motion which quickly wears off or breaks the water tube. The piston does not hit the drill squarely and is worn and chipped off on the sides. It is an expensive part ($10 each), and the average repairman leaves it in too long, causing additional cost for piston and water tube, and increasing the operating costs.

The rotation sleeve is repaired as follows: An old pair of Leyner drill-sharpener dies are bored as shown in Fig. 1. A ½-in. wooden spacer is placed between the dies and a 2-in. hole drilled. When the spacer is removed, the opening in the dies has an elliptical section with a short diameter of $1\frac{1}{2}$ in. and a long diameter of 2 in. This gives the metal space in which to flow during the first few blows of the swaging operation.

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*Mine inspector, Detroit Copper Mining Co., Morenci, Ariz.

*Mine foreman, Detroit Copper Co., Morenci, Ariz.

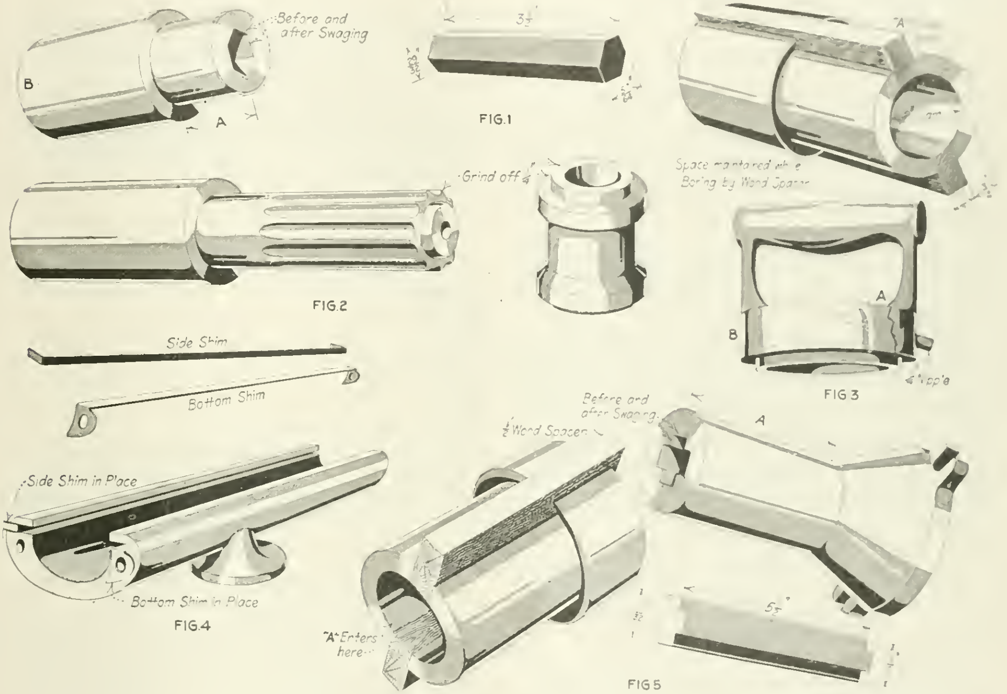
The worn rotation sleeve is heated and upset enough to maintain the proper length after swaging. This could be done by gripping in the sharpener and upsetting with a blind dolly, but is an unnecessary refinement. A few blows on the end with a flatter and hammer are sufficient. A hexagonal mandrel $\frac{29}{32}$ in. diameter is inserted in the hot rotation sleeve and the sleeve swaged down in the drill-sharpener dies. The mandrel has a slight taper so that it can be more easily driven out. A cold piston may be inserted at *B* to turn the hot sleeve while swaging.

In mines where there is no sharpener, dies can be made to perform the same work by hand. After heating to a dull cherry red, the sleeve is tempered in oil. This operation requires a half-hour and makes a sleeve as good as new. Several repaired rotation sleeves should be kept ready to replace those showing slight wear. This helps materially to keep the machines underground.

A piston, chipped off on the sides or worn, ruins the drill shanks. Pistons cost $12.75 each. Their life can be nearly doubled by annealing, grinding $\frac{1}{4}$ in. off the end and retempering. To keep the piston stroke the same, $\frac{1}{4}$ in. is faced off the lower end of the front-head washer, as shown in Fig. 2. This repair can be made in three hours.

Handles have to be replaced at a cost of $4.79 on account of the water-connection threads wearing and the head cracking inside the standard and down through the water opening. The threads can be tapped out once or twice for a little larger nipple. When there is not enough stock left to tap and rethread, the opening is plugged and a new one drilled and threaded in the opposite side of the handle.

When the handle is cracked inside the standard, as shown at *A*, Fig. 3, a long hole is drilled and tapped for a $\frac{1}{4}$-in. nipple. This allows the water to be introduced beyond the crack, making the handle good for further use. One hour is sufficient for either of these repairs.



KINKS FOR REDUCING DRILL-REPAIR COSTS

A good tube can be made by brazing two old ones. The process of brazing is as follows: A $\frac{5}{32}$-in. hole is drilled $\frac{3}{8}$ in. deep in the end of one old tube, and another tube is filed to fit into the drilled hole. Both ends are then heated to a white heat, spelter applied, and the joint made. The brazed tube is cut to proper length and the end entering the drill steel tapered and tempered. The brazed tubes give good satisfaction. They do not break at the joint but, like new water tubes, wear off on the end.

The No. 18 Leyner water tubes are $18\frac{3}{4}$ in. long, and the Jackhammer water tubes are $14\frac{7}{8}$ in. long. Hence broken or worn Leyner water tubes may be cut to proper length, tapered, tempered and used as Jackhammer water tubes. The slight difference in their diameters does not affect their usefulness.

Another way to save money is to buy the water tubing at 7c. per ft. and make your own tubes. Water tubes cost 61c., while the same length of tubing costs 9c.

The steel holder wears where it comes in contact with the drill until it slips over the collar on the drill shank. The end can be heated, closed up a little, and tempered at a dull cherry red in oil. Half an hour makes the repair. The part costs $2.

After annealing, the rifle bar and piston from a dry Jackhamer can be drilled with a $\frac{3}{32}$-in. drill to allow the water tube to pass through. They are then tempered and are ready for use in the wet machine.

In the C-110 piston drill the side wear on the cylinder guides and shell is taken up by side shims.

Repairing Front-Head Bushings

Front-head bushings are made of steel or bronze. The worn steel bushings are heated and closed up in a vise enough to make up for wear. One-eighth inch is filed off the collar so a thin shim may go over it and still fit into the groove in the front head. The bronze bushings are easier to repair, as the collar can be filed in a shorter time and does not require heating. They also have a scrap value. The bronze bushings cost $3.52 and the steel ones $3.40.

The water tubes in the No. 18 Leyner are made from tubing or are brazed as mentioned under Jackhamers. Leyner tubes cost 61c., while a corresponding length of tubing costs 12c.

The Leyner shell is not provided with shims to take the bottom wear of the cylinder guides as the C-110 drill is. Shims can be made for both side and bottom wear, as shown in Fig. 4. The side shims are simply straight strips bent back on each end of the shell. The bottom shims are long strips of thin iron bent and shaped at the ends to conform with the lines of the shell. At the back they are held by the two standards, while in front, $\frac{5}{8}$x2-in. bolts are used. Both classes of shims are made in $\frac{1}{32}$-in., $\frac{1}{16}$-in., and $\frac{1}{8}$-in. thicknesses.

The cylinder bushing in the BC-21 stoper drill is often broken off by chips from the anvil block or the drill shanks. The part costs $4.50 and is often replaced too soon. A few small pieces broken off the upper portion do no harm. It is not necessary to change this part until nearly half of the upper portion is broken off.

When the anvil block chips, wears or cups in the center, it can be faced off on the emery wheel in 15 min. and the saving amounts to $1.70.

The BC-21 front head wears rapidly because it takes the wear of turning the steel. Old drill-sharpener dies are bored for swaging this part, as shown in Fig. 5. Upsetting is unnecessary. The part is allowed to elongate, as the length has no effect upon the stroke and the longer front head gives more wearing surface for turning the drill steel. The swaged front head is heated to a dull cherry red and tempered in oil. With the proper dies and mandrel on hand, this repair can be made in 30 min. at a saving of $5.

Vibration causes the two heads on the feed piston rod to work loose. They can be made fast again by making new punch marks in the rod over the countersinks in the heads. They can also be brazed. The feed tailpiece becomes blunt and can be repointed on the emery wheel. The point should not be too sharp, as occasionally a careless miner turns on the air with the tailpiece over his foot.

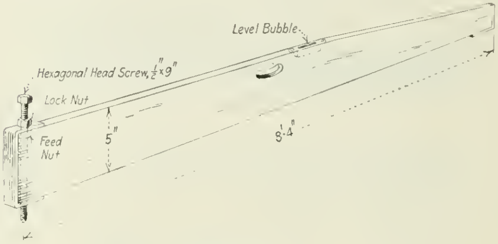
Top bushings can be bought for feed cylinders, but no bottom bushings are available. When the bottom bushing wear and become loose, it is not necessary to buy a new cylinder costing $13. A new bushing is cheaply made in a lathe and brazed into the lower end of the feed cylinder.

The air-drill repair man who is constantly on the lookout can repair enough worn and broken parts to cut repair costs in two. It should be borne in mind, however, that the use of any old part that delays the operator or reduces drilling efficiency is poor economy.

An Adjustable Grade Templet

By F. T. Teddy*

I have found the track-grade templet herein described and shown to serve admirably the purpose for which it was designed, particularly because of the adjustable feature embodied in it. As the illustration indicates, it is made from $1\frac{1}{4}$-in. material such as yellow pine. The ends are protected from wearing by strap-iron shoes, the holes in which are countersunk to receive the wood-screws that secure them in place. One of these is bent around the end of the templet in order that the nut of the adjusting screw may be held in place. Inexpensive level-bubbles may be easily procured, and one of these can be secured in a recess in the wood by means of plaster of paris.



A CONVENIENT TRACKLAYING TEMPLET

In use all that is necessary in order to establish any desired grade is to extend the screw through the necessary amount. Thus for a 1% grade the screw is extended through 1 in., for a 2% grade, 2 in., etc. A screw that will admit an extension of 3 in. is sufficient for all ordinary purposes. While this idea does not follow strictly the trigonometric principle, I believe it is sufficiently close for all practical purposes.

A Canvas Ditty Bag

Sailors are renowned for their ability to change ship quickly and with the least amount of baggage. They usually have a chest and a ditty bag and that's all. The latter piece of baggage is interesting to the engineer prospector, as it fits into his scheme of mobile equipment perfectly. As usually made it is cylindrical, about 1 ft. in diameter and 3 ft. high and made of heavy canvas with a double top. Small loops on the bottom and sides permit its attachment to the back of man or animal—as circumstances demand. Its volume is sufficient to contain a blanket roll and the personal effects of the user. It is waterproof and can be stowed in a variety of places depending on its packing. Its use as a sleeping bag for the owner's feet when they stick out of the end of a shelter tent has been known.

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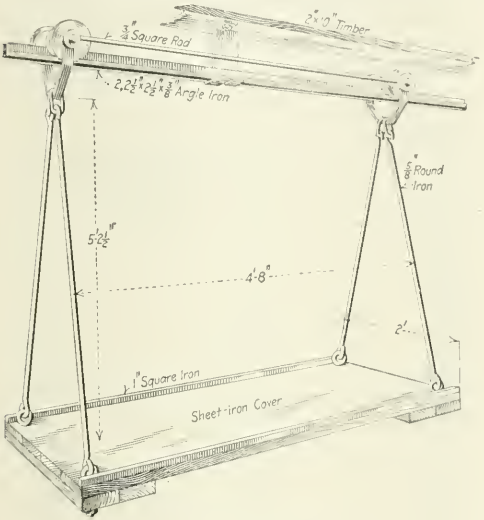
*Mining engineer, Ducktown, Tenn.

Details of Milling and Smelting

Battery Carriage for Supplies

By Arthur C. Daman*

The battery carriage for battery supplies shown in the accompanying illustration was built in the shops of the Aurora Consolidated Mines Co., Aurora, Nev., and has proved to be quite a success in handling the heavy dies, shoes, bossheads and false dies to and from the forty 1,550-lb. stamps. It was designed by Mr. Coutoure, former master mechanic of the company.



CARRIAGE FOR BATTERY SUPPLIES

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Spiral Tube-Mill Feeders

By Arthur C. Daman*

With the introduction of Dorr classifiers in closed circuit with tube mills, the best method of conveying the coarse sand overflow of the Dorr to the tube-mill feed trough became a problem. In recent years the introduction of large spiral scoops on the tube mills has made it possible to wash the sand from the Dorr discharge down the incline to the feed box. But here the question of water regulation enters. Too much water means the rushing of feed material through the mill with no apparent grinding, and too little water threatens us with an overloaded tube mill.

As the maximum efficiency is determined by a certain pulp consistency, it behooves us to get the best regulation of pulp feed. This is obtained with spiral feeders that can be connected to the Door-classifier driveshaft by a chain drive. At the discharge end of the spiral feed, the necessary amount of water to keep the proper consistency can be added. With the use of spiral feeders, the frequent shoveling and flushing down of accumulated sands at the end of the Dorr classifier is avoided. The spiral feeders used at the Nevada Packard mill have a life of 7 months, or about 20,000 tons conveyed, with an original cost of about $25. The power cost for the spiral is negligible.

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Sizing Flotation Concentrates

Some experiments on the screen analyses of flotation concentrates have been made by Charles Y. Clayton, of the School of Mines and Metallurgy of the University of Missouri, and are published in the school *Bulletin* for August, 1916. In carrying out the experiments the flotation concentrates obtained from previous tests were diluted with water and run through a set of Tyler standard screens. The material upon each screen was dried and assayed. In making the screen analysis, the dilute pulp passing through 260-mesh was put in large pans and agitated by stirring with a spatula and allowed to settle for about five minutes, when the water and unsettled slime were decanted and dried. The material poured off is classed as 260a, while the material remaining in the pan is classed as 260b.

The concentrates for experiments 1 to 4 inclusive, were obtained on a standard Callow pneumatic machine, that for experiment 5 in a Minerals Separation machine and that for experiment 6 from an actual flotation plant. The pulp ratio was 5 to 1. The oils used for obtaining the concentrates were as follows: In experiment 1, oil from water-gas tar four parts, and a solution of Fairbanks glycerin soap (5 grams of soap to 100 c.c. of

EXPERIMENT NO. 1

Through Mesh	On Mesh	Average Diameter, Mm.*	Wt., Grams	Pb, %	PbS, Grams	Gangue, Grams by Difference	Gangue, per Cent. Total
65	80	0.187	25.70	79.40	23.50	2.20	1.26
80	100	0.161	40.90	79.20	37.30	3.60	2.06
100	115	0.135	44.40	78.40	40.00	4.40	2.52
115	150	0.114	25.90	74.20	22.10	3.80	2.18
150	170	0.096	26.00	75.40	22.50	3.50	2.01
170	200	0.081	13.30	70.20	10.70	2.60	1.48
200	260	0.065	22.50	68.20	17.60	4.90	2.81
260a			117.90	60.40	82.00	35.90	20.50
260b			143.20	18.05	29.65	113.50	65.90

*The average diameters of particles in all the experiments were indentical with those in experiment 1

EXPERIMENT NO. 2

Through Mesh	On Mesh	Wt., Grams	Pb, %	PbS, Grams	Gangue, Grams by Difference	Gangue, per Cent. Total
65	80	5.00	63.10	3.67	1.33	0.72
80	100	19.50	75.40	16.35	3.15	1.70
100	115	6.70	74.00	5.72	1.00	0.54
115	150	15.60	76.00	13.69	1.90	1.05
150	170	10.40	76.40	9.17	0.66	0.36
170	200	21.00	71.20	18.00	3.00	1.62
200	260	17.20	70.40	13.98	3.22	1.74
260a		111.00	75.00	95.45	15.55	8.40
260b		234.20	29.20	78.95	155.25	84.00

EXPERIMENT NO. 3

Through Mesh	On Mesh	Wt., Grams	Pb, %	PbS, Grams	Gangue, Grams by Difference	Gangue, per Cent. Total
65	80	21.00	76.00	18.43	[illegible]	[illegible]
80	100	58.30	77.60	52.23	[illegible]	[illegible]
100	115	53.30	78.20	48.12	5.18	[illegible]
115	150	30.00	65.60	22.72	[illegible]	[illegible]
150	170	35.00	67.80	27.40	[illegible]	[illegible]
170	200	35.50	61.70	26.52	[illegible]	[illegible]
200	260	43.10	55.70	[illegible]	[illegible]	[illegible]
260a		170.00	67.00	[illegible]	[illegible]	[illegible]
260b		178.00	26.90	[illegible]	[illegible]	[illegible]

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*Mining engineer, 2678 Eudora St., Denver, Colo.

water) one part; experiment 2, pine oil No. 6 of General Naval Stores Co.; experiment 3, oil of citronella, prepared by McKesson & Robbins; experiment 4, flotation oil No. 17 of the General Naval Stores Co., and in experiment 5 the same agent; experiment 6, creosote oil No. 2, of the Cleveland Cliffs Iron Co. The quantity of oil was not recorded, the amount used being enough to give a good froth. The original concentrates were obtained from a dolomite lead ore. The results are shown in the accompanying tables.

These experiments show that the percentage of gangue material floated is greatest for the finest material. In experiment 1 the material through 260a assays only 18.05% lead and contains 65.90% of the gangue floated. Experiment 2 gave material through 260a of 29.2% lead containing 84% of the total gangue material floated. The same material in experiment 3 assayed 26.9% lead and contained 56.4% of the total gangue floated. In experiment 4 this product assayed 26.26% lead and contained 55.80% of the total gangue. In experiment 5 this product assayed 25.8% of the lead and contained 96.6% of the total gangue.

EXPERIMENT NO. 4

Through Mesh	On Mesh	Wt., Grams	Pb, %	Zn, %	PbS-ZnS, Grams	Gangue, Grams by Difference	Gangue, per Cent. Total
65	80	13.20	4.80	32.00	6.38	6.82	3.92
80	100	29.50	26.80	33.40	23.32	6.28	3.60
100	115	33.00	39.80	22.20	24.95	8.05	4.60
115	150	13.50	36.20	19.40	9.14	4.36	2.50
150	170	19.20	40.20	13.20	12.32	6.88	3.95
170	200	39.10	47.60	9.70	26.55	12.55	7.22
200	260	33.20	46.40	9.30	21.90	11.29	6.48
260a		111.37	40.40	9.25	91.44	19.93	11.45
260b		336.70	26.26	7.95	138.90	97.80	55.80

EXPERIMENT NO. 5

Through Mesh	On Mesh	Wt., Grams	Pb, %	PbS, Grams	Gangue, Grams by Difference	Gangue, per Cent. Total
65	80	0.00	0.00	0.00	0.00	0.00
80	100	4.40	40.00	2.22	1.78	0.22
100	115	27.10	76 20	23.70	3.40	0.43
115	150	36.90	72.20	30.60	6.30	0.80
150	170	25.00	77.80	22.36	2.64	0.35
170	200	34.60	76.40	30.80	3.80	0.48
200	260	35.50	71.80	29.30	6.20	0.49
260a		21.50	80.20	19.80	1.70	0.21
260b		1,080.00	25.80	320.40	759.60	96.60

DATA, FROTH FROM A MILL

Through Mesh	On Mesh	Wt., Grams	Pb, %	PbS, Grams	Gangue, Grams by Difference	Gangue, per Cent. Total
65	80	0.00	0.00	0.00	0.00	0.00
80	100	6.10	41.40	2.90	3.20	0.79
100	115	0.00	0.00	0.00	0.00	0.00
115	150	4.60	33.40	1.80	3.80	0.95
150	170	5.15	31.60	1.90	3.60	0.89
170	200	0.00	0.00	0.00	0.00	0.00
200	260	7.50	46.80	4.00	3.50	0.86
260a		105.00	62.40	75.40	29.60	7.30
260b		834.00	49.30	472.50	361.50	89.20

Experiment 5 shows less of the coarse gangue material floated than any other. This concentrate was made on machine No. 3, which allowed the coarse gangue material to settle to a certain degree. In experiment 6 there is shown a low percentage of material on the coarse mesh, due to the fact that the original flotation feed showed a high percentage of fine material.

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The Properties of Globular Agglomerates

The manufacture of globular agglomerates is discussed by C. A. Brackelsberg in *Zeit. fur angew. Chem.*, No. 29, 1916, and reviewed in the *Journal* of the Society of Chemical Industry. According to this report, the agglomerates are produced in a plant consisting of a mixer, an agglomerating drum and a drier. They may be made from almost any powder and any solution which crystallizes out or leaves a crusty residue upon evaporation. The finished product consists of balls that resist crushing, yield very little powder on breaking and possess a high degree of porosity due to evaporation of the liquid. Hence the action of gases, such as occurs in roasting and smelting is much more rapid and thorough than on briquettes or sintered products. Copper, lead, bismuth, antimony, gold, silver and zinc may be volatilized by the action of hydrochloric-acid gas on agglomerates containing them, and thus be separated from iron, manganese and nickel.

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A Belt Length Chart[*]

By W. F. Schaphorst[†]

The accompanying chart is useful when it is required to find out the number of feet of belting in a roll. The distance X must be measured, as shown, in inches. For example: How long is the belting in a roll that has 36 turns, the distance X being 50 in.? The dotted line drawn across the chart shows how easily the length is found; it is 470 ft. It will be observed that the range of the chart is great and will easily cover any ordinary roll.

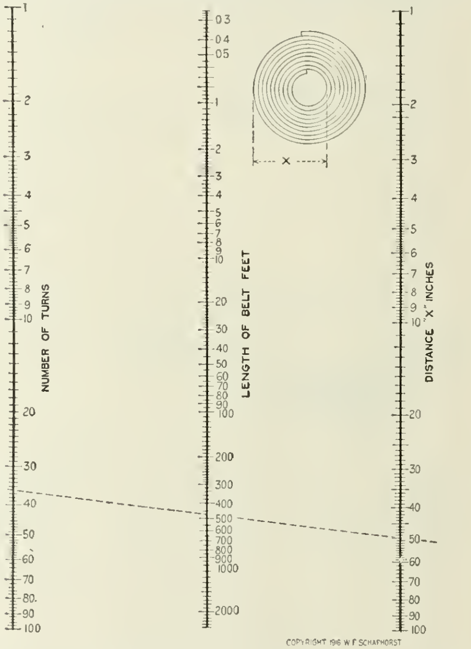

CHART FOR DETERMINING LENGTH OF ROLLED BELT

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Electric Furnaces in Sweden are now producing over 100,000 tons of steel yearly, according to J. O. Boving in the London "Iron and Coal Trades Review." The process has now been developed so that molten pig is delivered direct to the open-hearth furnaces which are heated by gases from the reduction furnaces. The liquid charge from the open-hearth furnaces is transferred to an electric refining furnace. The final steel is reported to be of remarkably high quality. Mr. Boving says this is plainly the right method where electric current can be obtained at a reasonable price.

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[*] Copyright, 1916, by W. F. Schaphorst.

[†] Mechanical engineer, Woolworth Building, New York.

Correspondence and Discussion

Mining Law Revision

I have read with interest the discussions on the proposed changes in the mining laws of the United States with reference to the staking of mineral lands. Most of the suggestions made have come from prominent engineers, and their views are conflicting. It occurred to me that 13 years of actual prospecting, coming in contact with different mining laws, might make the views of a prospector of some value in the discussion.

I am of the opinion that the requiring of a "discovery" either before staking or before the issue of a patent is a mistake and a hardship on the prospector. Take the hypothetical case of a drift or swamp-covered area lying between or near known deposits of valuable mineral. It might be impossible for the prospector with his limited means to make a discovery, yet he has absolute faith in the continuation of the deposit under the swamp or glacial drift and is willing to spend his time and best efforts there.

Who should be the judge of what constitutes a valid discovery? Doubtless there is a multiplicity of judicial decisions on this point, but the best judge is the prospector who stakes. The claim is valuable in his eyes, and he is the one who is to back his views with his work, and if he earns his patent by his labors, the claim should be his regardless of the views of one sent to inspect his discovery as to its sufficiency.

I feel very strongly on another point. There should certainly be an appeal from the land office to the courts on any question of rights under the act, or of disputed facts or on interpretation. Regardless of the possible delays and cumbersome procedure of some courts, any prospector would rather have his day in a real court of law than submit his rights to the final determination of any administrative officer.

Assessment work should be based on the number of days' work alone, not on the amount of rock broken or yardage stripped. The hardness of rock is too variable to work out an equitable system on that basis. Money should never be taken in lieu of assessment work. A bona fide prospector will always do his work with the consequent improvement of his property rather than pay the cold cash to the government. Certainly money payments retard the development of a mining district and would rarely be resorted to except by large interests.

The best acreage for a mining claim is 40, and in surveyed territory to conform to the governmental subdivision. In unsurveyed sections the claim should be as nearly 40 acres as the prospector can make it with north-and-south and east-and-west boundries, or as nearly so as he can make them with the lines and corners well marked. No one wants to stake less than 40 acres if an entire 40 is available. That acreage is needed at all mining operations for buildings, dumps, etc. In order to cover cases where land supposed to have been surveyed has not actually been surveyed or where all survey marks have been obliterated and cannot be found after the prospector has used due diligence in his search, there might be a provision in the law allowing him to stake the land as it would be staked in unsurveyed territory.

Work should be allowed to be performed on one claim on behalf of a limited number of other claims in the same group, provided that the claims are contiguous and under the same ownership.

I believe the Mining Act of the Province of Ontario, Canada, as at present administered, to be the best with which I am familiar, although it has grave faults. Among these is the loss of all rights to an unpatented claim in case of failure to renew a "miner's licence" after a certain time.

The provision to allow diamond drilling to count as assessment work according to footage is excellent. This is the only exception that should be made to the rule of all assessment-work requirements on days work.

WILLIAM E. SMITH.

Box 474, Sudbury, Ont., Canada, Oct. 20, 1916.

In looking over the discussion of the revision of the mining laws, there are some changes I might suggest. As to the time of doing annual work, most mining camps are in the mountains and I would recommend that the time be changed from midnight, Dec. 31, to July 1 at noon. The year beginning then would be better suited to everyone connected with mining. If the law should be changed, then for that year $50 worth of work could be done on or before July 1, noon. The last day of the year is likely to be cold and stormy, which makes it a hardship for re-locators or men doing their annual work, and I am sure that in many districts a great many miners lose their claims by not being able to stay or do the work at that time.

I would suggest that when an application is made for a patent and a number is given to a surveyor, the patent of that number be finished. I know of companies that made application, received their numbers, had the land surveyed and never paid any more money into the land office. They did not pay taxes, nor did they do any annual work, but they made the prospector believe the land was patented until someone went to the recorder's office and found out to the contrary.

One more suggestion: The patent application, the notice of advertisement and the notice of granting patent should be posted on the schoolhouse or post-office building by applicants. Sometimes these notices are printed in some obscure county paper and they are not seen by people who might wish to contest. If they were posted at the nearest schoolhouse or post office, everybody would be given a chance. There should be a map supplied to every postmaster of every district and it should be kept posted where it could be seen. I would suggest that the districts conform to the three or four school districts in the townships.

In the mining district here we have the towns of San José, Central, Ft. Bayard, Santa Rita, Hanover and

Fierro, and I suppose there are 3,000 mining claims recorded. If it were divided so that each town was a district by itself, the maps and other matters pertaining to them could be kept better. Instead of the mining claims being enlarged, I would make them smaller. Most mines do not cover five acres of actual mineral land. By cutting down, it would encourage more prospecting, more work and more investors. The mineral zones are nearly all covered, and if you increase the acreage, it means giving away something in which the future generations should have a share. Under the land laws of the United States, a native born has either to buy or take a desert tract which would take a lifetime to develop.

James A. McKenna.

Hanover, N. M., Oct. 29, 1916.

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Limestone Precipitation of Weak Copper Solutions

In the *Journal* of Oct. 21 I notice an article on "Limestone Precipitation of Weak Copper Solutions," in which you quote Dr. Gahl as saying: "We feel very hopeful about the success of our limestone precipitation, which, if it holds what it seems to promise, will develop into a novel feature of copper metallurgy."

It may be of interest to record that this method of precipitation is not as novel as the article in question would lead one to suppose. As far back as 1880 I had occasion to install a plant using lime as a precipitating medium, at a small copper mine in the Santa Clara district of Cuba, under rather novel conditions. The outflow on the hill side of a narrow valley, from what appeared to be an old adit which had entirely caved in, was highly impregnated with copper sulphate, the water being of a light blue color. Attempts had been made previous to my visit to precipitate the copper on scrap iron, but owing to the weakness of the solution, this method had not proved successful.

The stream bed for about half a mile below the tunnel was serpentine, and for that distance the water remained clear and limpid. Then all at once, at the intersection of another stream, the water became turbid and greenish white. Wondering what caused this change, I proceeded up the branch creek and found that for quite a distance it was running over a limestone formation. Further investigation of the water showed it to contain quite a percentage of lime and magnesia. An examination of the bed of the creek below the junction of the two branches showed a deposit several feet in thickness, of a slimy mass of a darkish brown color, carying from 22 to 26% copper.

Following up this cue with further experiments, we found that by flowing the copper-carrying water over a series of riffles made of burnt lime held in place by wooden slats, the entire copper contents were precipitated with such rapidity that no great length of flume was required, but the settling capacity had to be of considerable size, as the precipitate was flocculent and deposited slowly.

This plant was operated for some time and the slimes shipped to England averaged 23% Cu. Finally the plant was burned during the Cuban revolution.

While, of course, in the laboratory the reaction of lime on a solution of copper was well known, I believe that this Cuban installation was the first practical demonstration of the process on a commercial scale.

New York, Oct. 25, 1916. E. Gybbon Spilsbury.

Safety for Hoist Engineers

Mr. Scott's article in the *Journal* of Oct. 21, 1916, relative to the class of hoisting engineers often found in the West is well taken and is a subject that warrants considerable discussion as well as agitation with a view to improving present conditions. This question has been brought forcibly to mind recently while endeavoring to find a competent man for the operation of a double-drum Nordberg electric hoist on a 1,000-ft. shaft where hoisting was being done from several levels. After trying four men, all of whom came well recommended, I was finally able to get a man who filled the bill.

Many of our states and large mining camps demand a certificate from an applicant before allowing him to take a hoist, and to my mind, it would be greatly beneficial if we could demand that before taking a position as hoisting engineer a man be required to present a certificate of first, second or third degree, such certificate to be issued by the state authorities only after examination or after presentation of a record of experience on certain kinds of hoists.

As an illustration, a third-class degree or certificate would be given to the operators of small friction steam hoists or single-drum gasoline hoists; a second-degree certificate to men capable of passing an examination on double-drum electric or steam-geared or friction hoists; a first-degree certificate for operators of auxiliary-controlled double- or single-drum electric or steam or first-motion hoists.

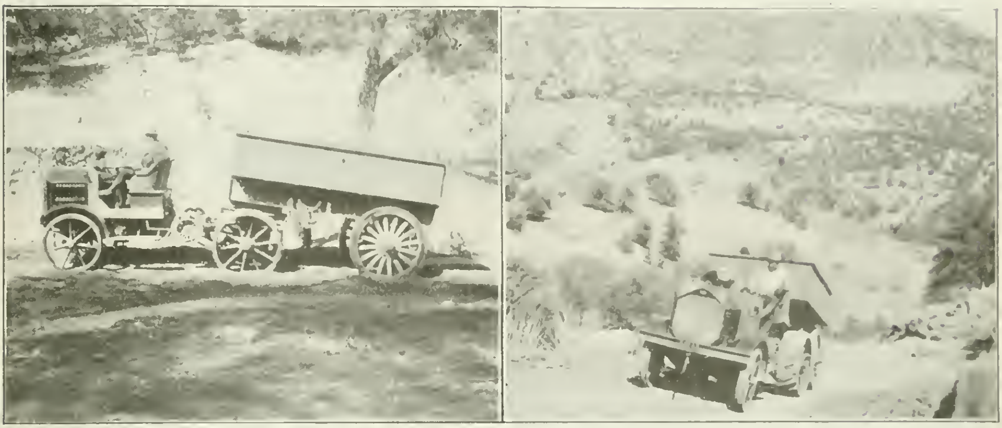
This is a field untouched in many states by the labor unions and one to which they might well look for strength, as the relation between the unions and the employers would certainly be much pleasanter if the employer knew that the union was assisting him by demanding that its members be able to fulfill certain requirements. This would result in a classification of union memberships whereby the union would resolve itself into an organization that, to a certain extent, would be an employment agency, its members classified and listed according to their requirements, capabilities, etc.

What a wonderful thing it would be if the modern mine operator, harrassed by inefficient labor, increasing costs, etc., could go to the phone and call up Mr. Moywood, the president or secretary of the local union, and ask for an A No. 1 hoisting engineer capable of handling a first-motion hoist, and receive a reply stating that just the man desired was at hand carrying splendid recommendations from past positions, etc., and that he would be up for an interview at short notice. The union man would be assured of the maximum scale of wages as set down by his union, and the employer would be assured of getting a man whose past experience had been cataloged and listed and in whom he could place confidence.

Any employer would be glad to be dictated to by a union if he knew positively that every member of that union was being dictated to by an organization that insisted that its members qualify along the lines by which they have obtained membership, thereby assuring the employer that every union man had qualified in his particular line and was a capable man. I greatly fear, however, that such ideal conditions will only be reached in the land beyond, and so we will continue to hire men on their own recommendation and, on finding them worthless, will resort to our only prerogative. W. V. DeCamp.

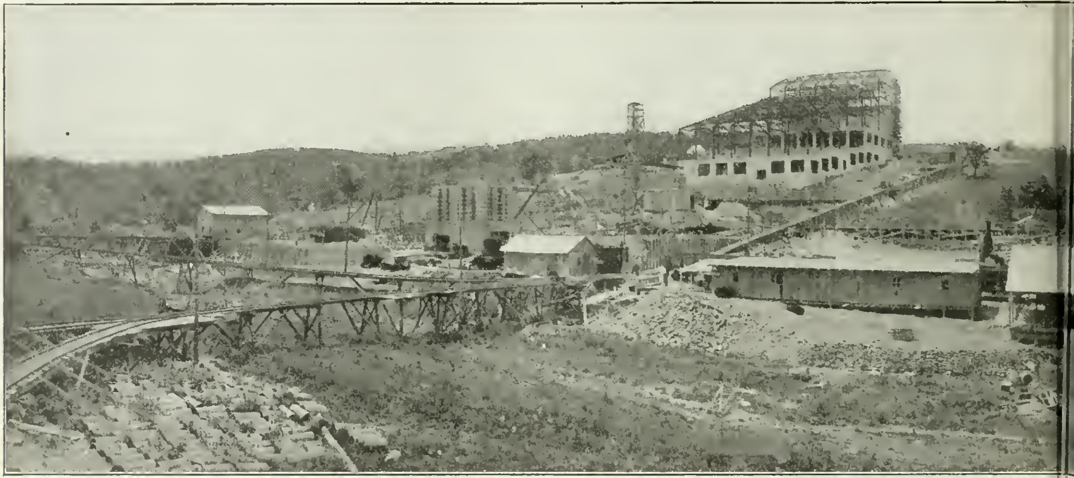
Mayer, Ariz., Oct. 26, 1916.

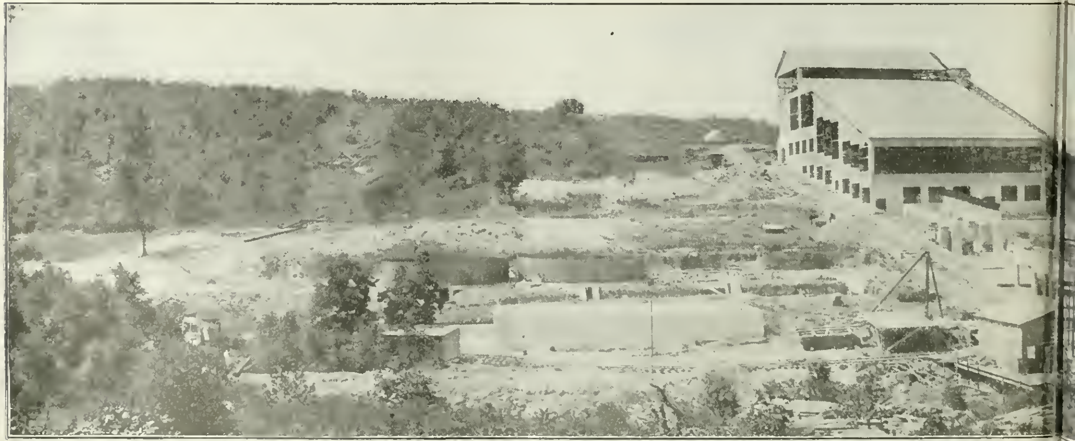
Photographs from the Field



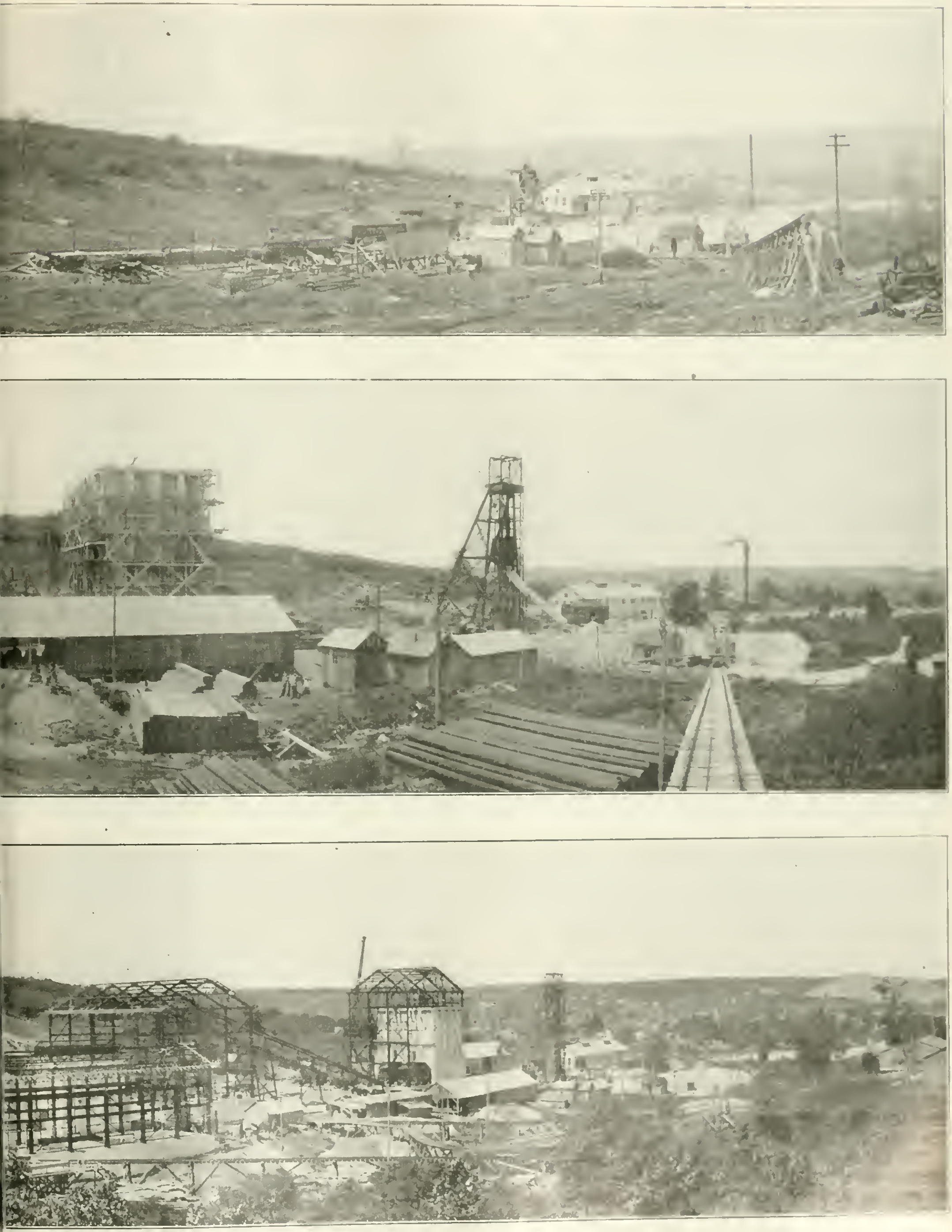
THE KNOX TRACTOR WITH SEMI-TRAILER IN USE BETWEEN DUQUESNE AND PATAGONIA, ARIZ.

PANORAMIC VIEW OF THE CHRISTMAS MINE, PINAL COUNTY, ARIZONA





PROGRESS OF THE CONSTRUCTION OF THE 2,500-TO
The upper photograph shows the mill site on Mar. 13, the middle one the progress



MILL OF THE FEDERAL LEAD CO., FLAT RIVER, MO.
the work on June 13, and the lower picture the accomplishment on Sept. 5, 1916

Electrolytic Copper Refining*

SYNOPSIS—The stages of electrolytic copper refining are the melting of blister copper and casting it into anodes; electrolytic refining to secure pure cathode copper; and melting the cathodes and casting into commercially appropriate form. The conducting of each stage is discussed, together with the appliances used.

With the exception of the large body of native copper in the northern peninsula of Michigan, the commercial ores of copper are sulphide ores, widely disseminated through the entire world. In the western part of the United States, notably Montana, Arizona and Utah, are enormous deposits which furnish 40% of the total production of copper. Large deposits are also found in Alaska, Mexico, South America, Africa, Japan and Russia, while the copper deposits of Spain have been utilized for centuries, not only for their copper contents, but also for their sulphur value.

For economic reasons, chiefly on account of the low copper contents of the ores which will not permit of freighting, the smelteries are erected near the mines where the ores undergo a series of metallurgical processes such as concentrating, roasting, smelting and converting, the final product being an impure copper technically known as "blister copper." This is not suitable for commercial purposes and must be refined, which may be accomplished by oxidation and subsequent reduction in reverberatory furnaces, depending upon the scorification effect of copper oxide to eliminate the impurities.

THE ELECTROLYTIC PROCESS

The electrical industry, which is utilizing the major part of the output of copper, however, requires an exceedingly pure grade which the fire-refining process cannot supply; moreover, most of the copper ores carry traces of silver and gold, which concentrate in the blister copper and which are not recovered by fire refining.

It is for these reasons that at the present time practically all blister copper is refined by the electrolytic method: First, on account of the high grade of the finished product, and second, because of the recovery of the silver and gold.

With the exception of refineries at Great Falls and Tacoma, all the refineries are situated on the eastern coast of the United States in order to facilitate the shipping of the finished material to Europe, for in normal times the shipment of refined copper to Europe far exceeds that of home consumption.

Electrolytic refining may be divided into three stages: Melting the blister copper and casting into anodes ready for the electrolytic tanks; electrolytic refining and obtaining cathode copper of 99.98% purity; melting of cathodes and casting the commercial shapes, such as wirebars for wire mills, cakes for rolling mills, ingots for the brass and alloy manufacturers, etc.

The blister copper is delivered to the refinery in the form of slabs weighing about 300 lb. These are melted in reverberatory furnaces known as blister furnaces, of 300,000 to 500,000 lb. capacity, the details of the operation being practically the same as in the refining furnaces, which will be described later. In this melting process but little refining is attempted, although some of the impurities are removed with the slag and the sulphur is practically eliminated. The copper is cast into anodes 37x28x1⅝ in., weighing about 500 lb. A typical assay of anodes is as follows:

TYPICAL ASSAY OF ANODE COPPER

Copper	99.25%	Antimony	0.052%
Silver	70.0 oz. per ton	Nickel	0.050%
Gold	0.25 oz. per ton	Lead	0.053%
Arsenic	0.060%	Iron	0.058%
Bismuth	0.003%	Tellurium	0.038%
Sulpher	0.004%	Oxygen	0.100%
Selenium	0.008%		

More complete analysis would disclose traces of many other elements.

The theory of electrolytic refining is simple. If in an electrolyte of suitable composition are placed two copper sheets connected to the terminal of a generator, the sheet connected with the negative pole being known as the cathode, the other connected with the positive pole being known as the anode, on passing a direct current of suitable voltage and density, the current will enter the anode, pass through the solution to the cathode, dissolving copper from the anode and depositing an equivalent quantity of copper upon the cathode. Owing to the energy generated at the anode, by the solution of the copper the total intensity factor, the voltage, is small, usually about 0.25 volt per tank. The capacity factor, the amperage, follows strictly Faraday's law, copper acting as a divalent metal. One ampere per hour deposits 1.186 grams of copper.

In practice a number of tanks are connected in series, the electrodes in the individual tanks being in multiple. The electrolyte is an acid solution of copper sulphate, usually 16% bluestone with 12% of free sulphuric acid. The current dissolves the impure copper from the anodes and deposits pure copper upon the cathodes, the impurities either dissolving and fouling the electrolyte or not dissolving and dropping to the bottom of the tanks, known as "slimes."

The products of electrolysis, therefore, are: Cathode copper, 99.98% purity; anode residues and slimes; and impure electrolyte.

Of the usual impurities found in blister copper, the nickel, cobalt, iron, zinc and arsenic dissolve and foul the electrolyte, while the silver and gold along with the other impurities remain in the slimes and drop to the bottom of the tanks.

Since the purity of the cathode copper depends on the purity of the electrolyte and impurities are constantly building up, it is necessary for all refineries to purify daily a certain volume or percentage of their electrolyte.

At some of the refineries the electrolyte is purified by a series of crystallizations, whereby the copper in the electrolyte is recovered as commercial blue vitriol and sold as such. The nickel is recovered either as nickel sulphate (single salts) or as metallic nickel, and the acid after removal of the arsenic is used over again in the electrolyte. At others the electrolyte is electrolyzed in tanks using insoluble anodes of hard lead "liberators" until practically all the copper has been deposited. The nickel sulphate is then crystallized, and the acid is used again in the electrolyte.

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*Excerpts from a paper by F. L. Antisell and S. Skowronski, presented at the annual meeting of the American Institute of Metals, September, 1916.

The slimes are periodically pumped from the electrolytic tanks to the silver department, where, after an extended series of metallurgical processes, the silver and gold are recovered in a pure condition. The semi-rare metals, selenium and tellurium, are also recovered, but the commercial demand for these is so small that only a fraction of the possible recovery is attempted. Small quantities of valuable platinum and palladium, which are recovered, concentrate in the slimes. The lead, bismuth and antimony are generally shipped either as crude metal or as flue dust to lead smelters for further purification.

The cathode copper containing 99.98% copper should be an easy melting proposition, but copper when molten absorbs gases to such an extent that the melting process becomes a refining process, refining from the gases absorbed during the period of melting. Copper when molten absorbs hydrogen, carbon monoxide and sulphur. Our methods of chemical analysis have not yet reached the refinement of determining hydrogen and carbon monoxide, both of which if present in copper must be there in very minute quantities. Sulphur, however, can easily be determined, and the effect of sulphur on copper has been carefully studied. The presence of oxygen, or copper suboxide, greatly increases the solubility of the above gases in copper, and it is for this reason that from 0.30 to 0.80% of copper suboxide will always be found in commercial copper.

The Technology of Refined Copper

Copper is said to be "tough pitch" when it has set with a level surface. "Underpoled" copper is that which has set with a concave surface, due to too high oxygen contents, and "overpoled" copper is that in which the oxygen content is so low that the solubility of the gases in the copper has decreased until the surface set shows a distinct convex crown, and sometime a worm-like projection called spewing. Overpoled copper has always been considered as copper with too low oxygen content, but it is possible to melt cathode copper of 99.99% purity in crucibles so as to prevent the absorption of gases and obtain a perfect "tough-pitch" bar of 99.99% purity containing neither sulphur or oxygen. Overpoled copper should therefore be considered as copper too low in oxygen for the amount of gases dissolved in the metal.

The percentage of oxygen in tough-pitch copper is directly dependent upon the amount of gases dissolved in the copper, and it is impossible to overpole copper free from these gases. The copper is melted in large reverberatory furnaces of 200-250 tons capacity. The furnaces in normal times are usually lined with magnesite bricks up to and above the metal line, with silica-brick roof and sides. Chrome bricks have been tried with success. The bottom of the furnace is usually of high-grade silica sand, although silica bricks have been tried on the smaller furnaces with success.

The usual fuel is bituminous coal low in sulphur, and to a limited extent powdered coal, fuel oil and gas. Direct coal fire is the usual type, carying a bed of fire 4 to 5 ft. deep. The melting or refining operation may be divided into charging, melting, oxidizing, deoxidizing (poling) and casting. All operations are so conducted that it takes about 24 hr. to carry through to completion the full cycle of operations.

Charging was formerly done by hand, but now all furnaces are provided with charging machines. The machine picks up 10 cathode sheets, weighing about 5,000 lb., at a time and puts them in the furnace much more compactly than could be done by hand, thus materially increasing the capacity of the furnace. The time of charging is usually 2 hr. After the furnace is charged, the side doors are closed and luted, and fire increased to hasten the fusion of the copper. In about 10 to 12 hr. enough copper is melted so that the oxidation period can begin. In this period the molten copper is nearly saturated with cuprous oxide and brought to what is known as "set copper," containing from 1 to 5% of suboxide. In this process all impurities are oxidized and all hydrogen, carbon monoxide and sulphur compounds removed. This is accomplished by blowing compressed air through iron pipes under the molten bath, also by "flapping" the charge. Flapping consists in striking the surface of the metal with the edge of the head of a rabble, in order to uncover the surface of the copper. The furnaceman watches the operation by taking button samples and observing the fracture, the fracture in all stages being characteristic and well defined. Tests during this period show that after melting, the sulphur content of the charge is from 0.0030 to 0.0050%, which is gradually driven off by the copper suboxide formed until at set copper the metal is free from sulphur. The sulphur comes from the fuel and the sulphuric acid left on the cathodes. During the oxidation period a strong basic oxide slag is formed, containing about 50% copper. This is melted in a blast furnace to blister copper.

After the charge is oxidized, the slag formed is skimmed off, the bath covered with coke or charcoal and the poling process begins. This consists in forcing the butt ends of green poles underneath the surface of the metal and causes a violent action in the metal bath, the carbon from the wood and coke reducing the dissolved cuprous oxide. The operations takes from 3 to 5 hr. When the suboxide of copper has been reduced to 0.3 to 0.6%, which can be readily told by the fracture of the button sample, the copper has reached the tough-pitch stage and is ready for casting. On a 250-ton furnace, 25 and sometimes 40 large poles will be used before the copper shows the proper pitch. During the poling the copper again picks up sulphur from the gases of the fuel and the coke used to cover the charge. The sulphur contents varying from 0.0010 to 0.0030% after poling.

The casting operation consists in forming the molten copper into commercial shapes, wirebars, slabs, wedge bars, cakes, ingots and ingot bars. The molds are made of copper and sprayed with bone-ash emulsion. The molds are placed radially on a circular casting machine—Clark casting machine or tangentially as in the Walker wheel. As the wheel turns around, the molds are filled from the furnace. After the copper has set, the molds automatically tip, dropping the copper bars into a water bosh, which pickles the copper and gives it the characteristic red color. The bars come up from the bosh on an endless belt, and after weighing, are ready for shipment. A representative analysis of refined electrolytic copper would be somewhat as follows:

ANALYSIS OF REFINED ELECTROLYTIC COPPER

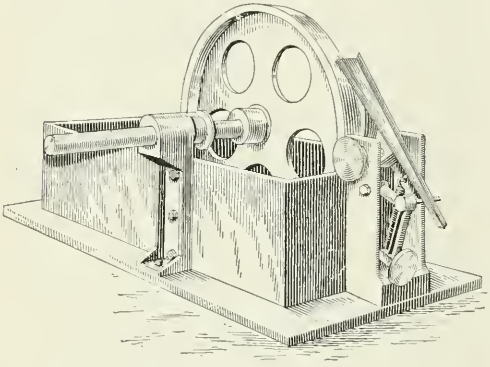
Copper	99.93000	Oxygen	0.04500	[illegible]	[illegible]
Silver	0.00100	Sulphur	[illegible]	[illegible]	[illegible]
Gold	0.00001	Iron	0.00350	[illegible]	[illegible]

It takes from 5 to 8 hr. to take out a charge, and during that time the refiner has to keep the copper at the proper pitch and set, which can be easily accomplished provided the oxidizing and poling have been properly done, but if the oxidation period has not been carried nearly to "set copper," after about two hours of casting the copper will become "unhealthy," show signs of overpoling, and the furnace will be difficult to control.

In conclusion, the tendency in copper melting has been to encourage large furnaces. Only twelve years ago a 100-ton furnace was considered a large one. Today the 100-ton furnace in refineries is almost obsolete—200-250-ton units having taken its place.

Flotation Oil Disk Feeder

A mechanical disk feeder for flotation cells has recently been placed on the market by the Braun Corporation, of Los Angeles, Calif. As shown by the accompanying illustration, it consists of a heavy disk rotating within a tank containing the oil or other reagent to be fed to the pulp. The rotating disk carries up a thin film of the reagent, which is scooped from the disk to any desired degree by the trough intercepting the smooth disk surface on its downward rotation side. Feed adjustment is regulated by the adjustment of the trough by micrometer screws. Grit or sludge entering the oil tank cannot disturb the regularity of feed by either choking the tank or reaching the disk surface. Two types of feeder are manufactured, one for feeding the oil and one for acid. The machine measures 30x20x15 in. and weighs 90 lb. net.



BRAUN DISK FEEDER FOR FLOTATION OILS

Lead Sulphide Roasting Reactions

W. Rrinders, in *Zeit anorg. Chem.*, 1915, XCIII, 213-31, and *Chem. Zeit*, 1916, XL, Rep. 196, through *Journ. Soc. Chem. Ind.*, Aug. 15, 1916, says that the roasting process consists of first incompletely roasting lead sulphide and then heating the product with further amounts of sulphide without admission of air, but with removal of the sulphur dioxide formed, until all the sulphur has been removed and the lead has separated. In this process the lead sulphate first formed does not react with sulphide to produce lead and sulphur dioxide directly nor are these products obtained by the interaction of lead sulphide and lead monoxide, but there are formed in succession the basic sulphates, $(PbO)PbSO_4$, $(PbO)_2PbSO_4$, $(PbO)_3PbSO_4$, and finally, PbO. Lead sulphide and lead monoxide are not stable together, but give lead and basic sulphate. Lead reacts with normal lead sulphate with the formation of sulphide, but this reaction does not take place with basic sulphates. The pairs of phases $PbS + PbSO_4$, $PbS + (PbO)PbSO_4$, and $Pb + (PbO)PbSO_4$ are stable and give monovariant equilibria when heated in closed tubes: only when the sulphur dioxide is withdrawn does the separation of the lead proceed. Pressure and temperature measurements have given, for the complete reaction, the equation $PbS + PbSO_4 = 2Pb + 2SO_2 — 99{,}543$ cal. The value calculated from the heats of formation is 95,230 cal. The separated lead retains a certain amount of lead sulphide in solid solution.

The Use of Gins and Shears

The gin pole is familar enough around the surface operations of a mine, but the three-legged gin is not as commonly used as it would be if its convenience and advantages were more generally realized. The gin, which requires no guys, is really a tripod formed of three poles; the two outside ones are called legs, and the third one the pry pole. It is used for lifting weights vertically and can safely be used for loads up to 17,000 lb. When made for permanent equipment, a windlass operated by hand spikes or crank is used between the two legs, and a block and tackle is hung from the pin and clevis through the top, the fall of which goes around the windlass. Two braces are used between the two legs, one above the windlass and one below.

In assembling the gin (Fig. 3) the legs and pry pole are laid on the ground with the heads together, the legs in one direction and the pry pole in the other. The head is assembled by putting the pin through the pry pole, clevis, and legs. The gin is raised, after being put together, by lifting the heads and bringing up the foot of the pry pole toward the feet of the other two legs.

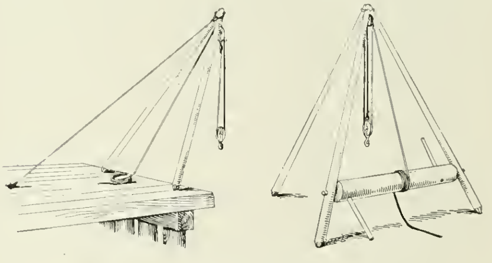


FIG. 1. SHEARS, AND FIG. 3. GIN

There are many times when a tripod with a block and tackle could be employed to great advantage, without the necessity of using a windlass, and for this purpose a tripod can be made with a lashing at the top which, for temporary work, will answer every purpose of the pin and clevis of a permanent gin. To make this lashing, as shown in Fig. 2, lay the three legs on the ground with their heads together as described; mark on each spar the distance, equal for all legs, from the butt to the center of the space to be occupied by the lashing. Lay the three spars on the ground parallel to one another with the head of the pry pole between the heads of the two legs, as described, leaving an interval of about 2 in. between the poles. Rest the heads of the three poles on a skid to give convenience in passing the lashing underneath the poles. Make a clove hitch (*A* in Fig. 2) on one of the outer spars below the lashing and take eight or nine loose turns around the three spars, as shown. Then take a couple of frapping turns (*B* in Fig. 2) between each pair of spars in succession and finish with a clove hitch on the central spar above the lashing, as shown. Pass a sling over this lashing, into the two bights of which the block is to be hooked, and the tripod is ready for raising in the manner previously described.

By means of this simple lashing it is possible, in a few minutes with only some rope, a block and tackle and three poles, to make a very stiff, serviceable device which will lift 8½ tons. This amount of rude equipment is more often at hand than any regular lifting device of the capacity given.

THE USE OF SHEARS FOR LIFTING WEIGHTS AT AN ANGLE

Shears, Fig. 1, consists of two spars of a suitable size for the weight to be raised, lashed together at the cross, with the feet spread apart. They are supported in an inclined position by means of guys. They are used for lifting heavy weights where the lift is at an angle; that is, not vertical. They are rigged as follows:

The two spars for the shears are laid alongside of each other with their butts on the ground, with points below where the lashing is to be resting on a skid. A clove hitch is made around one spar, and the lashing (see Fig. 2) taken loosely eight or nine times about the two spars above the hitch without riding. A couple of frapping turns are then taken between the spars (see *B*, Fig. 2), and the lashing is finished off with a clove hitch above the turn on one of the spars. The butts of the spars are then opened out, and a sling, or guy strap, having the splice in the center, so that it cannot come into either bight, is then laid between the spars above the cross and equally divided. Each bight is led around the spar farthest away from the guy for which it is intended, the bight brought back around both spars for the upper guy block to be hooked to, or the guy rope itself is attached to the guy strap. The other end of the guy strap is adjusted in the same manner, the strain on each guy thus tending to bind the spars together (see Fig. 2).

The main tackle sling is then put on over the cross, passing over the guy straps. The upper block of the main tackle is then hooked through both bights of the main sling and the hook moused.

If the shears are not too heavy, they are raised by lifting the head and hauling in on the proper guy ropes. If too heavy to raise in this way, a crutch is formed by lashing together two small poles near their upper ends, the feet of the crutch being slightly in the rear of the heels of the shears and secured to prevent them from slipping. The guy ropes of the shears are led over the crutch, and the crutch itself is raised by two light guy ropes until it is inclined to the front at an angle of about 15°. Then by hauling on the rear shear guy, allowing the crutch to rise as the shears rise, the latter can be raised until the crutch reaches a vertical position and ceases to act, after which the shears can be raised to position by continued hauling on the guys. Made of the proper size of material, such as can be obtained ordinarily, shears will handle weights up to 25 or 30 tons.

Both gins and shears ought to be used more about mine and mill construction where now the work waits either for a contractor's derrick or the final crane to be put in place. Their use would obviate many awkward makeshifts which are too often resorted to by force of necessity.

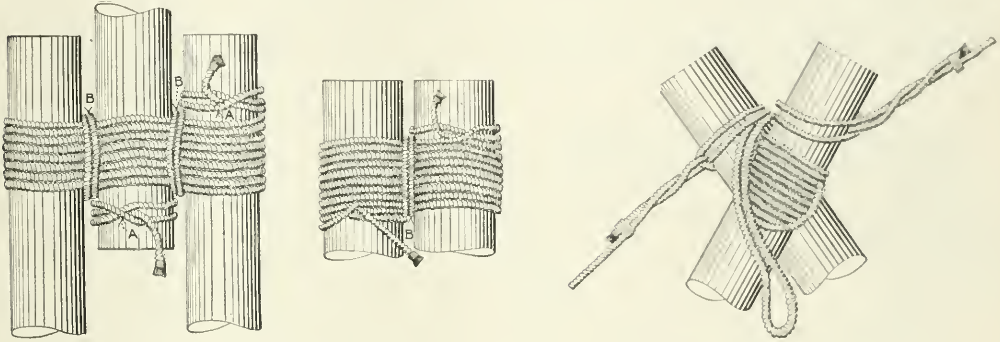


FIG. 2. DETAILS OF ROPE FASTENING ON GIN AND SHEARS

Report of Wallaroo and Moonta Operations

The report of the directors of the Wallaroo and Moonta Mining & Smelting Co. for the first half of 1916 has been issued and contains the following data relative to the production and activities during the period.

From the Wallaroo mines 28,886 tons of ore averaging 8.79% copper has been removed while 4,302 tons, averaging 11.81% copper has been taken from the Moonta mines. In addition 524 tons of concentrates from the latter averaged 14.85% copper. At the [illegible] the copper recovered from the treatment of [illegible] and [illegible] plus an additional 1,185 [illegible] from the treatment of purchased ores, [illegible] copper made a total copper production of 4,447 tons and indicated a metallurgical recovery of 94%. In addition to this copper production the sulphuric acid plant, which was in operations 159 days during the period, produced 3,250 tons of sulphuric acid. To accomplish this production 1,141 men were employed at the Wallaroo mines, 536 at the Moonta mines and 335 at the smelting works making a total of 2,012.

At the Wallaroo mines both the Taylor and Young shafts were sunk to depths of 2,966 and 2,575 ft. respectively. A total of 2,230 ft. of development work was done, showing up average grade ore. A total of 80,074 tons of ore was produced and a recovery of 95.06% was realized. At the Moonta mines more than the usual amount of development work was done with generally satisfactory showings. At the smelting works no additions have been made but in the electrolytic refinery additional capacity has been provided. Arrangements were made to provide for the manufacture of shells and upon the receipt of the first consignment of steel, Nov. 9th last, work started. Due to failure in receiving continuous shipments of steel the manufacture was interruped and finally discontinued.

⁂

Foreign Trade in Copper

Exports of copper from the United States in September are reported by the Department of Commerce as below, in pounds:

Ore and concentrates, contents	947,842
Unrefined, in bars, pigs, etc.	457,308
Refined copper in ingots, bars, etc.	65,267,928
Old and scrap	242,470
Plates and sheets	2,406,227
Wire	1,583,542
Total copper	70,905,317

The weight of ore exported in September was 15,884 tons; of concentrates 518 tons.

Imports of copper into the United States in September are reported by the Department of Commerce, as below in pounds:

Ore and concentrates, contents	15,010,209
Matte, contents	510,802
Unrefined, etc., in bars, pigs, etc.	20,119,481
Old, etc., for remanufacture	873,252
Composition metal, copper chief value	54,701
Total copper	36,568,445

Actual tonnage of copper bearing material imported in September was 43,676 tons ore, 11,766 tons concentrates and 444 tons matte.

⁂

Self-Luminous Paint

F. H. Glew, *Optical Soc.*, June 8, 1916, and *Chemist and Druggist*, 1916, LXXXVIII, 653, reports that when radium is mixed with zinc sulphide, it exerts a continuous excitation on the sulphide and eventually exhausts it. The British Admiralty specification for radium luminous paint is 0.4 mg. of radium bromide per gram of zinc sulphide; the paint is also made with half that proportion of radium. At the end of a year it is probable that paint made to the Admiraly specification will have only half its original luminosity. The more radium the paint contains the shorter will be the life of the zinc sulphide.

The act of mixing the paint exhausts the zinc sulphide somewhat, and it requires time for the radium to excite it to further action. A palette knife must not be used for mixing the paint or the crystalline structure of the zinc sulphide will be destroyed, with a corresponding loss of illuminating power. Other substances than radium are used in paint, mesothorium more frequently. Ionium would be an ideal substance, but it is not obtainable in a pure state.

⁂

Lignum-Vitae for Tunnel Sets

At a large gold-placer property it was found advisable to shorten a proposed ditch, or canal, by driving five tunnels at advantageous points. The greater part of the work being in tough andesite, roof support was necessary only at and near the approaches. Trees of almost infinite variety of strength and durability were available, as the ditch line traversed a jungle in the western foothills of the Andes, a few miles north of the equator. While for flume boards a certain tree called *tangarí* (resembling cedar, but yielding a sap similar to that of the "cow-tree" described by Baron Humboldt) furnished a wood that was extremely durable when kept wet, the conditions demanded a wood that was strong wet or dry.

Shorter tunnels of earlier construction, as well as exploratory drifts in the gravel banks, had been timbered principally with *tangari;* some props requiring replacement at intervals. Examination of some husky old legs showed that all the best-preserved timbers were lignum-vitæ, known locally as *guayacan* (order of *Zygophyllaceae*). While eight varieties of this tree are known, only two grow to considerable size. The *guayacan doble* (sometimes designated as *guayacan roble*) furnishes the toughest wood, the fibers being interlaced in a peculiar manner; but the plain *guayacan* was found as large as 5-ft. diameter at the base. Felling and topping was accomplished with Collins round-helved axes, the trunks being cut to suitable lengths with two-man crosscut saws. This work and the splitting of the logs were performed by Ecuadorian negroes. The shaping of the caps and legs was done by Jamaica-negro carpenters, directed by Irish-American hard-rock specialists. Unskilled labor for lifting and carrying was mainly *mestizo* and pure *Quichua* stock, The work was expensive, but much of the timber will be good for centuries.

In the course of the work a curious superstition was confirmed. Several of the negroes objected to cutting trees during a period when the moon was full, on the ground that the timber would be less durable. The trees were cut, but the timber was finally rejected. It was found that the sap fermented, making the sticks slimy, disagreeable to handle and less desirable than those cut in accordance with the old African custom.

⁂

Smelters Refuse Ore Shipments from the smaller shippers, is the complaint throughout the Arizona mining districts. The Arizona State Bureau of Mines reports congestion of ore at all the smelting plants at this time, adding that many of the small operators whose properties are under development claim the smelters have not refused to handle the increased tonnage of the larger mines. The small operator's development, depends upon sale of ore, and when markets are closed to him, he is severely handicapped. To make a prospect pay for its own development is a method that should be encouraged and not retarded. It is easy to understand the good relations between the big producer and the smelter, but the growth of the mining industry depends upon the coming in of new producers. To encourage the small ore shippers is to make possible the opening of new mines Naturally the smelters prefer large and regular shipments, since to handle the small shipment requires as much clerical work, computation, etc., as does a large shipment.

Editorials

After the War

As the war draws on, more and more things become clear. In the early days we heard much respecting the stupendous cost of it. That does not appear to have been so serious a check as it was thought it would be. Certainly, the thing has been protracted long after the time set by some economists and none of the nations is even wavering.

The cost of the war is not truly measured in dollars. The real measure is the use of material and men. Suppose for example, that Germany had ample resources of all necessary material, so long as she had the men to produce what was needed and maintain the requisite number on the front, she could keep on fighting indefinitely. She might cease to accumulate any wealth, but she might avoid going backward. Germany is not in that position, but the manner in which she has been doing things illustrates the point.

The actual cost of the war is the waste of life, the waste of material and the wealth that has to be sacrificed to get material from abroad. In this view Sir George Paish was manifestly correct. We are beginning to see the converse in the United States, where we are accumulating an enormous hoard of useless gold, but have not enough of metals, of foodstuffs, of clothing material to satisfy our own people.

This is taking the national view of things rather than the individualistic. Germany has long taken a national view. Great Britain, France and Russia did not. They are doing so now, and they will continue to do so after the war. That is one of the things that is sure. The manner in which Great Britain has organized and nationalized her industries is one of the remarkable things of the war.

Great Britain figures that she can continue this war for four years more before the cost will bear the same relation to national income that it did at the close of the Napoleonic wars; but regardless of how that may be, it is certain that even if the war should terminate now, all the countries of Europe would be under great economic strain in paying the interest on their foreign debts. Waste in living is just as disastrous economically to a country as is waste in war. The individual who squanders food is economically just as much a criminal as he who sets fire to a building. Recognition of this in Germany has caused the government to assume control of the mode of living by the people. France and England have done so to a less extent. But after the war we shall hear more of such policies. The cry will be economy. The waster will be a criminal, who will be punished. We may expect to see laws limiting the use of automobiles, limiting the theater, checking not only things that are wastes, but also those that are nonproductive. Europe is going to produce all she can and is going to sell to America all she can. America must buy. She cannot continue to sell without buying. If she can buy things cheaply, that will not be to her disadvantage; rather will it be to her advantage.

The fundamental idea is that after the war Europe will be on a basis of organized national economy. America will be on a basis of individualism, license and extravagance. The political dissensions of the last few years in the United States have not been over questions of national welfare—at least not in so far as domestic policy is concerned—but have been between classes and as to which should be favored. All ideas of efficiency in industry have been at a discount on the theory that they savored of Wall Street. National expenditures on pork-barrel legislation have mounted high. Private expenditures have mounted higher. The laboring classes have aimed to work less and to produce less. Waste has been rampant. It is but to state an economic platitude that coal, flour, sugar, cotton, paper and all commodities would not be so high today if the American people did not waste so much of them.

In brief, unorganized America is going to be confronted by organized Europe after the war. The war is, moreover, teaching us the lesson that organization of production and consumption does not mean cartels, combinations and trusts arbitrarily to raise prices in the interest of some people at the expense of others, but rather does it mean national control for the sake of economy and efficiency in the interest of everybody.

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The Demand for a British Department of Mines

The chief technical societies in Great Britain that have to do with mining and metallurgy—the Iron and Steel Institute, the Institute of Metals, the Institution of Mining Engineers and the Institution of Mining and Metallurgy—have united in a petition to the government for the creation of a department of minerals and metals. The duties contemplated for such a department are as follows:

1. Arrangements for expediting the completion of mineral surveys of the United Kingdom and of the Crown Colonies and other British possessions.

2. The systematic collection and coordination of information bearing on the occurrence, uses and economic value of minerals and their products, special attention being devoted to securing industrial applications for newly discovered minerals or metallurgical products and to finding mineral materials required for new metallurgical products or inventions. Some of this information should be promptly and widely disseminated in summarized form to those interested in the industries, through the medium of the existing publications of the institutions directly concerned.

3. The investigation of all questions and problems relating to the utilization of the mineral or metallurgical resources of the Empire.

4. The coördination and dissemination of information on mining laws, development of mineral areas, output, processes of extraction, plant, capital employed, markets, etc.

5. A general review from time to time of the developed and undeveloped mineral resources and of the position of each mineral or metal, to insure that the mineral wealth of the Empire is being exploited with due regard to imperial interests.

6. Generally, to advise the Imperial Government on all questions bearing on the mining and metallurgical industries. To perform this function efficiently it is essential that complete information should be available, and also that the in-

dustries concerned should be consulted through their respective organizations.

This movement is praiseworthy, but not very much confidence is ever to be placed upon a bureaucratic institution, conducted under governmental auspices. Look at the United States, where the most marvelous development of the world in mining and metallurgy has occurred wholly on private initiative.

We recommend to the mining and metallurgical institutions of Great Britain a concerted propaganda for the development of interchange of information among the miners and smelters of the United Kingdom. The ancient habits of secrecy, upon which we have previously commented, have been one of the great blights upon British mining and metallurgical progress. Observe, for example, the admirable transactions of the Institution of Mining and Metallurgy—an organization that has acquired the highest standing, not only nationally but also internationally. The major parts of its publication are of colonial and foreign origin. Seldom is anything offered from Cornwall, Wales or the north of England.

Not long ago the *Journal* invited a British metallurgist of international reputation to contribute a memoir upon the metallurgical practice of his district. He replied that regretfully he could not, for although he had been working there as superintendent and manager for about 30 years, he had never been in any of the works of the district except his own. The great strides in American progress date from the time when we became emancipated from the old traditions of secrecy and began freely to interchange information by conferences and visits and by contributions to the technical press and the proceedings of the professional societies.

Refined Spelter

It would be interesting if we could have statistics of the world's production and consumption of high-grade and other special classes of zinc during the war. Some time in the future we may be able to review that phase of the situation in a comprehensive way. At present we do not have statistics of the world's production of zinc, anyhow—only the outputs of some of the producing countries. That the demand for the superior zincs has been very large is of course well known, and the production has been correspondingly large. The New Jersey Zinc Co. and the American Zinc, Lead and Smelting Co. produce high-grade zinc directly from ore by virtue of the purity of the Franklin and Mascot ores respectively, although of course proper care in smelting and handling it is taken. There has been a small production of electrolytic spelter of high grade directly from ore, and that is now becoming large. Many other smelters have produced high-grade spelter by refining common by redistillation, either in ordinary ore furnaces, in special furnaces or in electric furnaces. These refiners have handled either their own product of common or have bought the latter in the open market, often with considerable influence on the latter. Brass special spelter, so called, is produced simply by selecting the best drawings of common spelter.

The development of the business of zinc refining could have but one natural result; namely, the contraction of the price differential between high-grade and common to a figure corresponding to the cost of refining. This has reference, manifestly, to high-grade broadly speaking. If a buyer insists on some special brand, the makers thereof may of course ask and get for it what they please, but in general they also are constrained to meet the market. Ever since the tension in zinc reached its climax, such a contracting tendency has been in evidence. The maxima were about 25c. for common spelter and 40c. for high-grade. No minute deductions ought perhaps to be drawn from those figures, for there was never a broad market for common spelter at the 25c. level, while at about that time high-grade and high-grade intermediate were held variously at 30 to 40c. per lb. It would probably be safe, however, to say that the real price differential at that time was 10c. per lb., and later it doubtless was higher, the prices for high grades being maintained for a long time after that for common had declined. But the natural law asserted itself gradually.

Of late there has been but little difference between the prices for common spelter and brass special. With the former at 10⅛c., the latter was about 10½c. This difference is not greatly in excess of what frequently prevailed in normal times, ⅛ to ¼c. per lb. being not uncommon. At the same time high-grade metal—99.9% Zn—sold at 14½@15c. per lb., a premium of but about 4¾c. over common. In former times the premium for special brands of high-grade, which then used to be produced in relatively small quantity, was about 2½c.

Without any doubt the price differential will eventually contract to the cost of refining, including an allowance for amortization of plant and plus a reasonable profit, which will be established by competition. The actual cost of redistilling zinc may be as low as ½c. per lb., and the loss of spelter may be as low as ½%, which would be ½c. per lb. on 10c. spelter. In ordinary practice, however, these figures are probably more nearly 1c. and 10% respectively.

British Copper Purchases

The large purchases of copper by the British government have been made on the basis of a price f.o.b., New York. Private buyers in Great Britain still insist, however, in buying on the old terms of c.i.f., England. This puts them at a disadvantage, for freight rates, war risks, etc., are so uncertain that an American seller can make c.i.f. terms only with such a margin in his favor as will amply protect him against vicissitudes. It would be better if British private buyers should purchase on basis of f.o.b., New York, and themselves assume the transportation and insurance charges. Of course there is now no private buying from Great Britain unless somebody has a chance to get supplies at less than the price at which the British government offers them.

The Boom in Copper Stocks

During the week previous to election there began something very like a boom in the copper stocks, which was apparently based upon a belated realization that these producers have been making a great deal of money, have been accumulating huge surpluses and have become, moreover, sure of a further large profit in 1917 by virtue of the sales that already have been booked. This led to a sort of riot in speculation. Once the fever is contracted, reason is lost. The conservative person who coolly figured that Utah might be worth intrinsically

95, let us say, is apt to lose his balance when it rises to 114, forgets what he used to think and begins to contemplate that it may go to 125.

Of course there has been talk about increased dividends, extraordinary Christmas extras, etc. That is all right within bounds, but there is enough uncertainty ahead to cause copper managements to be conservative, even if they have already sold at high prices a large part of their expected production in 1917. Nobody knows what is going to happen as the war draws toward a close. The wisest thing for every company is going to be to have a big surplus of cash when that time comes.

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New Uses of Metals

During the last year there has been an increased demand for many of the rare elements and many of the metals for which heretofore there has been but little use. To what extent this has been due to military needs and to what extent it is attributable to advances in the peaceful arts will remain for the historian of the future to tell. The stimulus that has been given to chemical and metallurgical industries undoubtedly has led to many important discoveries by chance.

At present molybdenum is in great demand. The supply of molybdenite is temporarily insufficient. There have been new demands for cadmium and bismuth. Selenium is a commercial commodity, and thallium is being produced. Modern chemistry is showing the harmfulness of minute impurities for many purposes. On the other hand, it is showing the benefit of minute additions of foreign substances for other purposes. For example, there is now being produced in the United States electrolytic tin of extraordinary purity. For some purposes this is found to be far superior to anything else, but for some purposes it has proved to be too pure, a fault that can, of course be easily corrected.

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The American Smelting and Refining Co. is going to retire the bonds—$15,000,000—of the American Smelters Securities Co., which are callable at 105, but also are convertible into common stock of the smelting company at par. The smelting company has called the bonds, which will mean that holders will convert them into stock, both the stock and bonds now selling at the same premium. The smelting company will thus relieve itself of bonded obligation, and another step toward the simplification of the relations between the smelting company and the securities company will have been taken. Inasmuch as the smelting company owns all of the common stock of the American Smelters Securities Co., the only issues of the latter in the hands of the public will be its preferred stocks A and B. The preferred B will become the premier issue of the whole smelting group, inasmuch as its dividends are guaranteed by the American Smelting and Refining Co.

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The recent strike at a lower level in the Magma mine in Arizona is believed by the management to promise the conversion of that property from the proportions of a small mine to those of a big one. Like the United Verde Extension, the Magma is a lode mine of high-grade ore. These interesting developments of the last year or two in Arizona bear out what we have previously remarked: namely, that the day of new mining discoveries of the first order is not yet past.

BY THE WAY

The *Ax-I-Dent-Ax*, "safety first" publication of the United States Metals Refining Co., at East Chicago, Ind., notes some good work in loading metal. It says: "We believe that a record was made by E. W. Merrick's 'huskies' when the regular crew of four men loaded 300 tons of lead in six hours, which is our idea of efficiency. The members of this gang are: Frank Obratte, Mike Skifish, Nick Pesusich and Andy Ambrose."

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The general manager of one of the large Arizona copper properties put in a year of his early apprenticeship as assayer at a mine down in the Republic of Honduras. Being more interested in his work than was compatible with indulgence in local terpsichorean entertainments, he gruffly declined an invitation to a *baile* with an offhand remark to the general effect that "dancing with lemon-tinted ladies offered no attractions." At the expiration of his contract he was informed that his attitude had not been such as to promote harmony with local officials, and that a renewal of employment was not convenient. This arrangement fitted in perfectly with the plans of the now famous engineer, who often chuckles as he recollects the farewell oration of the one individual, in all the camp, who had a kind word for him. This was an unclothed five-year old urchin who stood at a bend in the trail, gravely waving his tiny hand as he piped, *"Adios, quimico. Buen viaje, Don Benjamin."*

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Mining in 2 in. of ground may sound unreasonable, but it is really true, according to a writer in the New York *Evening Post.* Did you ever stop to consider what becomes of all the lead fired from the shells of trapshooters' guns? Of course you know trapshooters have the same hunting grounds week in and week out. Therefore the constant shooting over practically the same territory makes lead mines, for whether the aim is good or bad, the lead finally falls to the ground. Far-sighted contractors have seen the business possibilities in "getting after" this mining business. At prominent clubs, where many squads shoot every week, it is only a matter of a few years when it is profitable for the mining business. About three years ago the ground in front of the traps at the du Pont Gun Club was "mined," and a pile of lead of 23 tons was the result. A portion of the grounds of a club at Columbus, Ohio, was put through the "sieve" and 26 tons resulted. A year ago a second trip was made to the du Pont Club at Wilmington, Del., and results equal to the first attempt were obtained. Other club grounds are now undergoing mining treatments. The methods of securing this lead are simple. Plots of ground about 3x5 ft. are skimmed about 1½ in. deep. This topsoil is then put in piles and allowed to stand for two or three days until it dries. It is then put into a large coarse cylinder sieve which gets rid of the earth containing no lead. Then it is put through a fine sieve and more dirt is removed. If the earth sticks, several screenings are necessary until only the lead remains. [illegible] the remainder of the shooting territory is [illegible] the same manner. On grounds like the du Pont [illegible] takes about 60 lb. of earth to give 1 lb. [illegible]

Personals

Ralph Arnold is in New York.

H. K. McIntosh has gone from Goldroads, Ariz., to San Francisco.

A. L. Trent, lately at Isabella, Tenn., has gone to Drummondville, Quebec.

George A. Creswell has gone from Manhattan, Nev., to East Oakland, Calif.

H. G. Pickard, lately in Washington, has gone to Brantford, Ont., for the present.

W. de L. Benedict has returned to New York after an absence of six months in California.

Robert E. Cranston, of San Francisco, has gone to British Columbia on professional business.

Myron R. Walker, recently at the Cerro de Pasco in Peru, is now at Casa Grande, Ariz.

C. E. Musselran, recently with the American Zinc Co. at Mascot, Tenn., has gone to Allentown, Penn.

Grant D. Miller has returned from Cuba, where he visited some copper properties in western Cuba.

E. Gybbon Spilsbury has gone to Cuba on professional work and will be absent about three weeks.

H. P. Henderson returned to New York from Cuba, where he had been on professional business, on Nov. 8. Mrs. Henderson accompanied her husband.

Dr. J. Hunt Wilson, of Lehigh University, has become assistant professor of chemistry at Lafayette College

Blamey Stevens, of the Lane-Rincon Mines, Inc., Temascultepec, Mexico, is making a short visit to the United States

W. W. Adams has gone from San Antonio, Tex., to Minas de Palomas y Cabrillas, Higneras, Coahuila, Mexico.

Theodore J. Hoover has come over from London to enjoy a holiday of six months in this country. He will join his family in California.

George Aylard, of Victoria, president of the Utica Mines, Ltd., has been on a visit to the Utica in connection with the driving of the low crosscut tunnel on that property.

Dr. J. Ernest Carman, of the University of Cincinnati, has been appointed to the chair of geology at the Ohio State University, vacant by the death of Prof. Charles S. Prosser.

Dr. Eugene C. Bingham has resigned the professorship of chemistry at Richmond College to become professor of chemistry and director of the Gayley Laboratory at Lafayette College.

Heath Steele, of New York, has gone to Deadwood, S. D., on examination work. He will also go to Montana and Nevada on professional business, returning about the end of November.

M. St. Clair and son, of the St. Clair Mining Co., Duluth, Minn., who are heavily interested in the iron industry, were recently inspecting iron properties in the Fort William district, in Ontario.

Dr. George Otis Smith, director of the Geological Survey, will speak on "Geology and Public Service" at the December meeting of the Geological Society of America, which is to be held at Albany.

Dr. F. G. Cottrell, chief metallurgist of the Bureau of Mines, is in Butte, Mont., in conference with Dr. L. D. Ricketts. They are going over the recently drafted report of the Anaconda Smelter Board.

Dorsey A. Lyon has returned to Salt Lake City after a visit to New York and Washington. Mr. Lyon is in charge of the work being done by the Bureau of Mines in coöperation with the University of Utah

Prof. William Nicol, who has been on the staff of Queen's School of Mining, Kingston, Ont., for over a quarter of a century, has resigned on account of ill-health and has gone to Los Angeles, Calif., for rest.

Norman Braley has been promoted from the position of superintendent of the North Butte Mining Co. to that of general manager. Lester Frink, who has been assistant superintendent, has been made superintendent.

C. E. Lesher, statistician of the Geological Survey, left Washington Nov 1 for a month's trip to coal-producing centers. He is gathering information for the year-end review which is issued by the Geological Survey.

F. K. Brunton has resigned from the staff of the American Smelting and Refining Co at Garfield, Utah, to accept a position as assistant superintendent of the Consolidated Arizona Smelting Co. at Humboldt, Ariz.

J. D. Sperr, formerly of Oatman, Ariz., but now engaged as consulting engineer in the Jerome district of Arizona, has returned to his home in Prescott after completing an examination near the Chino copper mine in New Mexico.

Sidney Paige, in charge of Western areal geology for the Geological Survey, has returned from a general investigation of faulting in the San Juan Mountains in Colorado, in the Yosemite Valley region of California and in southern California.

Dr. Edward Hart has retired as active head of the chemical department of Lafayette College, Easton, Penn., but remains connected with the department as professor of chemical engineering and as librarian of the Henry W. Oliver Chemical Library.

Charles E. Mills has been appointed president of Cananea Consolidated Copper Co., vice Dr. L. D. Ricketts, who will remain with the company in an advisory capacity. Mr. Mills will continue as general manager of the Inspiration Consolidated Copper Co.

Van. H. Manning, director of the Bureau of Mines, will leave Washington Nov. 12 for Chicago, where he will address the American Mining Congress. Before returning to Washington he will visit Kansas City and other points where the bureau is doing work.

Herbert W. Gepp, general manager of the Amalgamated Zinc Co. of Australia, who has been in the United States on business for his company during the last two years, will sail for Australia about the end of November. He expects to return to the United States next spring.

Norman L. Warford, until Nov. 1 in charge of the powdered coal department of the Anaconda Copper Mining Co., has now become identified with the Powdered Coal Engineering and Equipment Co., of Chicago, Ill., in the capacity of engineer in charge of construction.

Charles Kettleborough, of the Indiana Legislative Bureau and a member of the State Commission on Mines and Mining, was in Washington recently gathering information looking to a revision of the mining code of Indiana at the next session of the legislature in that state.

Obituary

Alexander McKinnon died at Iron River, Mich., Oct. 17, aged 74 years. He was one of the pioneers of the iron country and founder of the town of Iron River. He owned interests in several large mines.

Joseph Lumley, one of the oldest manufacturers of mining machinery in the United States, died Oct. 21 at his home in Philadelphia, following an illness of three months. He was born in Dublin, Ireland, and came to this country with his parents when he was five years old. Forty years ago he started the manufacture of engines, boilers and mining machinery at Third and Cherry St., Philadelphia. He installed some large mining plants in this country and in South America. He leaves his widow, a daughter and a son.

James C. Wallace died at Cleveland, Ohio, Oct. 31, aged 51 years. His name had been linked closely with Lake vessel building for more than 20 years, as that of his father, Robert Wallace, had been for a generation. After passing through the public schools of Cleveland, the younger Wallace entered the employ of the Globe Iron Works as a machinist. In 1887 he went into the drafting room of the Cleveland Shipbuilding Co., of which his father was general manager and later president, and at length was given full charge of the drafting department. Five years later he was advanced to vice-president and general manager. In 1899, when the Cleveland Shipbuilding Co. was absorbed by the American Shipbuilding Co., Mr. Wallace became general manager, and in 1904 was elected president. He retired in 1914, and had since devoted himself to his vessel interests

Lieut. George Simpson, of Company C, Durham Light Infantry, was killed in action July 4, 1916. In the early part of the British advance in Picardy, Lieutenant Simpson earned the admiration of his men and the praise of his superior officers by his fearless bravery and efficient organization of stretcher parties at the front of the line. Left in command of the company by the wounding of his captain, he worked harder than ever; though without food or sleep for almost 36 hr. Within a few minutes of the time that his company was to be relieved the bullet of a German sniper passed through his head, causing instant death. Lieutenant Simpson was an occasional contributor to the "Journal" and an engineer of merit. His death is a loss to the profession as well as to the bereaved parents who, in mourning the loss of an only son, find consolation in the fact that their boy met a glorious and heroic end.

Societies

The Colorado Scientific Society, at its meeting Nov. 1, listened to Dr. William P. Headden, of the State Agricultural College, who presented his fourth paper on "Mineralogical Notes," and also a paper entitled "Some Analytical Notes on Titanium, Columbium, Tantalum and Zirconium."

American Mining Congress—The nineteenth annual meeting, as already announced, will be held at the Hotel La Salle, Chicago, Nov. 13-16. The provisional program shows that general sessions will be held each day. The Metalliferous Section, the Oil and Gas Section and the Coal Section will hold three sessions each; the Section on Uniform Mining Legislation five sessions. The Public Lands Section will also hold several meetings.

American Iron and Steel Institute—At the eleventh general meeting in St. Louis, Oct. 27, the chief point of interest was Judge Gary's presidential address, which was in the main an account of his impressions of China, Japan and the Philippines, obtained in his recent trip to the East. Technical papers were read as heretofore announced At the banquet in the evening a handsome testimonial was presented to Judge Gary in recognition of his services to the Institute. The presentation was made by President Schwab, of the Bethlehem Steel Co., in a brief speech.

New Patents

United States patent specifications listed below may be obtained from "The Engineering and Mining Journal" at 25c. each. British patents are supplied at 40c. each.

Amalgamator. Rowe F. Lounsberry, Sheridan, Wyo., assignor to Mid-Continent Machinery Co., Sheridan, Wyo. (U. S. No. 1,202,398; Oct. 24, 1916.)

Classifier—Ore Classifier or Separator. Frank A. Goodale, You Bet, Calif. (U. S. No. 1,201,956; Oct. 17, 1916.)

Crushing—Apparatus for Disintegrating Ores and Other Materials. Arthur Feust, New York, N. Y. (U. S. No. 1,202,278; Oct. 24, 1916.)

Electric Furnace. Ignacy Moscicki, Lemberg, Austria-Hungary. (U. S. No. 1,201,607; Oct. 17, 1916.)

Electric Furnace. Ingenuin Hechenbleikner, Charlotte, N C., assignor to Southern Electro-Chemical Co., New York, N. Y. (U. S. No. 1,202,837; Oct. 31, 1916.)

Flotation—Concentration of Ores. Allen Crawford Howard, London, England, assignor to Minerals Separation American Syndicate (1913) Ltd., London, England. (U. S. No. 1,203,341; Oct. 31, 1916.)

Lead Sulphide—Process for the Manufacture of the Sulphate, Sulphite and Oxide Directly From the Sulphide of Lead. James Gitsham, London, England. (U. S. No. 1,201,955; Oct. 17, 1916.)

Potash—Process of Producing Potash. George F. von Kolnitz, Charleston, S. C. (U. S. No. 1,201,396; Oct. 17, 1916.)

Separator—Ore Separator. Albert M. Plumb, Denver, Colo. (U. S. No. 1,202,219; Oct. 24, 1916.)

Stamp Mill. Hector Gawley, Tacoma, Wash. (U. S. No. 1,201,717; Oct. 17, 1916.)

Tank—Acid-Proof and Electrolytic Tank. Rowland T. Wales, Sewaren, N. J. (U. S. No. 1,202,457; Oct. 24, 1916.)

Zinc Oxide—Process for the production of Zinc Oxide. Edouard Hunebelle, Paris, France. (U. S. No. 1,201,586; Oct. 17, 1916.)

Assessments

Company	Delinq	Sale	Amt.
Alpha, Nev	Oct. 25	Nov. 15	$0.03
Big Cottonwood, Utah	Nov. 6	Nov. 24	0.01
Blue Bull, Nev	Oct. 16	Nov. 20	0.01
Blue Star, Ida	Sept. 25	Nov. 21	0.02
Buffalo, Ida	Nov. 15	Dec. 12	0.005
Cedar Creek, Ida	Oct 23	Nov. 23	0.01
Columbus-Rexall, Utah	Oct. 27	Nov. 17	0.02
Comet, Ida	Oct. 20	Nov. 20	0.00075
Confidence Silver, Nev	Nov. 8	Nov. 29	0.10
Cornet, Ida	Oct. 20	Nov. 20	0.00075
Consolidated Imperial, Nev	Oct. 25	Nov. 15	0.01
Diam Blk., Butte, Nev	Oct. 12	Nov. 18	0.01
Diamondfield Bl'k B'tte, Nev.	Oct. 12	Nov. 18	0.01
Duluth, Ida	Oct. 18	Nov. 18	0.001
Emerald, Utah	Oct 16	Nov. 18	0.00½
Emerald, Utah	Nov. 15	Dec. 9	0.00½
Enterprise, Ida	Oct. 19	Nov. 20	0.002
Friend, Ida	Oct. 21	Nov. 24	0.002
Hale and Norcross, Nev	Nov. 8	Nov. 29	0.03
Idaho & L. A., Ida	Oct. 16	Nov. 17	0.005
Idaho Mont, Ida	Oct. 30	Nov. 18	0.002
Idaho-Nevada, Idaho.	Nov. 15	Dec. 16	0.002
Lehi Tintic, Utah	Nov. 8	Dec. 2	0.0025
LeRoy, Ida	Oct. 28	Nov. 28	0.005
Mexico G. & S., Nev	Nov. 25	Dec. 18	0.10
Military, Ida	Oct. 25	Nov. 25	0.00025
Monarch-Pgh., Nev	Oct. 23	Nov. 27	0.01
Naildriver, Utah	Nov. 4	Dec. 4	0.01
Nevada-Stewart, Ida	Oct. 2	Dec. 2	0.002
New Hope, Ida	Oct. 11	Dec. 11	0.002
Ninemile, Ida.	Nov. 2	Nov. 17	0.0015
Nonpareil, Ida	Oct. 23	Nov. 23	0.001
North Franklin, Ida	June 19	Nov. 23	0.005
North Star, Ida	Oct. 10	Dec. 5	0.001
Old Veteran, Ida	Oct. 9	Nov. 8	0.002
Ophir, Nev	Oct. 25	Nov. 15	0.05
Raven, Ida	Oct. 23	Nov. 20	0.001
Rico-Argeotine, Colo.	Nov. 18	Dec. 5	0.01
Seg Belcher & Midas, Nev	Oct. 30	Nov. 24	0.02
Selma, Utah	Nov. 4	Nov. 23	0.005
Silver Moon, Ida	Nov. 25	Dec. 23	0.005
Silver Mt., Ida	Oct. 21	Nov. 24	0.002
Sonora, Ida	Nov. 15	Dec. 6	0.004
Star Antimony, Ida	Oct. 27	Nov. 17	0.001
Tobar, Utah	Nov. 2	Nov. 23	0.002
Torino, Ida	Oct. 20	Nov. 20	0.001
Tucker, Ida	Oct. 15	Nov. 15	0.003
Tyler, Ida	Oct. 12	Nov. 13	0.0015
Utah Arizona, Ariz	Oct 31	Nov. 25	0.005
Utah Metals, Utah	Oct. 23	Nov. 18	0.002
Utah United, Utah	Nov. 15	Dec. 4	0.01
Zuma, Utah	Oct 30	Nov. 30	0.005

Editorial Correspondence

SAN FRANCISCO—Nov. 1

Strike Situation in Amador County is improving. A long petition has been signed by merchants and miners asking for the return of men not engaged in the strike, and for protection to men that return to work. A number of men applied to Central Eureka and South Eureka, but not enough for complete resumption of extraction and milling. Sixty men started work at the Bunker Hill Oct. 30. Some of the strikers were inclined to resent the service of summons to appear in U. S. District Court to show cause why they should not be permanently enjoined from interfering with the operation of the mines; but were quickly shown that resistance was out of the question. These men are all foreigners, but they have an attorney employed by the local union and are supposed to be advised as to the power of the courts as well as to their own rights. Injunction hearing in San Francisco has been postponed until Nov. 6.

The Mine Safety Department of the Industrial Accident Commission will temporarily be in charge of H. M. Wolflin following the resignation of Edwin Higgins, which took effect on Oct. 31. Mr. Wolflin was first assigned to this work which embraces the duties of chief mine inspector of the commission and representative of the U. S. Bureau of Mines in the California district. He began the preliminary investigation in 1914, which resulted in the adoption of the mine-safety rules by the commission. He was assisted in 1915 by three deputies, G. Chester Brown, Fred L. Lowell and J. W. Gebb, who continue in position. Mr. Wolflin was advanced to the position of mine-safety engineer by the Bureau of Mines and assigned to the Pittsburgh branch at the beginning of 1916, and was succeeded as mine inspector in California by Edwin Higgins, who now accepts a position as safety engineer of the California Metal Producers' Association and a number of mines that are members of the association. At the time of the organization of the safety department of the commission and the appointment of Mr. Wolflin, there was an expressed preference for a Western man by some of the mine owners, who were not aware that Mr. Wolflin's home was in California and that he was a graduate of the Arizona School of Mines, as well as having the advantage of a course in Columbia University. The preference for a Western man was renewed upon the appointment of Mr. Higgins. The result of the labor of both men has been so entirely satisfactory, the system of inspection so strongly established and successfully operated, that the desire is at present stronger than ever for the appointment of someone of experience and acquaintance in California mines. At this time the appointment of a stranger, especially if he is not a metal miner, would likely meet with strong objection. The available men for the position are the three deputies now in the employment of the department, two of whom are graduates of the University of California School of Mines and the other a graduate of the Arizona School of Mines. These three men have had experience not only as practical mine superintendents, but are thoroughly familiar with the duties of mine inspection in California. The retention of Mr. Wolflin in the position of chief inspector would be satisfactory, but it is probable that the Bureau of Mines is desirous of continuing him in the position of mine-safety engineer. The appointment of either of the three deputies would result in maintaining the Mine Safety Department on the basis upon which it has been established and a greater assurance of advancement than would the appointment of a stranger or even of a practical mining engineer acquainted with mining methods in California but unacquainted with mine-safety work.

IDITAROD, ALASKA—Sept. 20

Dredging Yields from Otter Creek for the 1916 season will be below those of the previous year, owing to the handling of lower-grade gravels. Dredge operators' profits, however, will compare favorably with 1915 profits, owing to reduction in thawing costs, through improvements in boilers and equipment and the use of water for stripping the moss and overburden, employing the sun's rays to aid the steam points in their work. The yield of the hydraulic mines in this section was reduced by shortage of water. During the open season, now drawing to a close, this camp has had in operation two gold dredges of the continuous-bucket-line type, one dragline scraper with portable washing device, three hydraulic mines, four scraping plants and several smaller enterprises, and with few exceptions the operators have had a prosperous season. Rainfall has been less than average this year, which has been a drawback to hydraulicking but has not affected the dredging operations. Owing to the longshoremen's strike at Pacific Coast cities, great inconvenience and expense was experienced through lack of materials and supplies. As an illustration: J. E. Riley and associates are building a new 2½ cu.ft. dredge of the Union Construction Co. flume type. This dredge weighs about 200 tons complete, which represents only a small portion of the tonnage shipped to this camp this year. Had this material come through promptly this dredge would have been in operation by August and would have given a good account of itself this year. As it is, they are still short some material and from present indications will be unable to get more than a try-out this season.

A New Scraping Device was experimented with this season by J. E. Riley and associates, which if successful will enable the operators to handle much lower-grade gravels in the future. This machine is built much on the principle of the dragline scraper, the difference being that the washing device is stationary and the scraper travels from the point of loading to the hopper on trolley and cable, which is tightened by the drum on the scraping engine after the scraper has been loaded. The main dragline which loads the scraper also acts as hoist line when scraper is ready to be run up the trolley line to hopper. The scraper is placed in the cut by means of a spring line, which acts on the trolley line from the main engine. The experiment was conducted under the hardest possible conditions, the gravel being tight and packed with clay and it was found that the ordinary 8¼x10-in. engine could not develop sufficient power to load scraper properly nor to tighten the trolley line sufficiently to give necessary run-back. Under proper conditions and with the right set-up, the aërial scraper may be entirely successful and will reduce the cost of scraping nearly 50%. The future of this camp for several years to come is bright. The day of the pick-and-shovel miner here, as is the case in all the older camps in Alaska, is past and is being replaced with machinery that makes it possible to work at a profit ground of such low grade that the old-time miner was compelled to leave it.

BUTTE—Nov. 2

Examinations in Mine-Rescue Work and also in first-aid work will be held in Butte by H. J. Rahilly, mining engineer of the U. S. Bureau of Mines; Mr. Rahilly is at present in Butte to conduct examinations among the classes conducted for the past few months by J. L. Boardman. Those passing the examination will receive a Bureau of Mines certificate to that effect. The classes have been regarded as a great success.

Water-Power Development in Montana and other states is the object of the newly formed Intermountain Power Co. organized under the laws of Montana. Its principal office will be in Butte. Its capital stock is $500,000, comprising 5,000 shares of a par value of $100 each. The incorporators are C. F. Kelley, Charles J. Kelley, John Gillie, L. O. Evans and Eugene Carroll, all well-known Butte mining and business men.

Progress in Safety-First and first aid propaganda is being made at Butte. In order to prepare the younger generations for the tasks they will soon be called upon to perform, the Anaconda Copper Mining Co., upon the request of Butte school authorities, has inaugurated a system of instruction which will benefit both the company and its future employees. J. L. Boardman, of the company's safety bureau, recently delivered his first lecture at one of the Butte schools, in which he drew attention to the most common causes of every-day accidents, illustrating each with a story. He also pointed out how a little thought along lines of safety first might have avoided most of such accidents. After the lecture committees of the pupils were selected to make notes during the week of instances which come under their attention in which the application of safety-first principles averted accidents and other instances where failure to apply them caused such accidents. The committees will read and discuss the results of their findings at the next meeting. It is the intention to have the lectures and the forming of safety-first committees extended to all the public schools of the city.

DENVER—Nov. 1

Threatened Strike of Miners at Leadville has been put off indefinitely. It is understood that the union officials have requested the state's Industrial Relations Commission to visit the district and to render its report on local wage conditions. According to the state law, the miners could not strike and have any redress in the courts if they do not first submit their grievances to this committee. The committee itself has only an advisory or persuasive authority but it has been instrumental in amicably settling a number of controversies since its establishment less than two years ago. Meanwhile union meetings are being held and an effort is being made to induce all the district's miners to become members.

Radium Reduction is the plan of a group of Eastern men who are reported as proposing the establishment of a plant in Denver to handle ores to be mined in Montrose County. Possibly the company will secure the plant erected in Denver by the National Radium Institute in which the Bureau of Mines conducted its research work that led to the publication of its process for reducing radium. This company's arrangement with the Federal Bureau will terminate Dec. 1 and the entire plant will be for sale, probably. The headquarters and laboratories of the Bureau are now at the School of Mines, Golden. Fred Carroll, state commissioner of mines, has recently inspected the carnotite fields and he reports that the firm of Fuller, Beebe & Wilson, of Cleveland, Ohio, has erected a small concentrating plant for carnotite ore at Saucer Basin.

SALT LAKE CITY—Nov. 2

A Large New Tailings Dam is to be constructed by the Utah Copper Co. to extend the tailings pond from the Magna and Arthur mills; other improvements and changes at Garfield are also contemplated. These improvements will cost approximately $1,000,000. The dam will be extended to a point opposite Washington St., making an area for impounding tailings of about 1,100 acres. The present dam is 40 ft. high in places. A number of buildings, including the Western Pacific depot and freight house, baseball park, jail, Garfield garage, Miller-Cahoon lumber yard, ice houses, etc., must be removed. It will also be necessary to shift a number of miles of railroad track. Both the Western Pacific and the Salt Lake Route tracks must be moved in a curve toward the lake. The Bingham & Garfield R.R. is to build a new station near the west end of the dam, and the track will be carried by a gradual approach to the top of the dam, and run northwesterly into Garfield. Waste rock from the mines at Bingham will be used for the dam filling. Several hundred men will be employed. These improvements are regarded here as reflecting the confidence the company officials have in the copper market after the war.

Ohio Copper Stockholders are to have an opportunity to redeem the property, according to a telegram received here by Frank B. Cook, of the Columbia Trust Co. By a decision of the United States District Court the shareholders' protective committee formed as a result of the efforts of the North American Liquidation Co., Inc., is permitted to redeem the property of the Ohio Copper Mining Co. for the shareholders from the purchaser who acquired it at the sale which resulted from the foreclosure of the mortgage upon the property. Two conditions are imposed by the court in turning Ohio Copper over to the protective shareholders' committee. One is, that there shall be paid into the court whatever amount (after hearings), the court shall determine is due upon the bonds, less whatever sums have been realized from the property (a) by the trustees in bankruptcy (b) by the receivers appointed in the foreclosure proceedings and (c) by the purchaser since the foreclosure sale. The other condition is that all shareholders of the Ohio Copper Mining Co. be permitted to participate in the redemption and reorganization. The determination of the amount due and the validity of the bonds may be litigated. Hearing has been set for Nov. 13. Utah stockholders have been asked if there is any legal objection in Utah, to the use of the name of Ohio Copper Mining Corporation for the new company. A plan outlined for the reorganization includes a new corporation capitalized at 2,500,000 shares, par value $1, to be sold by an underwriting syndicate at par, less 15% commission; 1,000,000 shares to remain in the treasury, present stockholders to subscribe for the stock at $1 per share.

JOPLIN, MO.—Nov. 4

Three Thousand Smeltermen on Strike is the report from Henryetta, Okla. The workers were employed at the zinc smelteries at Henryetta and at Kusa. They demand higher wages and are members of what is known as the Working Class Union and are not associated with the American Federation of Labor. No disorders have been reported and the companies have not attempted to resume operations.

Two More Zinc Smelteries are being planned for Fort Smith, Ark. Actual construction on [illegible] to be known as the Athletic Smelting Co. [illegible] be started during the coming week while representatives of Eastern smelting [illegible] notified the president of a Fort Smith [illegible] that they will be here Monday to look [illegible] for a 1,?00-ton plant. Charles T. Orr, [illegible] City, is behind the Athletic Smelting Co. [illegible] the head of the Wingfield Bertha [illegible] Webb City, and the Athletic [illegible] two of the largest sheet ground [illegible] district. Oth [illegible] are interested with him in the smelting venture. A tract of 37 acres has been obtained half a mile south of the Fort Smith Spelter Co.'s plant, and connection by switch will be had with the Arkansas Central R.R. The United Iron Works, of Springfield, has been awarded the construction contract. The initial capacity of the plant is to be 1,500 to 2,000 tons of ore a month, for which there will be 2,400 retorts. It has not yet been decided whether there will be four blocks of 600 retorts each or three blocks of 800 retorts. The plant is to cost about $200,000 and will give employment to about 150 men.

KANSAS CITY, KAN.—Nov. 2

Kansas Natural Gas Co. Wells in Kansas will be valueless in four years, according to the testimony of its president, Victor Hays, in the hearing on Oct. 30 before Judge Wilbur Booth, at Kansas City, Kan. About 8% of the company's production is coming from Kansas wells, and the company is trying to make up for the shrinkage by the purchase of new property in Oklahoma. It was reported on Nov. 1 that H. L. Doherty & Co. would take over this company.

ISHPEMING, MICH.—Nov. 4

Iron Ore Shipments continue at a steady pace from the mines of the Lake Superior district. There is still a shortage of boats which has tied up some of the shovels of late, in spite of the fact that a number of the smaller companies are through shipping for 1916. It looks now as if the total shipments for the year would reach 62,000,000 tons, over 50,000,000 tons having gone down the lakes already this year. Never have stockpiles been cleaned out as they are at present. Ore that has been in stock for years and had grass growing on it has been shipped. Some ore was moved from the Marquette range that had been in the piles for as long as 26 years. It has been the greatest year in the history of the iron-ore trade, but the operators are figuring that 1917 will be still greater. Lake freights are to be raised, while the costs of production will undoubtedly be higher. The mine operators have not had increases that were consistent with the advances in the price of pig iron and they will ask for considerably more next year. One large railroad operator stated this week that the lake shipments this year will fall 6,000,000 tons short of the furnace requirements for the winter, and plans are now being made to move a large tonnage of ore by rail. The only obstacle that will prevent a big movement is the shortage of locomotives. The railroads have plenty of cars, but a large number of locomotives will be required, and the roads do not see now where they can get them. It is believed by some that as much as 75,000,000 tons of ore will have to be moved in 1917. The 1916 shipments will probably be 12,000,000 tons in excess of any previous year.

WASHINGTON, D. C.—Nov. 4

A Petroleum Experiment Station, it is understood, will be urged before the appropriation committee of the House shortly after the convening of Congress.

House Committee on Mines and Mining may convene in Washington 10 days before the opening of the short session of Congress. It is understood that Representative Foster, the chairman of the committee, is anxious to have taken up at that time his bill providing for numerous changes in the mining law.

Proceedings of Pan-American Scientific Congress will be ready for general distribution Apr. 1. The papers are being edited by Dr. Glen L. Swiggett, chairman of the committee on publication. The papers in nearly every case will be printed in the language of the original. The paper of Dr. George Otis Smith on "Public Interest in Mineral Resources" has been translated into Spanish at the request of the Argentine section of the Congress.

A Large Saving to the Oil Industry of the United States has been accomplished by the work of the Bureau of Mines. This was made possible by calling to the attention of operators ready means of eliminating unnecessary waste. The Bureau is conducting a campaign looking to the introduction of the most efficient methods of drilling. These methods are expected not only to save natural gas but to protect the oil sands from premature flooding by water.

Site of Mine Experiment Station in the Northwest is still undecided though an announcement regarding the selection is expected during the next week. The Secretary of the Interior has been closely engaged in the Mexican conference and has had no opportunity to look over the voluminous data which were collected by Director Manning, of the Bureau of Mines, who recently conducted hearings in all cities making a claim for the station. While officials will not comment on the probable site of the northwestern station it is believed here that Seattle will be selected.

TORONTO—Nov. 4

Two New Nickel Refineries are now in prospect for Ontario. The International Nickel Co. is building its new refinery at Port Colborne, Ont., and expects to be in a position to turn out refined nickel in a year's time. The company will appropriate several million dollars for the plant, but it will no doubt be built in units, capable of enlargement as necessity demands. The British American Nickel Co., under the new management of E. P. Mathewson, formerly of the Anaconda, will also build a refinery, probably in the vicinity of Welland. This company will use the Hybinette process. It is understood that the company has already obtained contracts for a considerable tonnage of refined nickel for delivery in England. This is not a Government order although it is understood that the British government is interested in the company. Construction work will be carried on as rapidly as possible, and under aggressive management the prospects are encouraging. The company has plenty of ore, the main source of supply being the Murray mine; it is of rather low grade, being slightly under 3% combined nickel-copper. Unfortunately there appears to be but one Creighton mine and that belongs to the International Nickel Co.

Marked Revival in Port Arthur District is being experienced, some important discoveries of copper deposits having encouraged development. At the Tip Top copper mine, near Kashabowie, 82 mi. west of Port Arthur on the Canadian Northern, which last winter sent 340 tons of ore of good grade to the smelters, diamond drilling has shown a continuation of the vein at 1,000 ft. from the shaft and encountered a second vein 26 ft. in width, of which 15 ft. is high-grade ore. A railway spur is being built from the main line to the mine which has 20,000 tons of ore on the dump, running about 6% copper with small gold and silver content. A flotation plant and smeltery are under consideration for the spring. Another claim 3 mi. west of Mine Center is being developed under option by the Mine Center Copper Co. The vein, which was discovered last May, is wide and has been exposed for 350 ft., the ore increasing in richness at a depth of 30 ft. Three cars have been shipped to the Trail smeltery, returns from two of which were $1,030, after paying for treatment and freight. Sixty tons per day are being placed on the dump, which will be shipped at the rate of a carload per day. Four other claims in the neighborhood are being developed.

The Mining News

ALABAMA

GOODWATER (Clanton)—Large force opening graphite mines; commenced erection of mill and camp buildings.

SLOSS-SHEFFIELD STEEL AND IRON (Birmingham)—About 60 men reported caught in Bessie coal mine near Palos, following an explosion, Nov. 4. Explosion killing 92 men occurred here several years ago.

ALASKA

ALASKA GASTINEAU (Juneau)—In October milled 158,000 tons assaying $1.327 per ton; extraction, 82.49%.

ALASKA MINES CORPORATION (Nome)—Order placed with Yuba Construction Co. of California for No. 3 dredge; will dig 61 ft. below water line; manganese-steel buckets of 10-cu.ft. capacity. Dredge expected to have minimum capacity of 960,000 cu.yd. in eight months' season. Contract for manganese-steel buckets sublet to Taylor-Wharton Iron and Steel Co., Highbridge, N. J.

ARIZONA

Gila County

MIAMI COPPER (Miami)—In October made new high production record of 4,859,433 lb. copper.

ARIZONA COMMERCIAL (Globe)—Struck 3 ft. high-grade ore 10th level. Strike regarded of great importance. Installing pumps on 14th level to enable sinking to 16th.

MIAMI CONSOLIDATED (Miami)—Two Star drilling machines expected by Nov. 15. Two shifts sinking inclined shaft to reach ore said to assay 6 to 8% copper. Henry V. Snell, manager.

GREATER MIAMI (Miami)—At recent meeting elected new officers: H. S. Prince, president; R. H. Emery, vice-president; H. C. Prince, treasurer; J. G. Van Lemen, secretary.

Greenlee County

SHANNON (Clifton)—October output 757,000 lb. copper compared with 744,000 for September. Reduced output from normal caused by loss 4½ days, owing to flood in district.

Mohave County

NELLIE (Oatman)—At 350-ft. level 9 ft. of ore opened; mine 7 mi. south of town.

ELKHART (Chloride)—Unwatering nearly completed by Guggenheim representatives after which property will be sampled.

GOLCONDA CONSOLIDATED (Chloride)—Fredonia mine shaft enlarged to increase operations and new hoist installed. Plans extensive development.

MIDNIGHT (Chloride)—Drifting on orebody cut on 300-ft. level confirms opinion regarding importance of strike. Reported large shaft will be sunk for which equipment ordered.

Pinal County

RAY CONSOLIDATED (Ray)—October production 7,500,000 lb. copper.

CALIFORNIA

Amador County

CONSOLIDATED AMADOR (Sutter Creek)—Concrete-lined 9,000-gal. tank completed at 500 level; will be used as an intermediate reservoir for water pumped from lower levels. Repairing of shaft progressing.

SOUTH KEYSTONE (Sutter Creek)—Hoisting machinery formerly used at Amador Queen purchased. Grading and laying foundations in progress. Property situated between Sutter Creek and Amador and consolidated with the McIntire, Boyston and North Star claims. John A. McIntire, of San Francisco, and associates, of Tacoma, will develop the property, beginning with unwatering North Star 1,000-ft. shaft and drifting from 600 level to the orebodies of the South Keystone.

Butte County

BUMBLEBEE (Oroville)—Machinery received for installation at this property in Morris Ravine to be developed by Ford Brothers, of Los Angeles.

SOUTH BANNER (Oroville)—Expected to have electric installation completed by Dec. 1, when development on large scale is contemplated. Property in Morris Ravine.

Eldorado County

SILVA (Georgetown)—Shaft being cleaned out by company developing Georgia Slide mine.

BEEBE (Georgetown)—Unwatering of shaft is affecting domestic wells in town; several years ago when mine was in operation, wells went dry.

Plumas County

DUTRE & MAYNARD (Quincy)—Owners returned to Quincy with 132 oz. gold from last cleanup of gravel mine worked by shooter. Gold nuggets obtained worth from $1 to $200. Property situated on Squirrel Creek worked in early days by ground sluicing, but shooter method is more economical, entailing less labor.

PLUMAS BONANZA (Quincy)—Prospecting and development work to be started by W. F. Roeder, of San Francisco; owned by Roeder and the estate of Captain Reed. Since death of Captain Reed about two years ago, mine has been idle except for assessment work. Large amount of development by tunnels and a 100-ft. shaft. Property on Winters Creek.

Shasta County

MIDAS (Knob)—Crude-oil engine for this property in Harrison Gulch arrived at Redding and will be hauled to the mine in parts on motor trucks. Distance about 60 mi.; cost of transportation from Redding will be approximately equal rail freight from Eastern factory; about $650, or more than $10 a mile.

Sierra County

ALASKA (Pike City)—One-mile tunnel to be run to cut lode below bottom of 600-ft. shaft. Owned by New York corporation, with Brig. Gen. W. S. Schuyler, retired, in charge.

BLACK DIAMOND (Downieville)—Bonanza quartz uncovered near Poker Flat by Winrod & Peckwith, of Downieville, who have been prospecting ground on Hopkins Creek from which much gold was extracted by crude methods in early days.

WILLOUGHBY (Downieville)—Sold by Farrell Bros. to Benjamin Boram and associates, of San Francisco, who are preparing for extensive winter operations. Large vein carries free gold and 10-stamp mill is operating. E. M. Farrell in charge.

HERKIMER AND BUNKER HILL (Downieville)—Channel found; breasting and washing under way with good yield in coarse gold. Power hoist being installed, and working force increased. Operated under bond by Gustav De Bretteville, of San Francisco, who is personally in charge.

YORK-FINNEY (Downieville)—Ore heavily studded with coarse free gold encountered by 10 ft. of sinking in bottom of old shaft through a "horse" which discouraged former owners. Vein 18 in.; increasing in width; between serpentine and slate. Hoist and electric lights installed, snowsheds erected, and compressor plant to be added at once. Shaft will be sunk to 100 ft. level before drifting on vein. Under bond to Finney Mines, Inc., of Sacramento. G. B. Morse, superintendent.

Tuolumne County

OMEGA (Sonora)—Large shoot of high-grade ore reported, carrying 6 to 8% sulphurets. Operated under bond by Lange & Husey

BLACK OAK (Soulsbyville)—Diamond drill installed at 900 level for exploration.

Yuba County

YUBA CONSOLIDATED GOLD FIELDS (Hammonton)—Laying of first steel, Oct 13, in construction of Yuba No. 16. Dredge is to have 16-cu.ft. buckets and two tailing stackers to be employed in placing tailing on either side of Yuba River channel, in accordance with agreement with Government for reclamation of river and preventing flood damage to property adjacent. Design and construction of dredge by Yuba Construction Co.; Newton Cleaveland, manager; Paul E. Morse, superintendent of construction.

COLORADO

Boulder County

WHITE RAVEN (Ward)—Oreshoot of good grade opened on 400-ft. level at 600 ft. from shaft.

PRIMOS CHEMICAL (Lakewood)—Large shoot good-grade tungsten ore discovered recently by lessees.

GOLD EAGLE (Caribou)—Reported bonded recently by B. A. McGee, John Carlson and R. C. Null for $25,000.

YELLOW PINE (Boulder)—High-grade silver ore opened on Lucky Seven lease. In Vanceluse vein, 3-ft. shoot assaying $100 in silver discovered.

Clear Creek County

RAYMOND TUNNEL (Georgetown) — Shoot good grade ore carrying gold, silver and copper opened at depth of 1,000 ft. Property just south of Capital mine where rich gold ore discovered recently.

Gilpin County

INCIDENTAL (Central City)—Opened 1-ft. shoot heavy iron sulphide ore rich in copper.

Lake County

IBEX (Leadville)—Regular shipments being made, stated to be largest production in history.

IRON-SILVER (Leadville)—Will move its offices from Oro in upper California Gulch to Leadville. Reason assumed to be exhaustion of orebodies in immediate vicinity of old headquarters; will continue to operate other portions of its large holdings, more tributary to Leadville.

Ouray County

GOLD CROWN (Ouray)—New capital secured and milling plant will be completed at once.

SUMMIT COPPER MINING AND MILLING (Ironton)—Driving Koehler tunnel on San Antonio group resumed. Property near Red Mountain on line between Ouray and San Juan counties.

Park County

GOLD SLIDE (Alma)—Shaft will be sunk 100 ft. by contract. Bids being received.

Saguache County

MANITOU TUNNEL (Bonanza)—Tunnel now in 806 ft. Driving temporarily suspended. Tunnel will cut at depth veins in Manitou Basin. Manager, John Ashley.

EXPRESS-HEADLIGHT (Bonanza) — Property 5 mi. south of Bonanza worked under direction of Manager McKenzie. Steam hoist and compressor installed at shaft and drifting on 100-ft. level under way. Some high-grade gold ore shipped.

San Juan County

LEE & KLONDIKE (Silverton)—Will be worked during winter.

BUFFALO BOY (Silverton)—Contract let to drive drift 100 ft.

CROWN JEWEL (Silverton)—New oreshoot opened in development work on Emerald claim.

SILVER LEDGE (Chattanooga)—Mill operating steadily. About 12 cars concentrates shipped monthly.

DAVY LEASING CO (Silverton)—Regular shipments being made to Silver Lake milling plant for treatment.

GENESEE (Ironton)—Low-grade ore from this property near Red Mountain sent to Silver Lake custom mill and high-grade to Durango smelting plant.

HAMLET (Howardsville)—Mill completed and running satisfactorily. Sufficient ore developed in mine to insure steady operation. Arrangements made for winter work.

GOLD KING (Gladstone)—Mill resumed operations after six weeks' shutdown for repairs. Mine development work continued Tonnage will be increased. J. H. Slattery is manager.

SUNNYSIDE (Eureka)—Twenty cars concentrates shipped during second half October. [illegible] Wambsgantzs killed by falling rock while making tram repairs near portal of Terry tunnel.

Summit County

MICHIGAN (Kokomo)—Regular shipments are being made. Crew of 30 men employed

WILFLEY (Kokomo)—Daily production 50 tons good grade zinc ore made. Reported one quarter million tons developed

WELLINGTON MINES (Breckenridge)—Over 2,500 tons ore and concentrates shipped September New shaft being sunk near western end to prospect virgin ground.

FORTUNA (Frisco)—Strike of good-grade ore made recently. New capital invested and work will be conducted on larger scale Mine on upper North Ten Mile Creek.

EXCELSIOR (Frisco)—Development work under way for some time and considerable tonnage ore blocked out. Mine equipped with compressor, drills and 50-ton milling plant Operated by lessees under management of Eyvind Flood

PIONEER CONSOLIDATED (Breckenridge)—Milling plant alterations completed. Will begin operation as soon as pipe-line repairs completed Snow sheds, timber shed and blacksmith shop being built at tunnel portal. Bids received for extending tunnel, now in 60 ft.

Teller County

LAST DOLLAR (Victor)—Electric hoisting plant and compressor to be installed.

PORTLAND (Victor)—Development in ore on 19th level progressing satisfactorily.

CRESSON (Cripple Creek)—New high-grade oreshoot opened on the 13th level.

IDAHO

Blaine County

FEDERAL MINING AND SMELTING (Hailey)—New mill at North Star mines completed and operating. E. Percy Smith, superintendent.

Shoshone County

SILVERADO (Osburn)—New mill will soon be operating. A 4,000-ft. tunnel cut vein 1,200 ft. below surface and drifts developed orebody 900 ft. long, 18 in. to 10 ft. wide assaying average 4% lead and 8 to 10 oz. silver per ton. Winze sunk on ore 110 ft. Dr. W. H. Farrar, manager.

MICHIGAN

Copper

ISLE ROYALE (Houghton)—Now shipping over 3,000 tons daily to mill.

INDIANA (Rockland)—Drill down 40 ft. on Butler lode shows good copper indications.

MOHAWK (Mohawk) — Considerable additions made to mine crew to increase November output.

HANCOCK (Hancock)—Reported October output broke record with production refined copper over 400,000 lb.

FRANKLIN (Demmon)—Increase of rock tonnage due to installation of endless-rope tram haulage, which seems to work satisfactorily.

KEWEENAW (Phœnix)—Because of the shortage of labor, unable to get required rock tonnage for mill to run steadily for even one shift.

CALUMET & HECLA (Calumet)—Work is going ahead rapidly in clearing site for extension of reclamation plant at Lake Linden, and also for the foundry extension at the mine.

WHITE PINE EXTENSION (Ontonagon)—Hundred-ton experimental stamp mill will not be erected till spring. Drifts on 200-ft. level reported in rock carrying 30 lb. copper per ton.

NEW BALTIC (Baltic)—Shaft down about 40 ft.; walls have been standing so firmly that it has not been necessary to timber as yet; ledge should be encountered within next 10 ft. and drilling begun.

CHEROKEE (Houghton)—Some good ground encountered in crosscut driven at 218 ft level to find width of vein, apparently about 17 ft As soon as the width is definitely ascertained, sinking will be resumed.

MICHIGAN (Rockland)—Now almost through the lode—supposed to be the Evergreen—with the main crosscut finding the width to be about 36 ft After the crosscut has been driven far enough so that the work will not interfere, some drifting will be undertaken. Work on hanging wall of the Algomah amygdaloid is encountering leaner ground, same being true of western drift of the Baltic lode. Development work is expensive at this property as there has been so much dead work in the way of crosscuts. Stamp mill rehabilitated and will be ready to go into operation in the spring; mill was complete some time ago, but has been remodeled.

MINNESOTA

Mesabi Range

FRANTZ (Buhl)—Mine to be reopened shortly idle two years. Underground property M A Hanna Co will be the operators and will employ about 100 men.

WEBB (Chisholm)—Shipping has stopped for the year and concentrator and washing plant closed. Full crews employed underground and trestles in place for winter stockpile

SHENANGO FURNACE CO (Chisholm)—Last ore of the year has been shipped Underground mines will work throughout the winter The five Shenango boats now carrying ore for independent companies.

CHISHOLM (Chisholm)—Operations resumed [illegible] being [illegible] It [illegible] of M[illegible] Lake. Chisholm shaft will be ready [illegible] Jan 1, much of the [illegible] been put in [illegible] in the shaft, [illegible]

MISSOURI

Joplin District

RAMAGE (Joplin)—Will start its West [illegible] plant on Nov 11 after two months' shutdown Mill has capacity of 1,000 tons daily. H H H[illegible]rizell is now superintendent

W M SHERIDAN (Joplin)—Rushing work on new mill near Cardin, Okl Will be ready in 30 days Preparatory mining operations developing rich ore

E J PRATT (Webb City)—Made [illegible] drill strike on lease adjoining town of Baxter Springs Kan Rhoads shown at two levels Will mean an extension of Picher-Cardin field to the north

PRAIRIE OIL CO—Has taken leases on large acreage near Neosho and will drill for oil and gas

BUDD M ROBINSON (Joplin)—Has shaft in ore on newly developed tract northwest of Cave Springs Century Zinc Co has sublease and has eight good drill holes.

MONTANA

Jefferson County

BOSTON & CORBIN (Corbin)—As result of installation of flotation in mill, production in first half of October was [illegible]2,000 lb. of copper and 2,117 oz of silver—an increase of 28% over preceding similar periods.

Lincoln County

IN TROY DISTRICT there is a greater activity than at any time in its history Togo company is driving tunnel to reach vein, 2 ft wide on surface, carrying silver-lead ore running as high as 100 ounces of silver per ton. Silver Tip company has let contract for 900 ft of crosscutting to reach another rich silver-lead vein. At Sylvanite property, 20 mi north of Troy, equipment for developing gold vein is being installed. The most extensive work in the district is carried on by Snowstorm Mines Consolidated Co., which is building a railroad, power plant, mill and other equipment for operation of the Banner & Bangle mines

Powell County

B & B (Avon)—Shipping ore assaying 6% copper and $1 to $8 gold per ton Recent shipment netted $15 per ton Preparing to sink 200 ft. deeper to open orebody.

Silver Bow County

BUTTE-GREAT FALLS (Butte)—Work at properties in extreme northern section of Butte district discontinued until assessment of 5c a share can be collected.

DAVIS DALY (Butte)—Preparations under way for treatment of zinc ores at Ophir concentrating mill of Butte-Detroit Co. Flotation unit being installed, planned to treat from 100 to 150 tons daily.

BUTTE MONITOR MINING CO. (Butte)—After two months' shutdown, driving of tunnel resumed, now in 800 ft It is planned to drive tunnel 3,500 ft Property in southeastern section of Butte district No veins as yet encountered in tunnel

TUOLUMNE (Butte)—October production was twice that of September Output in November is expected will average at least 150 tons per day At company's Butte Main Range and Colusa-Leonard Extension properties in eastern section, development is progressing

NORTH BUTTE (Butte)—Quarterly report, Sept 30, shows production of 5,953,985 lb of copper, 217,833 oz. silver and 102.53 oz gold Development during quarter Crosscuts, 2,251 ft; drifts, 1,630 ft; raises, 1,109 ft; shaft, 223 ft; stations, 46 ft.; total, 5,562 lin ft. Work has opened additional ore in all the veins exploited at company's properties on Anaconda Hill Development continuing in company's properties in eastern section

ANACONDA (Butte)—The Lexington mine and other property of the moribund Atlantic Mines Co were sold Nov 1 at public auction to the Anaconda company for $673,717 Under terms of sale stockholders will receive $12.50 a share in cash The Lexington will be exploited by new owners chiefly for its zinc ores In lower level of Leonard mine body of 6¾% copper ore cut for 20 ft on 2,800 level Copper production of company's Butte mines in October estimated at 21,500,000 lb as against 24,900,000 lb for this month last year

MINES OPERATING CO (Butte)—Incorporated under laws of Delaware with capitalization of 10[illegible] shares, par $1,000 to operate property of defunct Butte Duluth Mining Co. [illegible] district Officers and directors are: Alfred F[illegible] of Salt Lake, president and general manager; C W Whitley, of Salt Lake general manager [illegible] the American Smelting and Refining Co [illegible] president, H A Frank, of Butte, secretary [illegible] MacGinniss, of Butte and F L N[illegible] of Salt Lake About 50 [illegible] Ore averaging 1[illegible] copper will [illegible] practically same manner as [illegible] precipitation will be effected [illegible] table iron, instead of [illegible]

NEVADA

Clark County

BIG CASINO (Searchlight)—Sinking main shaft 300 ft. to 750-ft. level to develop additional orebodies. Sixteen men employed underground, three shifts. Walter W. Wishon, manager.

Esmeralda County

MERGER MINES (Goldfield)—Crosscutting from east shale contact drift, to south on 1,170-ft. level St. Ives claim.

BLUE BULL (Goldfield)—On 700-ft. level at point about 700 ft. easterly from shaft encountered new vein of encouraging character.

JUMBO JUNIOR (Goldfield)—On 880-ft. level drift has progressed 60 ft. in vein yielding assays up to $30 per ton. Winze has been started showing improved conditions.

GOLDFIELD CONSOLIDATED (Goldfield)—In September total production 25,800 tons; net realization, $16,072. Total mining expense, $2.55; milling, $2.12; total net costs, $5.83 per ton.

KEWANAS (Goldfield)—Recent report states operations on 840-ft. level have developed limited tonnage of low-grade ore amenable to flotation treatment. Ore of shipping grade encountered, but "bunchy" thus far.

Humboldt County

HUMBOLDT TUNGSTEN (Lovelock)—Ore from mine now going to mill bins of new 75-ton plant at Toulon. Plant erected by Stearns-Roger Manufacturing Co. and is practically completed.

ROCHESTER MINES CO. (Rochester)—Contract for 12,100-ft. aërial tram from mine to mill let to St Louis firm. To be completed in 60 days at cost of about $35,000. Company estimates saving of $24,000 per year.

ST. ANTHONY MINES CO. (Fanning)—On 200-ft. level, vein is 7 ft. wide, of slightly better grade than at surface. On surface about 2,000 ft. from present workings another tungsten vein has been uncovered, showing about 4 ft. of ore. About 30 men employed.

Nye County

TONOPAH ORE PRODUCTION for week ended Oct. 28 was 9,959 tons, valued at $195,202, compared with 9,864 tons for week previous. Producers were: Tonopah Belmont, 2,878 tons; Tonopah Extension, 2,380; Tonopah Mining, 2,250; Jim Butler, 1,150; West End, 675; Halifax, 215; Rescue-Eula, 190; McNamara, 90; miscellaneous, 125 tons.

McNAMARA (Tonopah)—Present face shows 6 ft. milling ore; regular shipments being made to West End mill. Working through West End shaft.

TONOPAH EXTENSION (Tonopah)—In September mine and mill receipts were $146,638; current expenses, $81,286; operating profit, $65,352.

WEST END (Tonopah)—The old Ohio shaft on California claim repaired to 500-ft. point. Is about 750 ft. deep. Expect to resume sinking by end of November.

TONOPOH EXTENSION (Tonopah)—September profit $64,896 from 9,545 dry tons, yielding 1,564.76 oz. gold and 170,614 oz. silver. Main operations are from 950-ft. level, No. 2 shaft, to 1,540-ft. level Victor shaft.

WHITE CAPS (Manhattan)—The west 210-ft. level and 310-ft. levels connected by raise in ore averaging $17 per ton. Grading for mill, which will be moved to point near shaft. Preparing to sink shaft to 435-ft. level.

Storey County

OPHIR (Virginia)—Joint Con. Virginia west crosscut advanced to 441-ft. point.

CON. VIRGINIA (Virginia) Joint Ophir west crosscut advanced to 310-ft. point.

ANDES (Gold Hill)—Saved 47 cars of ore from 350 level. Returns of $840 for September shipments to Selby.

UNION CON. (Virginia)—Extracted from 2,500 level 22 cars of ore, averaging $18.30, and 47 cars, $16.50. Prospecting from 2,300 to 2,700 levels.

JACKET MILL (Gold Hill)—Received 420 tons ore from surface dump, running mill three full days, cyanide plant also operating. Shipped bar of bullion.

COMSTOCK PUMPING ASSOCIATION (Virginia)—One of new vertical pumps installed below level of 2,700 station of Mexican-Ophir winze. Removing station pump from south compartment preparatory to installing another vertical pump. Overhauling other pumps of the system.

NEW MEXICO

Grant County

SANTA RITA DEVELOPMENT (Santa Rita)—W. H Weed announces development started by diamond drilling with three drills, driving 1,000-ft. tunnel and active mining on Ruddle claims. Hoist machinery placed and ore shipments expected in 30 days.

PENNSYLVANIA

BETHLEHEM STEEL (Bethlehem)—Awarded $2,000,000 contract to Dravo Contracting Co., Pittsburgh, for erection four blast furnaces, open-hearth plant, blooming and plate mills at Sparrows Point, Md., for Maryland Steel Co. works.

UTAH

Beaver County

MONTREAL (Milford)—From 50 to 100 tons low grade copper ore produced daily. Ore carries excess of iron, largely as magnetite. Railroad spur being built to mouth of tunnel. Property being worked by Alfred Frank, of Salt Lake, and John MacGinnis, of Butte.

Box Elder County

LAKEVIEW (Saline)—Nine cars of ore mined during October. Five cars of lead ore and zinc ore shipped, and four broken awaiting shipment. Zinc averaged 35% and lead between 25 and 40%. Twenty lessees working. S. S. Arentz, manager.

Juab County

TINTIC SHIPMENTS for October amounted to 788 cars. There were 22 shippers.

MAY DAY (Eureka)—During September 6 cars shipped, and up to Oct. 26, four cars. Company has paid two dividends totaling $40,000 this year.

CENTENNIAL-EUREKA (Eureka)—Shipments being increased. Week ended Oct. 27, shipments amounted to 26 cars. Much development being done.

EUREKA HILL (Eureka)—Ore running high in silver with some copper and lead opened on Pierce-Hardy lease, on what is thought to be old Silver Gem vein, which in past produced much ore.

IRON BLOSSOM (Silver City)—Drifting from 1,300 level of winze in north end of property to reach copper orebody, after which sinking in winze to be continued. Siliceous ore amounting to 100 tons being shipped daily.

EAGLE & BLUE BELL (Eureka)—Additional connections, made recently between Eagle & Blue Bell and Victoria workings, facilitate handling of ore from latter. Victoria section producing about 200 tons weekly. W. Owens, superintendent.

Millard County

ANTELOPE STAR (Black Rock)—Property, 9 mi. west of Black Rock on Millard-Beaver county line, attracting attention. Lead ore of milling grade opened at intervals for 1,800 ft. along strike; higher grade portions in the milling ore. Two different veins.

Salt Lake County

SHIPMENTS FROM ALTA for week ended Oct. 27 were between 15 and 18 cars; principal shippers were the South Hecla and Michigan-Utah. At present there is shortage of teams. Supplies are being brought up for the winter. Regular back haul price for freight has been $6 per ton. Recently as high as $10 for the 9-mi. haul has been paid.

UTAH COPPER (Bingham)—Production for October estimated at about 21,000,000 lb.

SOUTH HECLA (Alta)—Much ore broken. Mine bins full and excess stored underground. George H. Watson, general manager.

UTAH CONSOLIDATED (Bingham)—Current rate of production reported at approximately 1,000,000 lb. copper a month, and 1,500,000 lb. lead. Company derives additional income from 8,250 shares Anaconda stock.

PERUVIAN CONSOLIDATED (Alta)—Special stockholders' meeting called for Nov. 20 to consider increase in capitalization from 450,000 to 1,000,000 shares, par value $1. Company will absorb former Miller-Peruvian, which was operating Peruvian property under lease. Adjoins South Hecla and Sells on southwest.

CONGER (Bingham)—Raise from the Montana-Bingham's tunnel now up 900 ft. Still 400 ft. to go before connections will be made with workings from which ore is being mined. Raise started in Bingham Amalgamated ground and was driven partly to demonstrate apex of a vein, which is expected to connect with old Conger stopes; also to secure ventilation, etc. Copper ore being mined in old workings at about 200-ft. depth.

Summit County

PARK CITY SHIPMENTS for October amounted to 6,321 tons of ore and concentrates; 11 shippers.

THREE KINGS (Park City)—Winze being sunk below 540-ft. level down 110 ft. Objective point contact of limestone with underlying Ontario quartzite. Ore makes on and near this contact in neighboring properties.

DALY WEST (Park City)—Ore being mined on 1,700-, 1,900- and 2,000-ft. levels. Between 100 and 125 tons of ore milled daily. Some first-class ore being shipped. Production for first 10 months of year has been about 8,000 tons of ore and concentrates.

SILVER KING CONSOLIDATED (Park City)—Newly remodeled Grasselli mill and sampler being warmed up. Regular shipments over 10,200-ft. aërial tramway to be started soon. Thaynes Cañon tunnel in 800 ft. Several hundred tons of ore accumulated awaiting shipment.

Tooele County

IN DEEP CREEK there is much activity owing to new railroad, on which work has been started by the Utah Construction Co. Five miles of grading has been done, and rails and ties are arriving at Wendover. The Gold Hill terminus is to be named Goodwin, in honor of Judge Goodwin, of Salt Lake City, who has long advocated building a road into this section.

CAPELL SALT (Wendover)—Company, whose property is on Western Pacific, 120 mi. southwest of Salt Lake City, is increasing capacity. Much of the crude salt produced from the salt beds carries 90% sodium chloride.

VIRGINIA

VIRGINIA SMELTING (Norfolk)—Secretary F. A. Eustis reports recent fire started at top of sintering plant, where 2,300-volt electric power wires seriously hampered crew's efforts to extinguish. Before controlled, fire entirely destroyed screening and crushing plant and seriously damaged sintering plant. Plant operating under temporary arrangements pending sintering-plant reconstruction by contract; hoped to complete by Jan. 1

WISCONSIN

Zinc-Lead District

WISCONSIN ZINC (Platteville)—Heavy range zinc ore proved by drill over 700 ft. in length on Calvert Estate ½ mi. north of Benton. Company's two new producers, the C. A. T. and Birkbeck making large output.

LINDEN ZINC CO. (Linden)—This company, heretofore operating under lease the Campbell Magnetic Separating plant at Cuba City, has purchased the Cuba plant outright; has expended $18,000 in remodeling the machinery equipment. Capital stock increased from $10,200 to $75,000. The Linden plant will also be overhauled, making a combined capacity of 100 tons of green ore per day. Raw zinc concentrates are purchased from independent producers of the district.

CANADA

British Columbia

STANDARD SILVER-LEAD (Silverton)—Strike of 3-ft. clean lead orebody made in No. 5 tunnel. This is third important strike in last few weeks, two strikes high-grade lead-silver ore made in September in upper tunnels Alpha claim.

Ontario

IN LAKE OF THE WOODS DISTRICT a test mill run on the Cameron Island property is reported to have given returns of $29 per ton, about 62% of assay values. An increased percentage said to have been obtained by use of converter-roaster invented by Aaron Beam, of Denver.

SHAMROCK (Cobalt)—Strike of high-grade ore made on 300-ft. level.

DOME (South Porcupine)—October production, $185,000 from treatment of 40,200 tons of ore; average value, $4.60 per ton; working cost, $2.69 per ton.

NEWRAY (Porcupine)—Diamond drilling has disclosed vein 12 ft. wide at 600-ft. level. Core assays are reported at $23.90 to the ton. Three veins found on surface cut by diamond drill.

INTERNATIONAL NICKEL CO. (Port Colborne)—Surveys for refinery completed and excavation begun so as to have the foundation completed before freezing sets in. It is expected to have the plant ready for operation within 12 months. The plant will be constructed in units; number of employees at outset will be about 300.

VACUUM GAS AND OIL CO. (Thamesville)—Recently shipped three cars of oil and has four wells pumping and four others which will be in operation about the middle of November. Company has secured new leases in the Thamesville, Brooke, Kent and Elgin oil fields and in the Tillsonburg, London and Bayham gas pools. Contract made with a pipe-line company to handle gas output.

HOLLINGER CONSOLIDATED (Timmins)—For four weeks ended Oct. 6, gross profits $241,293 from 49,770 tons of ore; average value, $9.07 per ton; working cost, $3.86 per ton milled. Mill ran 90.5% of possible time. This is the first time that the increased dividend has been earned since the merger, the deficit to date being $239,740. The crosscut from the Hollinger ground has reached the Millerton, and it is announced that No. 12 and No. 41 veins are the same body extending for about 1,000 ft Central shaft is now down to 800-ft. level. Steel headframe, hoisthouse and crusher station completed. New mill nearly closed in and first unit is expected to be ready in March.

CUBA

CANDIDA (Los Acostas)—This Pinar del Rio copper mine recently shipped a cargo of 1,100 tons of high-grade ore to the United States on the Norwegian steamer "Imperator," making a total of about 3,000 tons from this one orebody.

COSTA RICA

MILLION-ACRE OIL TRACT optioned by Washington S. Valentine of 17 Battery Place, New York, for American syndicate.

CHOSEN

ORIENTAL CONSOLIDATED (Unsan)—Cable estimate, October cleanup $121,200. Details of September bullion yield were: Tabowie mill, $25,869; Taracol mill, $25,398; Maibong mill, $19,649; Taracol cyanide plant, $49,224; Maibong tube-mill plant, $3,696; total, $123,836; tons milled, 26,391. Rainfall below normal and additional power contracted at 1½c. per kw-hr. from Okura & Co. as against regular price of 2c. Cholera, which has been raging in Japan, spread to Chosen in September, but is expected to be checked by the cold season. No cases north of Seoul as yet and none in Unsan district since 1902.

The Market Report

Metal Markets

NEW YORK—Nov. 8, 1916

An extraordinarily large business, with spectacular features, was done in copper, the price for which advanced sharply. Good business was done in lead and zinc, lead at unchanged prices and zinc advancing slightly.

Copper, Tin, Lead and Zinc

Copper—A very large business was done, both for domestic and foreign account, the aggregate of sales being upward of 125,000,000 lb., without any doubt. The demand was both persistent and insistent. A good many buyers had manifestly overstayed their market and had been compelled finally to buy on the best terms they could get. This was exhibited in the demand for early copper, but producers could not furnish much of that in view of the scarcity of their supplies. January copper, and indeed copper for delivery during the first quarter of 1917, has now become very tight. During the last week a large business was done for first-quarter and second-quarter delivery, the major market covering both of those periods. Some business for the second half of 1917 was done, but nowhere near so much as in the previous week.

Prices rose right from the beginning and exhibited wide variations for same delivery, not only between different times of the day, but also between different offices at the same time. Monday was especially a big and excited day. On that day the supply of first-quarter copper became practically cleaned out, and the price advanced to 29c., r.t., at the close. Sales of November-December copper were made at 30c. in considerable quantity; i.e., several hundred tons. At the close of the week, November-December was about 30c.; January, 29¾c.; first-quarter, 29@29½c.; second-quarter, 28½@29c., all regular terms.

Copper Exports from Atlantic ports in October were 32,975 gross tons.

Copper Sheets, the base price is nominally 37½c. for hot rolled and 38½c. for cold rolled. Prompt deliveries command toll. Wire is stronger, 33@33½c. nominal.

Tin—A small but steady business was done. At the beginning of the week spot was 41¾c.; futures, 40¾c.; at the close, spot, 42¾c.; futures, 41⅝c.

Visible Stocks of Tin Oct. 31 were: London, 7,375; Holland-Banka and Billiton, 2,194; United States, 7,846; total, 17,415 gross tons. This is an increase of 1,223 tons during October; and of 4,261 tons over Oct. 31 last year.

Tin Exports of the Federated Malay States in September were 3,636 gross tons; for the nine months ended Sept. 30 they were 32,610 tons, being 2,230 tons less than in 1915, and 4,088 tons less than in 1914.

Lead—This market was quiet and firm. Some large orders were placed and the aggregate of business was probably a little larger than in the previous week. Canada was a persistent buyer. Some Russian orders for shipment to Vladivostock were placed and more are said to be pending. The price quoted for lead at Pacific Coast ports is 7¼c.

Spelter—A small business in common spelter was done at advancing prices. A considerable business in brass special at about 10¾c. was reported, and there was a large business in high grade, the price of which is still quoted at about 15c.

Zinc Sheets—The base price has not changed from that quoted last week, the quotations being $16 per 100 lb., f.o.b. Peru, Ill., less 8% discount.

Other Metals

Aluminum—The demand continues strong and supplies show no increase. Quotations are as per last week, 64½@66c. per lb. for No. 1 ingots, New York.

Antimony—Spot was quoted at 12¾@13¼c., but one of the largest interests made no offers to sell at less than 13½c. for future delivery. In general, the market for futures was rather firmer.

Imports of ore, matte, etc., containing 1,226,100 lb. of antimony from Alaska during the eight months ended Aug. 31 are reported by the Department of Commerce.

Quicksilver—Firm at $80. Stocks in New York reported small. San Francisco reports, by telegraph, $75@76, market very dull.

Minor Metals—Current quotations for **Bismuth** are $3.15@3.30 per lb., New York—**Cadmium** is quoted at $1.30@1.50 per lb.—**Cerium**, electrolytic, is sold at $8@9 per lb.—**Cobalt Metal** is quoted at $1.35 per lb.—**Magnesium** is steady, with sales at $3.50@3.75 per lb. for 99% pure. **Selenium** is from $3 up to $5 per lb., according to size of order.

Gold, Silver and Platinum

NEW YORK—Nov. 8

Gold imports at New York from Ottawa have been suspended for the present.

Gold in the United States Nov. 1 is estimated by the Treasury Department as follows: Held against gold certificates outstanding, $1,770,202,919; in Treasury current balances, $268,965,399; in banks and circulation, $660,968,658; total, $2,700,136,976. This is an increase of $502,025,211 over Nov. 1 of last year.

Silver has rapidly advanced owing to an improvement in the Eastern Exchanges. It is reported that considerable buying has been done by both India and China. Heavy sales by China in the last few months may occasion purchases in quantity to replace the depleted metal in that country.

Coined Silver in the United States Nov. 1 is estimated by the Treasury Department as follows: Standard dollars, $568,270,319; subsidiary coins, face value, $189,695,716; total, $757,966,035. Of the dollars, $170,021,918 are held against silver certificates outstanding.

Platinum Market again stronger; quoted at $95@100. The jewelry trade continues to use considerable quantities.

Palladium—Quoted at $75 per oz.

Zinc and Lead Ore Markets

Platteville, Wis., Nov. 4—Quotations of the district are according to the following figures. Base price per 2,000-lb. ton for material assaying 60% zinc is $70 for premium ore down to $65 for medium grade ores. For material assaying 80% lead the base price per 2,000-lb. ton is $80@82. Shipments for the week were 2,677 tons of zinc ore, 77 tons of lead ore, and 828 tons of sulphur ore. For the year, to date, the figures are, 109,403 tons of zinc ore, 3,725 tons of lead ore, and 27,034 tons of sulphur ore. Shipped during the week to separating plants, 4,162 tons of zinc ore.

Joplin, Mo., Nov. 4—Price quotations per 2,000 lb.: Blende, high, $81.60; 60% zinc, premium ore, $80; medium grades, $79@72; low, $70. Calamine, per ton 40% zinc, $45@38. Average selling price, all grades of zinc, $63.95 per ton.

Lead, high price, $87.50; base, $87@84; average selling price, all grades of lead, $84.11 per ton.

Shipments of the week: Blende, 6,730 tons; calamine, 2,005 tons; lead, 1,356 tons. Value, all ores the week, $672,680; 44 weeks, $31,407,290.

The market price of blende assumed a peculiar spurt awhile on Friday afternoon, with an exceptionally strong demand at advancing prices, but by night had quieted down and several buyers had been withdrawn from the market. Blende ore as low as 49%, with over 16% iron received bids of $60, $70 and $77 within the afternoon. The advance was so rapid and the buyers out of the market before the fact was fully known, sellers not knowing the situation were reporting rumors tonight of $82.50 to $85, of which there is no basis but rumor. Lead demand is creating new records in prices almost every week, with a general upward tendency. American Zinc, since acquiring the Granby lead smelters, is a strong competitor of the Eagle-Picher company.

The low stage of water continues a depression to production.

Other Ores

Manganese Ore—By a clerical error manganese ore was quoted in this column last week at 70@75c. per unit, delivered at tidewater ports, when 60@65c. was intended. This week we quote 60c.

Imports included 280 tons of manganese ore from Liverpool at Baltimore.

Tungsten Ore—Business continued very active, $17 per unit being paid for prompt delivery. There are considerable inquiries in the market for further forward contracts, but negotiations are still pending. Arrivals during the last week were absorbed with exception of a small tonnage. We quote the market at $16.50@17. Ferro-tungsten continued at $2.60 per lb.

Molybdenum Ore—Prompt molybdenite is still hard to obtain. We quote $1.70@1.80 per lb. MoS_2. Ferromolybdenum active at $1 per lb. for prompt, and $3.65 for forward.

Antimony Ore—Considerable inquiry, but little has been obtainable. Small quantities of high grade reported sold at $1.60 per unit.

Iron Trade Review

NEW YORK—Nov. 8

There is no change in the general condition of the iron and steel market from last week.

The main point of interest is the great activity in the pig iron market, with the rapid rise in prices, which are now from $2 to $2.50 above those of a week or two ago. Buyers are not apparently pressing so much for immediate supplies as seeking to provide for 1917 needs.

There is some improvement in orders for structural steel, though many projects are held back on account of high prices.

PITTSBURGH—Nov. 7

The sharp advances in pig iron have continued. Southern iron has advanced from $17 to $20 at

SILVER AND STERLING EXCHANGE

Nov.	Sterling Exchange	Silver: New York, Cents	Silver: London, Pence	Nov.	Sterling Exchange	Silver: New York, Cents	Silver: London, Pence
2	4.7569	68¼	32 3/16	6	4.7569	69½	33¼
3	4.7569	68¼	32¼	7			33 5/16
4	4.7569	68¾	32½	8	4.7569	71¼	34¼

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine.

DAILY PRICES OF METALS IN NEW YORK

Nov.	Copper: Electrolytic	Tin: Spot	Lead: N. Y.	Lead: St. L.	Zinc: St. L.
2	27½ @28	41¾	7.00	6.90 @6.92½	10¼ @10
3	27¾ @28¼	41⅞	7.00	6.87½ @6.92½	10¼ @10½
4	27¾ @28¼	42¼	7.00	6.87½ @6.92½	10¼ @10
6	27¾ @28¼	42¼	7.00	6.87½ @6.92½	10¼ @10½
7					
8	28½ @29½	42¾	7.00	6.90 @6.92½	10½ @10¾

The quotations herein are our appraisal of the average markets for copper, lead, spelter and tin based on wholesale contracts for the ordinary deliveries of the trade as made by producers and agencies, and represent, to the best of our judgment, the prevailing values of the metals, reduced to basis of New York, cash, except where St. Louis is basing point.

The quotations for electrolytic copper are for cakes, ingots and wirebars. Electrolytic copper is commonly sold at prices including delivery to the consumers and is subject to discounts, etc. The price quoted for copper on "regular terms" (r.t.) is the gross price including freight to the buyer's works and is subject to a discount for cash. The difference between the price delivered and the New York cash equivalent is at present about 0.25c. on domestic business. The price of electrolytic cathodes is 0.05 to 0.10c. below that of electrolytic. Quotations for lead represent wholesale transactions in the open market for good ordinary brands. Quotations for spelter are for ordinary Prime Western brands. Only St. Louis price is given, St. Louis being basing market. We quote New York price at 17c. per 100 lb. above St. Louis.

Some current freight rates on metals per 100 lb. are: St. Louis-New York 17c.; St. Louis-Chicago, 6.3c.; St. Louis-Pittsburgh, 13.1 cents.

LONDON

Nov.	Copper: Standard Spot	Copper: Standard 3 Mos.	Copper: Electrolytic	Tin: Spot	Tin: 3 Mos.	Lead: Spot	Zinc: Spot
2	124	119	143	180	181½	30½	52
3	124	119	143	182½	183	30½	52½
4							
6	124	119	144½	182½	184½	30½	[illegible]
7	124½	120	146	183½	184½	30½	[illegible]
8	124	119	147	183½	184½	30½	[illegible]

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2,240 lb. Copper quotations for electrolytic are subject to 3% discount. For convenience in comparison of London prices, in pounds sterling per 2,240 lb., with American prices in cents per pound the following approximate ratios are given, reckoning exchange at 4.80: £15 = 3.2[illegible]; [illegible] = 4.29c.; £30 = 6.43c.; £40 = 8.57c.; [illegible]. Variations, £1 = 0.21¼ cents.

higher with practically no intermediate sales, while the local market is up $1 to $2. Steel prices are also advancing but prices are not clearly defined in some products as the mills are reserved about selling, being already committed as far ahead as is considered advisable. On Nov. 1 the iron- and steel-pipe mills advanced lap-welded pipe one point, or about $2 a ton, while steel boiler tubes were advanced two points. On Nov. 6, wire products were advanced $3 a ton, making nails, $2.85, base. The American Sheet and Tin Plate Co. has withdrawn from the market on tin mills products, being practically sold up for the half year. Its tinplate price had been $5.75 but there was not enough to go around and some of its customers have bid independents $6.25 without getting material, although independents were selling regular customers at $6.

The Carnegie Steel Co. produced 970,000 gross tons of steel ingots in October, a new month's record, and many other mills broke records. Serious fears are entertained that car shortages may curtail steel output in the next couple of months. Since Sept. 1, about 52,000 freight cars have been ordered, equal to 2% of the number in service. Deliveries would run to next October if the steel were furnished in regular course, but in the event of more serious car shortages the mills may give the steel precedence over other business, excepting that of the Government.

Fears of an iron-ore shortage are now removed, as the movement down the lakes to Nov. 1, with prospects of 4,500,000 tons in November and 1,500,000 tons by all-rail, promises 64,000,000 tons for the season. There is very serious danger of pig iron production being curtailed by shortage of coke or of cars.

Pig Iron—The market advances as soon as a few sales have been made at a given price, and following the advance of $2 a ton in all grades reported a week ago bessemer is up $2 more and other grades $1. A consumer of bessemer who wanted 3,000 tons got 1,500 tons at $26 and immediately paid $27 to other sellers for 1,000 tons and 300 tons respectively, since when odd lots have sold at $28.50. Doubtless there is unsold capacity to the middle of next year but producers are unwilling to sell, seeing they can secure higher prices and being fearful of a coke famine and car shortages. There is scarcely any inquiry for second half. We quote: Bessemer, $28@28.50; basic, $23@24; foundry, $24@25; malleable, $23.50@24.50; forge, $23.50@24.50, f.o.b. valley furnaces, 95c. higher, delivered Pittsburgh. Low phosphorus, 0.035%, has sold at $40, furnace.

Steel—It is reported on good authority that the leading sheet producer in England, itself a producer of steel but being "controlled," recently bought 25,000 tons of bessemer sheet bars at $46, f.o.b. Youngstown, and about 10,000 tons of sheets. The market is strong at $50 for billets and $52 for sheet bars, with no regular offerings. Rods are $60@65 and ordinary forging billets $70@75.

IRON ORE

Shipments of Lake Ore continue heavy, in spite of bad weather. Shipments from Lake Erie docks to furnaces have been much delayed by short supply of cars.

Ferroalloys

Ferrovandium exports from the United States eight months ended Aug. 31 were 1,062,932 lb., which is 220,667 lb. more than for the entire year 1915.

Ferrosilicon, 50% is quoted at $98@100 per ton at mill. Bessemer ferrosilicon is from $33 for 10% up to $43 for 16% at mill.

Spiegeleisen, 20% is quoted at $50@55 per ton f.o.b. cars, according to size of order.

Ferromanganese—The market is quiet at $165 for domestic and $164 for imported, on contract, with prompt at the same level.

Coke

Connellsville—The market has stiffened further, with spot furnace bringing $7.50@8, while spot foundry is $9@10, and shipped chiefly in hopper cars. Production cannot be increased, owing to car and labor shortage while demand is heavier, regular furnaces requiring more on contract while there is demand from removed points, copper producers in the northwest being out for large tonnages of prompt. A contract for 15,000 tons a month of furnace coke over first half has been closed at about $4.

Chemicals

NEW YORK—Nov. 8

The general markets are in good shape and trade in heavy chemical is steady.

Arsenic—Business is fair, supplies better and prices steady at $6@6.25 per 100 lb., according to size of order.

Copper Sulphate—Business quiet. Prices, $10.50@11.25 per 100 lb., according to size and terms of order.

Nitrate of Soda—Demand continues fair. Prices a little soft at $2.90 per 100 lb. for both spot and futures.

STOCK QUOTATIONS

N. Y. EXCH.†	Nov. 6
Alaska Gold M.	12
Alaska Juneau.	6⅞
Am.Sm.&Ref.,com.	112¾
Am. Sm. & Ref., pf.	117¼
Am. Sm. Sec., pf. A	99½
Am. Sm. Sec., pf. B.	92½
Am. Zinc	52⅞
Am. Zinc, pf.	83
Anaconda	98
Batopilas Min	1¾
Bethlehem Steel.	669
Bethlehem Steel, pf	145
Butte & Superior	68½
Chile Cop.	23
Chino.	64⅝
Colo.Fuel & Iron.	54
Crucible Steel	93¼
Dome Mines	24¾
Federal M. & S	18¼
Federal M. & S., pf.	43¾
Great Nor., ore ctf.	43¾
Greene Cananea	53¾
Homestake.	130
Inspiration Con	67⅞
International Nickel	51½
Kennecott	55
Lackawanna Steel.	90⅞
Miami Copper	39⅞
Nat'l Lead, com.	69¼
National Lead, pf.	112
Nev. Consol.	25⅛
Ontario Min	6⅞
Quicksilver	2½
Quicksilver, pf.	3½
Ray Con	29¾
Republic I &S.,com.	80⅛
Republic I. & S. pf.	114¾
Sloss-Sheffield	74¾
Tennessee Copper	22¼
U. S. Steel, com.	123¼
U. S. Steel, pf.	121⅞
Utah Copper	113½
Va. Iron C. & C.	57

N. Y. CURB†	Nov. 6
Buffalo Mines	1
Butte & N. Y.	1½
Butte C. & Z.	15 11/16
Caledonia	.48
Can. Cop. Corpn	2 1/16
Cashboy	.06
Cerro de Pasco.	44⅞
Con. Ariz. Sm	2⅞
Con. Coppermines.	2⅞
Con. Nev.-Utah.	⅞
Crystal Cop.	.80
First Nat. Cop.	5¼
Florence	.70
Goldfield Con	.57
Goldfield Merger.	.06½
Granite	.40
Hecla Min	7⅞
Howe Sound.	5⅞
Jerome Verde	1 11/16
Joplin Ore & Spel	.45
Kerr Lake	4⅞
Magma	49
Majestic.	.55
McKinley-Dar-Sa	58
Mother Lode	.37½
Nevada Hills	.22
N. Y. & Hond	15
Nipissing Mines.	8⅞
Oro.	.04
Ray Hercules	4⅞
Rochester Mines.	.59
St. Joseph Lead.	19⅞
Standard S. L.	1½
Stewart.	.19
Success.	.37
Tonopah	5 11/16
Tonopah Ex.	5⅞
Tribullion	3/16
United Zinc.	5
White Knob, pf.	2¼
White Oaks.	4
Yukon Gold.	2¼

SAN FRAN.*	Nov. 6
Alta.	.04
Andes	.10
Best & Belcher	.06
Bullion.	.01
Caledonia	.30
Challenge Con.	‡.05
Confidence.	.20
Cons. Imperial.	.01
Con. Virginia.	09
Gould & Curry.	03
Hale & Norcross.	.05
Jacket-Cr. Pt.	.04
Mexican	.11
Occidental.	.65
Ophir	.26
Overman	.03
Savage	‡.10
Seg Belcher	.03
Sierra Nevada.	.29
Union Con.	.58
Utah Con.	01
Belmont.	4 65
Jim Butler.	.91
MacNamara.	.09
Midway	.23
Mont.-Tonopah.	.18
North Star.	.16
Rescue Eula	.27
West End Con.	.69
Atlanta	09
Booth	.10
C.O.D. Con.	.02
Comb. Frac.	.05
D'field B B	[illegible]
D'field Daisy.	.05
Jumbo Extension.	.31
Round Mountain.	.36
Sandstorm Kendall.	.04
Silver Pick	.19
Central Eureka	‡.05
Argo	.07
Ariz. Central	10
Big Jim.	1.18¾
Lazy Boy.	.06
Oatman No. Star.	‡.14
Tom Reed	2 20
United Eastern.	4 50
United Western	.04

BOSTON EXCH.*	Nov. 6
Adventure	3⅝
Ahmeek	106½
Algomah.	1
Allouez.	71
Ariz. Com., ctfs.	14½
Bonanza	.40
Butte-Ballaklava	2¼
Calumet & Ariz.	79½
Calumet & Hecla.	589
Centennial	21
Copper Range.	71¾
Daly West	2½
East Butte.	16
Franklin	9½
Granby	93½
Hancock.	13⅝
Helvetia	.25
Indiana	3⅞
Island Cr'k, com	62½
Island Cr'k, pfd.	92
Isle Royale	34½
Keweenaw.	5⅞
Lake	13⅛
La Salle	4⅛
Mason Valley.	7
Mass.	15¾
Mayflower.	4
Michigan.	4½
Mohawk	96
New Arcadian.	6¾
New Idria	13⅞
North Butte	22¾
North Lake.	2¼
Ojibway.	1½
Old Colony	3
Old Dominion	72
Osceola	91
Quincy.	93¼
St. Mary's M. L.	88
Santa Fe.	2¼
Shannon	9
Shattuck-Ariz.	31½
So. Lake.	5½
So. Utah.	.27
Superior	15
Superior & Bost.	7
Tamarack.	43½
Trinity.	7
Tuolumne	.60
U. S. Smelting.	74⅞
U. S. Smelt'g, pf.	51¼
Utah Apex	3
Utah Con	16½
Utah Metal.	7⅞
Victoria	6⅞
Winona	4½
Wolverine.	46½
Wyandot	1½

BOSTON CURB*	Nov. 6
Alaska Mines Corp.	.83
Bingham Mines.	9½
Boston Ely	70
Boston & Mont	82
Butte & Lon'n Dev	53
Calaveras	5½
Calumet-Corbin	.02
Chief Con.	2
Cortez	.30
Crown Reserve.	45
Davis-Daly.	4 3/16
Eagle & Blue Bell	1 11/16
Houghton Copper	1⅞
Iron Cap Cop., pf.	6½
Mexican Metals	.55
Mines of America	2½
Mojave Tungsten.	3⅞
Nat. Zinc & Lead	.61
Nevada-Douglas.	1⅞
New Baltic.	2⅞
New Cornelia	18½
Ohio Copper.	.25
Oneco	.80
Rex Cons.	.45
Rilla	.10
United Verde Ext.	39½

SALT LAKE*	Nov. 6
Big Four	1.10
Black Jack.	.06
Cardiff.	6.90
Colorado Mining.	.18
Crown Point.	05½
Daly-Judge	8 00
Emma Cop	2 50
Empire Copper.	1.25
Gold Chain	.10
Grand Central.	.60
Iron Blossom.	1.70
Lower Mammoth.	.05
May Day.	.12½
Opohongo.	01¼
Prince Con	1.32½
Seven Troughs	04
Silver-King Coal'n.	2.90
Silver King Con.	3.70
Sioux Con.	.15½
So. Hecla.	1.70
Uncle Sam.	.06
Wilbert.	09½
Yankee.	.16

TORONTO*	Nov. 6
Bailey.	07½
Beaver Con	40
Chambers Ferland	15
Coniagas.	4.75
La Rose.	.55
Peterson Lake.	18
Right of Way	05
Seneca Superior	‡ 09
T. & Hudson Bay	73.00
Temiskaming.	.60
Wettlaufer-Lor.	.08
Dome Exten.	30
Dome Lake	57
Foley O'Brien.	70
Hollinger.	6.62½
Jupiter	26
McIntyre.	1 79
Newray	.97
Porcu. Crown.	.67
Vipond	.41
West Dome.	34

STOCK QUOTATIONS—Contioued

COLO. SPRINGS	Nov. 6
Doctor Jack Pot	09
Elkton Con	.10
El Paso	.40
Findlay	.03
Gold Sovereign.	.04
Golden Cycle.	2.42
Granite	.60
Isabella	.23½
Jack Pot.	.05
Mary McKinney.	.30
Portland.	1.93
Vindicator.	1.60

LONDON	Oct. 19
Alaska Mexican	£0 15s0d
Alaska Tre'dwell	2 17 6
Burma Corp.	4 6 10½
Cam & Motor.	0 11 9
Camp Bird.	0 7 6
El Oro	0 8 9
Esperanza.	0 10 9
Mexico Mines.	3 17 6
Nechi, pfd.	0 13 6
Oroville.	0 16 9
Santa Gert'dis	0 11 0
Tomboy.	1 1 0

* Bid prices. † Closing prices. ‡ Last Quotations.

MONTHLY AVERAGE PRICES OF METALS

Silver	New York			London		
	1914	1915	1916	1914	1915	1916
January	56.572	48.855	56.775	26.553	22.731	26.960
February	57.506	48.477	56.755	26.573	22.753	26.975
March	58.067	50.241	57.935	26.788	23.708	27.597
April	58.519	50.250	64.415	26.958	23.709	30.662
May	58.175	49.915	74.269	26.704	23.570	35.477
June	56.471	49.034	65.024	25.948	23.267	31.060
July	54.678	47.519	62.940	25.219	22.597	30.000
August	54.344	47.163	66.083	25.979	22.780	31.498
September	53.290	48.680	68.515	24.260	23.591	32.584
October	50.654	49.385	67.855	23.199	23.925	32.361
November	49.082	51.714	..	22.703	25.094	...
Dec.	49.375	54.971	.....	22.900	26.373	.....
Year	54.811	49.684	...	25.314	23.675	...

New York quotations cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

Copper	New York		London			
	Electrolytic		Standard		Electrolytic	
	1915	1916	1915	1916	1915	1916
Jan.	13.641	24.008	60.756	88.083	65.719	116.167
Feb	14.394	26.440	63.494	102.667	*	133.167
Mar.	14.787	26.310	66.152	107.714	*	136.000
April.	16.811	27.895	75.096	124.319	*	137.389
May.	18.506	28.625	77.600	135.457	*	152.522
June.	19.477	26.601	82.574	112.432	95.333	137.455
July.	18.796	23.865	76.011	95.119	91.409	125.500
Aug.	16.941	26.120	68.673	110.283	82.333	126.304
Sept.	17.502	26.855	68.915	113.905	85.250	134.071
Oct.	17.686	27.193	72.601	122.750	88.000	142.523
Nov.	18.627	.....	77.744	......	93.273	....
Dec.	20.133	.....	80.773	.....	100.430	.....
Year	17.275	.....	72.532	.....	.....	.....

Tin	New York		London	
	1915	1916	1915	1916
January	34.260	41.825	156.550	175.548
February	37.415	42.717	176.925	181.107
March	48.426	50.741	180.141	193.609
April	47.884	51.230	166.225	199.736
May	38.790	49.125	162.675	196.511
June	40.288	42.231	167.636	179.466
July	37.423	38.510	167.080	168.357
August	34.389	38.565	151.440	169.870
September	33.125	38.830	152.625	171.345
October	33.080	41.241	151.554	179.307
November	39.224		167.670	.....
December	38.779	.	167.000	.....
Av. year	38.590	...	163.960	.....

Lead	New York		St. Louis		London	
	1915	1916	1915	1916	1915	1916
January	3.729	5.921	3.548	5.826	18.606	31.167
February	3.827	6.246	3.718	6.164	19.122	31.988
March	4.053	7.136	3.997	7.375	21.883	34.440
April	4.221	7.630	4.142	7.655	21.094	34.368
May	4.274	7.463	4.182	7.332	20.347	32.967
June	5.932	6.936	5.836	6.749	25.170	31.011
July	5.659	6.352	5.531	6.185	24.611	28.137
August	4.656	6.244	4.520	6.088	21.946	29.734
September	4.610	6.810	4.490	6.699	23.151	30.786
October	4.600	7.000	4.499	6.898	23.994	30.716
November	5.155	.....	5.078	.....	26.278	.....
December	5.355	.....	5.266	.....	28.807	.....
Year	4.673	.....	4.567	.....	22.917	.....

Spelter	New York		St. Louis		London	
	1915	1916	1915	1916	1915	1916
Jan.	6.386	16.915	6.211	16.745	30.844	89.810
Feb	8.436	18.420	8.255	18.260	39.819	97.762
Mar.	8.541	16.846	8.360	16.676	44.141	95.048
April.	10.012	16.695	9.837	16.525	49.888	99.056
May	14.781	14.276	14.610	14.106	68.100	94.217
June	21.208	11.752	21.038	11.582	100.614	68.591
July	19.026	8.925	18.856	8.755	97.250	50.750
Aug	12.781	8.730	12.611	8.560	67.786	51.587
Sept.	13.440	8.990	13.270	8.820	67.841	52.095
Oct.	12.800	9.829	12.596	9.659	66.536	54.159
Nov.	15.962	.....	15.792	....	88.409	.....
Dec.	15.391	.....	15.221	....	89.400	.....
Year	13.230	.....	13.054	.....	67.553	.....

New York and St. Louis quotations, cents per pound. London, pounds sterling per long ton. * Not reported.

Pig Iron, Pitts.	Bessemer‡		Basic‡		No. 2 Foundry	
	1915	1916	1915	1916	1915	1916
January	$14.59	$21.60	$13.45	$18.78	$13.90	$19.70
February	14.55	21.16	13.45	18.93	13.90	19.51
March	14.55	21.81	13.45	19.20	13.95	19.45
April	14.55	21.65	13.45	18.95	13.95	19.45
May	14.61	21.78	13.60	19.11	13.83	19.58
June	14.70	21.95	13.67	18.95	13.77	19.34
July	14.94	21.95	13.91	18.95	13.68	19.20
August	16.01	21.95	15.31	18.95	14.75	19.25
September	16.86	22.88	15.95	19.58	15.70	19.53
October	16.95	24.61	15.96	21.26	15.80	21.51
November	17.57	....	16.47	....	17.20	....
December	19.97	....	18.44	....	18.95	....
Year	$15.82	.....	$14.76	.....	$14.95	.....

‡ As reported by W. P. Snyder & Co.

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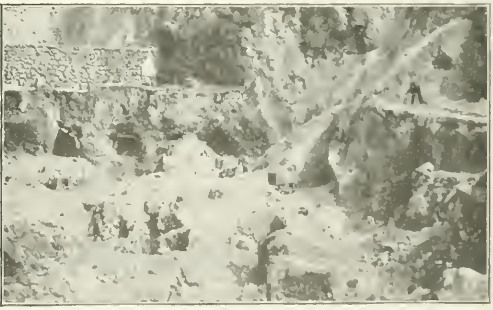
The Morococha and Casapalca Districts in Peru

By Joseph T. Singewald, Jr.* and Benjamin LeRoy Miller†

SYNOPSIS—The Morococha and Casapalca districts are in the the Department of Junin, Peru, and have both responded to the stimulus of American capital. The mines produce copper, silver and zinc. The principal mines are operated by the Cerro de Pasco and the Backus & Johnston companies, but there are other independent mines that are producing. The district is in high country, reaching at times over 15,000 ft., and the orebodies are of diverse character. The individual features of the mines are described.

There are two old mining districts in the Department of Junin, Peru, near the summit of the Cordillera Occidental and close to the Oroya railroad, that under the stimulus of American capital have developed considerable activity during the last few years and become really important producers. These are the Morococha district on the east side of the divide, and the Casapalca district on the west. Practically nothing of a definite descriptive nature has been published about them in recent mining literature, and it is the purpose of this article to provide such information.

VIEW OF MOROCOCHA MINES FROM CHURRUCA MINE



CHURRUCA OPENCUT, SHOWING OLD UNDERGROUND WORKINGS

The Morococha District

The Morococha district lies on the east side of the Cordillera Occidental in the Department of Junin, a short distance to the north of the Ferrocarril Central del Perú, known as the Oroya railroad. It is connected with that line at Ticlio, the highest station on the west side of the divide, by a branch line 9 mi. in length that crosses the divide at an elevation of 15,865 ft. and then descends to the town of Morococha to an elevation of 14,800 ft. This branch enjoys the distinction of being the highest railroad in the world and is 51 ft. higher than its nearest competitor, the Potosi branch of the Antofagasta & Bolivia Ry. in Bolivia. At the same time it affords the most magnificent scenery that can be seen from a railroad anywhere in the Andes, equaling that of the main line in ruggedness and excelling it in the magnificence of the glaciers that seem to be hardly a stone's throw from the car windows. It is 166 km. by rail from Lima to Morococha.

Morococha is one of the old mining districts of Peru and in its earlier history furnished argentiferous lead ores with more or less gold. After the independence of Peru was established, there was but little activity in the district until the advent of L. Pflücker & Sons in about 1850. They erected an amalgamation and lixiviation plant at Tuctu and enjoyed practically a monopoly of the district until 1886, when the Monteros came in and planned developments on a large scale which only in part materialized. They erected a concentrator below Lake Huascacocha and began the construction of a narrow-gage railroad connecting with the mines, but which was never completed. The richer ores in these days carried as high as 50% Pb and more ounces of silver than per cent of lead.

Before 1894 the only copper ores worked in the district were sulphates from the oxidized ores of the San Miguel mine, for use in the Tuctu plant. In that year larger-scale operations were started at this mine, and from that time the district was gradually converted into a copper camp, until now the argentiferous lead ores are completely neglected. The district rivals Cerro de Pasco as the most active and important metal-mining district in Peru. Two factors have brought this about—the advent of the railroad and, to an even greater degree, the entrance of American capital about ten years ago. The two large American mining companies in that part of Peru, realizing the possibilities of the district, began acquiring the various small properties and consolidating them into larger mines warranting systematic and extensive development. Both of them—the Cerro de Pasco Mining Co. and the Backus & Johnston company—had their own smelteries for treating the ores, that of the former company being at Fundicion, near Cerro de Pasco, on the company's railroad, 180 km. by rail from Morococha, and that of the latter at Casapalca, on the Oroya railroad, 20 km. distant. A third American company to enter the district at this time through the purchase of the Churruca mine was the Peruvian Mining, Smelting and Refining Co., controlled by the United States Smelting, Refining and Mining Co. It erected a smeltery at Rio Blanco on the Oroya railroad, 25 km. below Casapalca, which was put in blast in 1908, but operated only a short time. The Churruca mine is now operated by Backus & Johnston. The mines acquired by the Cerro de Pasco Co. are now owned by the Morococha Mining Co., which is the largest operator in the district.

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*Associate in economic geology, Johns Hopkins University, Baltimore, Md.

†Professor of geology, Lehigh University, South Bethlehem, Penn.

The monthly production has reached 20,000 tons of ore averaging about 12 oz. Ag. and 10% Cu. Most of this comes from the mines of the Morococha Mining Co. and of the Backus & Johnston company. The remainder comes chiefly from the La Huillca and La Vieja mines of the Sociedad Minera La Huillca, a Peruvian company, and from the Alexandria mine. The ores from the former are treated at a small customs plant on the shores of Lake Huacracocha, owned and operated by John Galliver, and those from the latter at the Casapalca smeltery. The ores of the small operators, aggregating a very small tonnage, must be disposed of to the three plants already mentioned.

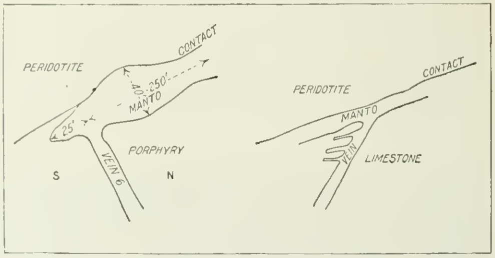
The Geography and Geology of the District

The district lies in a nearly east-west trending valley with its outlet to the east, though the railroad comes in over the divide from the west, bordered by extremely rugged and high mountain ranges; those on the north side are covered by numerous glaciers and culminate in the magnificent pyramidal, glacier-covered peak of Yanacinga. In the valley are three large lakes known respectively from west to east as Huacracocha, Morococha and Huascacocha, with elevations of 15,200, 14,800 and 14,300 ft. The town of Morococha lies at the south end of Morococha Lake, and the active portion of the district centers about it. The section of greatest activity lies between Huacracocha and Morococha Lakes and is comprised within an area roughly one mile square. Another active area is in the gulch opening into Morococha Lake from the south above the town.

The geology of the district has never been worked out, but it is apparent from merely a hasty visit that it offers many interesting problems. There are both igneous and sedimentary rocks present. The sedimentaries consist of a great series of limestones and quartzites of Mesozoic age, in part, at least, Cretaceous. Two kinds of igneous rock are of importance in connection with the orebodies, which formerly went under the names of andesite and greenstone, but which have recently been determined by Prof. C. P. Berkey, of Columbia University, to be porphyry and peridotite. The ores occur in both the sedimentary and igneous rocks.

Two kinds of ores occur in the district—the silver-lead ores, which are not being worked, and the more or less argentiferous copper ores that provide the present output. The following description is in reference to the latter class only. These ores average from 8% to 10% copper, with a silver content in ounces somewhat greater than that figure. Under favorable conditions ores running as low as 5% or 6% copper can be worked. The average copper content of the ores of this district is higher than that at Cerro de Pasco.

It is doubtful whether any other mining district of equal area possesses such a diversity of orebodies as regards shape and geologic position as does this district. It is, in fact, in these respects the most interesting and varied of the many districts visited in Latin America. From point of output, most important are the veins in the porphyry. Where these veins reach the contact of porphyry and peridotite, if the contact is steep, they rapidly fray out, but if relatively flat, the orebody spreads along the contact to form the flat-lying masses of considerable horizontal extent known as *mantos*. The filling of the veins usually consists of quartz and pyrite with enargite and tetrahedrite as the copper minerals. The relative abundance of the last two minerals varies from vein to vein and even in different stopes of the same vein. In some veins sphalerite is a prominent constituent.



VEINS TERMINATING IN "MANTOS"

At the left is vein 6, terminating at the flat contact of porphyry and peridotite. At the right is the termination of a vein, in the Isabel mine, as "manto" against peridotite contact, with enlargements along bedding planes on hanging-wall side

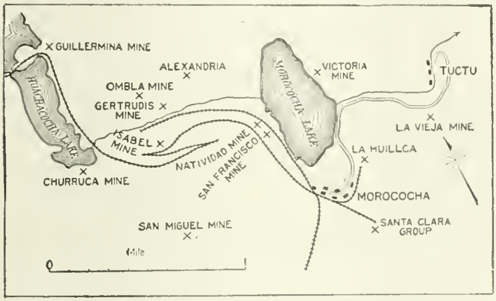
The other extreme is represented by veins entirely in limestone. These are replacement veins in which replacement has been particularly prominent along certain beds, causing local horizontal enlargements which may be repeated at several horizons. In some cases the original bedding of the limestone is preserved in the ore. The ores of these veins are characterized by the predominance of chalcopyrite with some bornite as the copper minerals, to the subordination or almost complete absence of the sulphantimonides found so abundantly in the veins in the igneous rock. The principal filling is quartz and pyrite with a little sphalerite and galena.

A closely allied type is represented by replacement veins in limestone of the same nature as the preceding, but which are terminated by a great *manto* at the contact of the limestone with overlying peridotite. A fourth type is that of *manto*-like replacements in limestone lying upon a foot wall of igneous rock which is cut by narrow veins with the same filling as the *manto*. The Guillermina mine belonging to this type supplies rich silver ores characterized by the presence of rhodonite and rhodochrosite. Still another type is illustrated by the Churruca mine, which seems to be an irregular replacement in limestone. The chief copper mineral is chalcopyrite.

Judging from the mines visited, chalcopyrite is more characteristic of the ores in limestone, occurring in but very small quantity in those in the igneous rock. The conditions of occurrence of enargite are almost the opposite, whereas tetrahedrite is found abundantly in both. Pyrite and quartz are the most abundant minerals and are always present, while rhodochrosite and rhodonite are local in their occurrence. Galena is not very abundant in the copper ores, but in some of the mines sphalerite occurs in large quantity.

CHARACTERISTICS OF THE MINES

In the preceding paragraphs the general characteristics of the ores and ore deposits have been summarized, and it is now proposed to describe briefly some of the more important mines in order to bring out more clearly those features. The situations of the mines are shown on the accompanying map. The mines of the Morococha Mining Co. will be described first.



MAP OF CENTRAL PART OF MOROCOCHA DISTRICT, SHOWING PRINCIPAL MINES

The San Francisco mine is the most important producer of the district. It is working a system of branching veins with an east-west strike and variable dips ranging from 60° N. to 70° S. Owing to the inadequacy of the pumping facilities to handle all the water, a number of the veins have been bulkheaded and work is confined to the two most important, known as Nos. 4 and 6. These are worked through a shaft in which level 1 is at the level of Morococha Lake and the lowest level, 5, at that of the drainage tunnel being driven to unwater the mine about 400 ft. lower.

The filling of vein 4 consists chiefly of pyrite with enargite and contains but little tetrahedrite and not much gangue. The walls are usually well defined with a distinct parting. Vein 6 differs from vein 4 in carrying less enargite and more tetrahedrite.

At the east end of vein 4 is a steep porphyry-peridotite contact at which it pinches to an unworkable stringer, which is said to be the usual experience at the contact of these rocks where it is steep. Another body of peridotite is encountered at the west end of the mine, where it overlies the porphyry with a gentle southwesterly dipping contact. The vein likewise terminates at this contact, but in doing so the orebody spreads out into a great horizontal *manto*. The termination of vein 6 at this contact is shown in the cross-section on p. 890. A little to the east of this point the porphyry is cut by a small peridotite dike, and while the vein is continuous across this dike and has its normal width and filling on each side, it consists only of a narrow, gouge-filled fissure in the peridotite. These phenomena indicate that the peridotite did not fracture nearly so readily as the porphyry and that ore-bearing solutions rising in fractures in the porphyry were dammed and spread out along flat contacts with overlying peridotite.

The Natividad mine adjoins the San Francisco on the north and works part of the same system of veins. It is owned jointly by the Morococha Mining Co. and the Backus & Johnston company. Operations have been nearly at a standstill waiting for the unwatering of the mine by the drainage tunnel that is being driven.

The ore of the Guillermina mine differs from the rest of the ores that are now being worked in that it is essentially silver. The highest-grade ores consist of tetrahedrite associated with rhodochrosite and rhodonite. Quartz is also a prominent gangue mineral. Galena, sphalerite, chalcopyrite and pyrite occur in subordinate amounts. Where sphalerite is prominent, the silver values are usually low.

The orebodies consist of a series of flat lenticular masses having a maximum width of 3 to 4 ft., formed by the replacement of limestone at its contact with an underlying porphyry. The contact has a general north-south strike and dip of about 10° to the west, and the igneous rock is probably a sill that has been injected into the limestone series. At the contact the foot-wall porphyry has been decomposed to a soft, gougey material. The effects of oxidation along the contact are evidenced in the ores to a depth of 300 ft.

At several places narrow veins were seen in the porphyry with the same minerals that the replacement ores show, and at one point such a vein spread out at the contact into a *manto* in the limestone, suggesting that veins of this sort were the channels by which the mineralizing solutions gained access to the limestone.

The orebody at the Gertrudis is a replacement vein in limestone with enlargements along certain bedding planes, similar to that of the Ombla mine, described in more detail farther on. The ore consists chiefly of pyrite and quartz, with chalcopyrite the principal copper mineral and tetrahedrite next in importance. A very little sphalerite is also present.

MINES OF THE BACKUS & JOHNSTON COMPANY

The mines which are next described are those worked by the Backus & Johnston company. The Isabel is furnishing the largest tonnage. The principal ore mineral is tetrahedrite, with chalcopyrite second in importance, and enargite present in but small quantity. Pyrite and quartz are the most abundant minerals. The orebody is a replacement vein in limestone with a strike of 20° W. and a dip of 55° SW. Overlying the limestone is a peridotite bed at which the vein terminates by spreading out into a broad *manto*, 20 ft. thick, the limits of which have not yet been determined, but which has been worked for a distance of 60 ft. along the strike of the vein and 100 ft. at right angles to it. The dip of the contact is 35°. To a depth of about 50 ft. below the *manto* at intervals of about 10 ft., there are enlargements of the vein on the hanging-wall side through the replacement parallel to the bedding of 1- to 3-ft. thicknesses of limestone for distances of as much as 30 ft. away from the vein. These relations, which afford excellent examples of the effects of the damming of the mineralizing solutions by the peridotite, are shown in the right-hand sketch on p. 890.

The Ombla mine is working a replacement vein in limestone with an east-west strike and nearly vertical dip, and cuts a series of limestones with a strike at right angles and a dip of 40° to the west. The vein has an average width of about 4 ft., but shows local enlargements resulting from a more extensive replacement of certain beds of the limestone in which the ore preserves distinctly the original bedding of the rock. These enlargements include thicknesses of strata of 10 to 12 ft., and usually extend about 15 ft. beyond the walls of the vein; sometimes they occur on one side only and at other times on both sides of the vein, and in extreme cases extend out as far as 50 ft. beyond the vein. The principal copper mineral is chalcopyrite, but some bornite is also present here. In addition, there occur pyrite, quartz, sphalerite and a little galena. Because of an increase in quantity of chalcopyrite and bornite the grade of the ore of this mine with an added depth of 120 ft. has exhibited a marked increase in copper content.

The Churruca is the only opencut mine in the district, and the orebody is a large, irregular replacement in limestone. The chief ore mineral is chalcopyrite with which is associated much pyrite. In the upper part of the orebody are small pockets of tetrahedrite and enargite.

The richest zinc ore of the district is produced by the Victoria mine, the ores of which contain as much as 25% zinc.

The Santa Clara group of mines includes the Manuelita, Maria and Minero, all of which are working veins in the porphyry that carry an appreciable zinc content. Tetrahedrite is the important ore mineral and there is very little enargite present.

The Independent Mines of the District

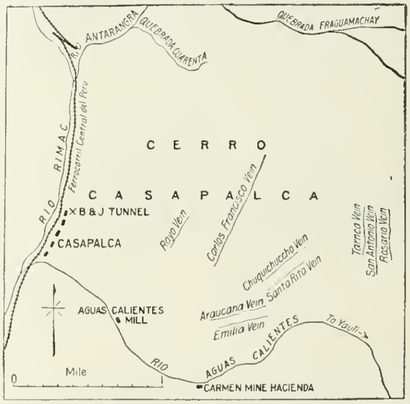
In addition to the mines already described, there are two important independent producers—La Huillca group and the Alexandria. The former works veins of the same character as those in the Santa Clara group, except that they carry a little more zinc. The latter, which is owned by Marcionelli & Hansa, is working the continuation of the vein on which the Gertrudis mine is located, and the ore is of the same character except that it carries much sphalerite and also a little rhodochrosite.

The Morococha district is undoubtedly in the early stages of a great development. Three crosscut tunnels are being driven to open up new ground and to do away with pumping in the mines. The Morococha Mining Co. is driving a tunnel from Tuctu under Lake Morococha at a depth of 395 ft. below its level to unwater the San Francisco and Natividad mines. This tunnel, which has a length of over 4,000 ft., has probably been finished by this time, as it was estimated last October that its completion would require but two months' work. Close to the portal of this tunnel and at the same level, the Backus & Johnston company is driving a tunnel that will have a length of over 4,500 ft. to develop the deeper ground of the Ombla, Gertrudis and Alexandria mines. The same company is running a third tunnel from Tuctu to unwater the Santa Clara group and La Huillca mines. The completion of these tunnels will make possible the production of a much larger tonnage in the district.

The hydro-electric plants of the Cerro de Pasco Mining Co. and the Backus & Johnston company furnish ample power and have enabled the installation of machine drills and other modern mining machinery. As a result working costs have been considerably reduced and large tonnages of ore made available that formerly were of too low grade to work.

The Casapalca District

At Casapalca, on the main line of the Ferrocarril Central del Perú, about 145 km. from Lima, is the Backus & Johnston company's smeltery and concentrating plant. Here are treated the ores from the near-by mines of the company, those from the company's Morococha mines and a certain amount of purchased ores. The following account of the district is based to a large extent on information obtained in the course of a conversation with Joseph A. Irving, superintendent of the Carlos Francisco mine.



MAP OF ACTIVE PART OF CASAPALCA DISTRICT, SHOWING PRINCIPAL MINES

The present mining activity centers on the Cerro Casapalca, a mountain rising above the town on the east from an elevation of 13,600 ft. at the smeltery to over 17,000 ft. at its summit. The most important producer is the Carlos Francisco mine. Other producing mines are the Aguas Calientes, Carmen and San Antonio, and the Chuquichuccho and Santa Rita are being developed and should soon reach the producing stage. The situations of these mines are given on the above map. The orebodies are for the most part veins in andesite, but some extend beyond the igneous rock into the limestone which it intrudes. The Carlos Francisco mine has a monthly crude-ore output of 6,000 tons, which it is planned to increase to 10,000 tons. The average grade of the crude ore is 25 to 30 oz. Ag, and 1¼ to 1½% Cu. This tonnage is obtained from the ore in place and by reworking the upper dumps of the mine. The crude ore is screened and the fines sent direct to the smeltery. The coarse product is then hand-jigged and the concentrates likewise smelted.

The tailings of the hand jigs are treated in the 120-ton mill and concentrated in the ratio of 3½ to 1. The total product that goes to the smelter aggregates 3,000 tons monthly and averages 40 oz. Ag, 2% Cu, 5% Pb, 13% Zn, 5 to 10% Fe and 20% SiO_2.

The principal vein of the mine is the Carlos Francisco, which is cut by a tunnel one mile long from Casapalca, at a distance of 2,700 ft. below the outcrop, which at the time the tunnel was driven was at a depth of 1,700 ft. below the lowest workings. About halfway in, this tunnel cuts a vein known as the Rayo, but no work is being done on it. An aërial tram 2 km. long connects the plant with the upper workings, 2,000 ft. above the tunnel level. The strike of the vein is nearly north-south and it dips to the west at an angle of 60°. Though it pinches to a width of 1 ft. or less and swells to as much as 12 ft., the average width of 2½ ft. is maintained. For a distance of about 2 km. along the strike the country rock is a silicified andesite, but at each end the vein passes out into limestone. The present operations are confined to the vein in the andesite.

The most abundant minerals in the vein filling are quartz and pyrite, with tetrahedrite the valuable constituent. There is little chalcopyrite present, and galena and sphalerite are not abundant. The ratio of silver to copper in the ore shows a gradual decrease with increasing depth, so that, whereas in the upper levels this ratio was 1 : 20, in the low levels it is only 1 : 30.

The fact that this vein has been developed over a horizontal distance of 2 km. and a vertical distance of 2,700 ft. without reaching its limits and that it is continuous throughout this extent with a fairly uniform width and character of filling marks it as truly a remarkable vein.

The Aguas Calientes mine is working the southern extension of the Carlos Francisco vein and sells to the Casapalca smeltery monthly 600 tons of sorted ore and mill concentrates made at its own mill, averaging 100 oz. Ag and 3½% Cu.

The monthly production of the Carmen mine is 600 tons of hand-sorted ore, of which one-fourth is first-grade, carrying 150 oz. Ag and 2% Cu, and three-fourths second-grade, carrying 50 oz. Ag and 1% Cu. It is working the Araucana and Emilia veins.

The only ore in the district with ruby silver and with sufficient gold to be paid for is that produced by the San Antonio mine. Its output is all hand-sorted and consists of about 10 tons of first-class ore with 200 oz. Ag, and 500 tons of second-class with 50 oz. Ag. and 1½% Cu.

Nevada Consolidated Copper Co.

Nevada Consolidated Copper Co., McGill, Nev., reports a total production of 24,585,393 lb. of copper for the third quarter of the year, this being divided into 8,537,231 lb. in July, 7,688,014 lb. in August and 8,360,148 lb. in September. During the quarter 1,020,546 dry tons of Nevada Consolidated ore, averaging 1.68% copper, was milled, and of the tonnage milled 84% was supplied from the pits and 16% from the underground workings of the Ruth mine. In addition, 16,775 dry tons of Giroux Consolidated Mines Co. ore was milled during the quarter.

The cost of copper produced, including Steptoe plant depreciation and all charges except ore extinguishment, and after crediting all miscellaneous earnings, was 8.67c. per lb., as compared with 8.51c. for the previous quarter. Excluding the item of depreciation the cost was 8.01c., as compared with 7.78c. for the previous quarter. The outcome is figured on copper price of 23.883c. per lb. for the quarter and 21.959c. for the first nine months of this year. No copper available for delivery remains unsold.

There was a surplus for the quarter of $1,901,740 after payment on Sept. 30 of the 27th dividend at 50c. per share and extra dividend No. 6 of 50c. per share. There was set aside $173,187 for plant and equipment depreciation and $103,205 for ore extinguishment, leaving a net balance to earned surplus for the quarter of $1,625,318 and a total balance of $11,091,015 in earned surplus.

Russian Mining Development During the War*

Charles Bogdanowich, Director of the Geological Committee of Russia, in passing through Paris, has made the following communication to the Geological Society of France on mining explorations conducted in Russia since the beginning of the war:

Before the war Russia was tributary to foreign markets, and thus we were suddenly deprived of several common minerals that had formerly come to us from Hamburg and Berlin, such as fluorite, barium ore, mica, infusorial earth, potassium salts, pyrite and ores of arsenic and antimony. Tungsten, molybdenum and vanadium, very important for the special steel industry, were likewise lacking. The ministry of defense, the industrial companies, engineers and manufacturers then requested the Geological Committee of Russia, which is a center for geological data of almost all Russia, to supply information on the deposits of these minerals at home.

WORK OF THE GEOLOGICAL COMMITTEE

The Geological Committee, thanks to the work of 30 years past, was able to furnish exact and detailed information on the locations of the beds and their quality, but unfortunately they were insufficiently posted as to the quantities, for the majority of the known deposits were not worked, owing to the general commercial conditions of the country. Nevertheless this informatory work has had great success; it has led to activity both private and governmental.

At the instance of the government, the Geological Committee organized, in 1915, prospecting work followed by development of fluorite, iron pyrites, saltpeter, alunite, etc. The investigations of fluorite have been crowned with great success. The question of coal was studied near Petrograd, by request of the municipality, and the Geological Committee obtained substantial industrial results.

These works were approved by the government and the Duma. In 1916 the accrued budget of the committee was sufficient to enable its corps of geologists and engineers—more than 70 persons—to be sent into the Ural, the Caucasus and Siberia, and engage in greatly varied reconnaissances.

Numerous questions present themselves to the Russian geologists: What deposits are suited for immediate working? Which may increase their output? Which are of especial industrial interest? The question of rare metals interests us particularly. We have lately organized research and development of tungsten in the Ural, near Ekaterinburg, and at some points in the Transbaikal.

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*Translated from the "Echo des Mines et de la Métallurgie," Paris.

I would point out that in the second year of the war, at the time of industrial mobilization, when in all the Russian provinces industrial military committees were organized with the support of the government, by the efforts of representatives and delegates of industry, trade and engineering, the Geological Committee formed a part of the Central Industrial Military Committee directed by M. Poutchkoff.

The Geological Committee thus became the source of all the information on the true conditions of the various deposits, the exploitation of which had occasioned many companies to be formed. Since it often occurs in such cases that mineral values are exaggerated, an examination by the Bureau of the Central Industrial Military Committee was necessary to regulate, coördinate and direct efforts toward the same object, with minimum expense for the people and the state.

I can assure you very frankly that the geologists of our committee have taken their share of responsibility in the common work, which they execute with all the qualities demanded by science, and love of country.

Thanks to the very recent working of deposits in some cases new, I may assure my friends in France that the Russian industry can now be supplied from its own resources in the most important metals, such a copper, lead, zinc and manganese. I hope this year we shall increase our production of gold and that we shall develop the exploitation of ores of some rare metals, such as molybdenum, tungsten and arsenic. The information that the Geological Committee has gathered recently throughout Russia authorizes me to affirm that the mining prosperity of that country is assured for the future.

In spite of all this urgent work, the committee has continued its scientific studies and its systematic explorations in the oil fields of the Caucasus and Uralsk, in the Donetz coal basin and the platinum-bearing lands of the Urals without longer neglecting the gold fields of Siberia. We are fixing our attention upon the possibility of increasing the output of the gold lode deposits and that of the alluvial fields, the latter by dredging.

During the war the committee has completed the new edition of the geological map of European Russia in six sheets and finished the mineral map on the same scale, which is indispensable to the former in order to show the distribution of mineral deposits in the natural metallogenic districts. This map is about to be printed and will be completed with an explanatory text on the mineral and metalliferous deposits of all Russia.

The Russian government, represented by the Minister of Commerce and Industry, gives us powerful support and is thinking of extending the geological service considerably.

Mineral Production of British Guiana

Gold production of British Guiana, as reported by the Lands and Mines Department, for the nine months from April to December, 1915, amounted to 39,793 oz., a decrease of 12,397½ oz. from the corresponding nine months of the previous year. Of the total, 29,695 oz. came from placer washings, 9,990 oz. from dredging and the remainder from quartz mines.

Dredging was carried on in the No. 2 mining district by the Guiana Dredging Co. with four dredges in the Konawaruk River, and by the Minnehaha Development Co. with one dredge in the Minnehaha and one dredge in the Mahdia Creek.

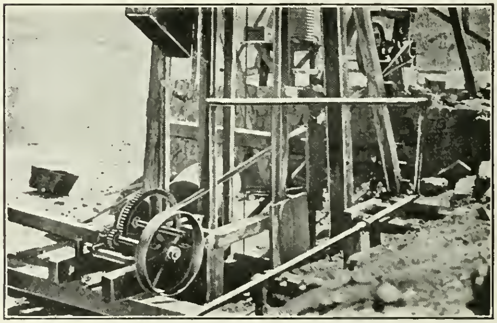
The output of diamonds during the same period was 19,461 stones, weighing 3,678¼ carats. The estimated value of these stones was $36,782.50.

Temporary Mine Pumping Plant

Santiago Correspondence

In the mining districts of Chile it is often necessary to dewater a mine in order to be in a position to drop the option. Usually this mine has only surface water in it, so that a permanent plant is not needed. No one knows of a gasoline sinker, and a steam plant means much expense and a search for fuel, because wood for fuel in the mining districts is the exception rather than the rule.

With a vertical shaft or even with a slightly inclined shaft, the ordinary deep-well pumping head has served excellently. The size of the pump and of the kerosene engine should be proportioned to the cubic contents of the flooded workings, but my suggestion is that a very small plant be laid down, the time lost in pumping being devoted to some other agreeable pursuit.



A TEMPORARY MINE-PUMP INSTALLATION IN CHILE

Usually these old mines have the shaft in anything but good condition. This means that dewatering can go on at the same time that the shaft is being lagged with cactus and pear trees. Then if the removal of the water superinduces a cave, nothing but the end of the pipe is bent, thus saving the feelings of the pumpmen. If ingenuity equal to the correspondent's is available, it will be possible to hug the foot wall with the pipe and hoist dirt and old timbers and work on the shaft, while pumping.

In the illustration the pump replaces a horse whim and skip in an inclined shaft. The horse had been used since the mine was opened—the same horse. The bucket leaked seriously. Probably at the beginning the horse walked rapidly and the bucket did not leak. At the time I saw the equipment, the leakage overtook the horse and the bucket arrived—wet it is true, but in a condition to discourage continuous operation.

The Bisulphite Process

By An Occasional Contributor

SYNOPSIS—Process is about ten years old and is but one of many methods proposed for extracting zinc by means of sulphurous acid. In theory, zinc in ore is roasted to oxide without formation of sulphate; oxide converted to soluble bisulphite and separated from insoluble ore; soluble bisulphite converted to insoluble monosulphite by heating to boiling point, and finally converted to zinc oxide by heating in cast-iron retorts. Because of various difficulties encountered in practice, handling about three tons of ore daily, commercial success was impossible. In general, oxidation to zinc sulphate, or the direct use of sulphuric acid, is preferred.

Methods that have been proposed for the extraction of zinc from its ores and compounds, by means of sulphurous acid, are numerous. A search at the Patent Office will reveal a large number of applications dating back half a century. Many of these patent specifications merely reveal chemical absurdities; others involve mechanical conditions that are impossible on any commercial work. In general, most of the specifications indicate that the experiments, if any, which were made before the patent was applied for were purely qualitative and only on a test-tube scale.

The so-called bisulphite process is the only one dealt with in this article, and it will be considered from a metallurgical and mechanical point of view only. This process had its genesis about 10 years ago. Its object was to extract zinc (and recover it in the form of oxide suitable for the spelterman) from any complex ores or products; that is, from those raw materials that could not be handled directly by the spelterman or could not be concentrated and thereby produce a concentrate suitable for the spelterman.

Naturally, during the years that have elapsed since the process started, other improvements have taken place and the need for a bisulphite or similar process is not as great as it was. For instance, the spelterman, by mining his raw materials, will now handle products containing lead or lime (or both) that he would not have touched a few years ago. The machine-made pots used in spelter works also help considerably in handling complex charges. Advances in ore dressing now make it possible to dress up complex materials and make a good product for the spelter works. Also the residues from the spelter pots (retorts) are now commonly dressed for recovery of lead and silver. All this has made possible and acceptable to the spelterman most of the complex ores and products which a few years ago would have been refused. Hence the necessity for a process for complex zinc-lead-silver or other complex zinc ore has very largely ceased to exist.

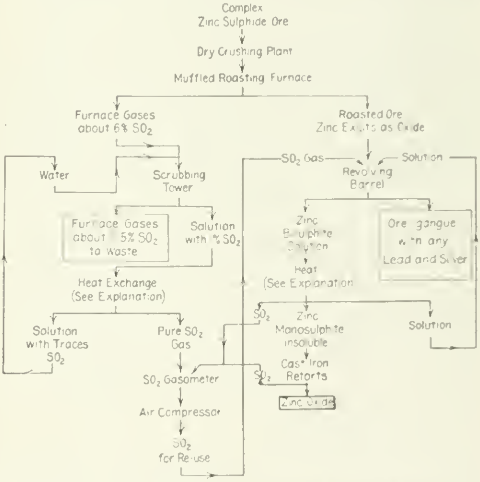
Original Form of the Process

It must be borne in mind that, however broad and foolproof any process may be, variations are demanded by different ores and for different fields of operation. The procedure as first tried about ten years ago is shown in flow sheet No. 1. This provides for roasting the ore in a muffle furnace at a finishing temperature of about 950° C. so that no zinc remains as sulphate; therefore the majority of zinc is oxide. By using a muffled furnace the gases from the ore are rich in SO_2 (sulphurous acid), say 5 to 7%. Hence, by the aid of a scrubbing tower a weak solution of SO_2 is obtained at a nominal cost; but after once starting up, since theoretically all the SO_2 used is returned to the circuit, only enough SO_2 has to be absorbed daily in the scrubbing tower to make up for losses.

Heat required for boiling the SO_2 out of the solution from the scrubbing tower or for heating the bisulphite solution (and thereby causing half the SO_2 present to be evolved as gas) was obtained by heat-exchange arrangements, by cooling the gases from the muffle furnace; that is, both the SO_2 gases and the fuel gases.

The gaseous SO_2 acting on the roasted ore in the presence of water renders all zinc, which exists as oxide, soluble in the course of two or three minutes.

As a solvent for zinc oxide, SO_2 is so desirable because it is possible to form zinc-bisulphide solutions containing about 8% zinc, and these solutions on being raised to the boiling point under favorable conditions for the evolution of SO_2 give off half of the SO_2 as pure gas and deposit as insoluble zinc monosulphite about 90% of their zinc contents. This insoluble zinc monosulphite is heated in cast-iron retorts, yielding zinc oxide and SO_2 gas that, like the SO_2 from heating the bisulphite solution, is used again on a new lot of roasted ore. The zinc oxide is heavy, free from traces of lead or silver and makes first-grade spelter. The ore residue, after the extraction of all the SO_2-soluble zinc, contains all the lead and silver—in fact, everything except zinc—and in a concentrated form due to removal of zinc and consequent loss of weight.



FLOW SHEET NO. 1, SHOWING ORIGINAL BISULPHITE PROCESS

Obviously, to suit this procedure the ore must have high sulphur contents to aid the muffle roasting and must not be too high in lead or the high temperature of the finishing roast will cause sintering. Ores with much lime or magnesia are not desirable, as these materials consume SO_2. The lime and magnesia will eventually appear with the final zinc oxide, as sulphate of lime is very soluble in SO_2 solution.

The defects in the procedure outlined in flow sheet No. 1 were so numerous that the process had to be abandoned. The high temperature of the finishing roast in the muffle-roasting furnace causes zinc to combine with iron oxide and thereby produce zinc compounds which do not yield their zinc to the acid solvent. This is a vital defect and has caused a large amount of work. It is true, there are complex zinc ores so low in iron or manganese that a high-temperature roast does not cause decrease in zinc solubility, but such ores are the exception. Muffle roasting of zinc ores is not too simple or low in working cost, especially when the sulphur contents fall low.

The originators of the procedure thought that, having endeavored to guard against the formation of sulphate of zinc both in the ore and in the solutions, practically all the zinc would be in the form of bisulphite and would be recovered as zinc monosulphite by heating the bisulphite solution. This is not so. There will be some zinc sulphate in the ore when the roast is finished, and the solutions in being handled by pumps will gradually oxidize to sulphate. No satisfactory plan was provided for dealing with this ever-growing quantity of sulphate of zinc in solution.

No air compressor was found of any use for any length of time for pumping the SO_2 gas into the revolving barrel. Various types of compressors were used, including those of the diaphragm type, but in the long run they all failed. The maintenance cost was much too great, and this alone was enough to shut down the work. All pipes conveying zinc-bisulphite solution gradually blocked up through the zinc monosulphite crystallizing out.

In general the smell of the SO_2 was so great that, after using all possible precautions, even if all other conditions had been correct, the original procedure could not have continued. Solutions had to be handled in large quantities by pumps, and these solutions contained over 10% of loosely combined SO_2. As a matter of fact, if a solution contains about 1% of loosely combined SO_2 (that is, attached to zinc as bisulphite), it is impossible to stand near a small tank into which only a 1-in. stream of such 1% solution is running.

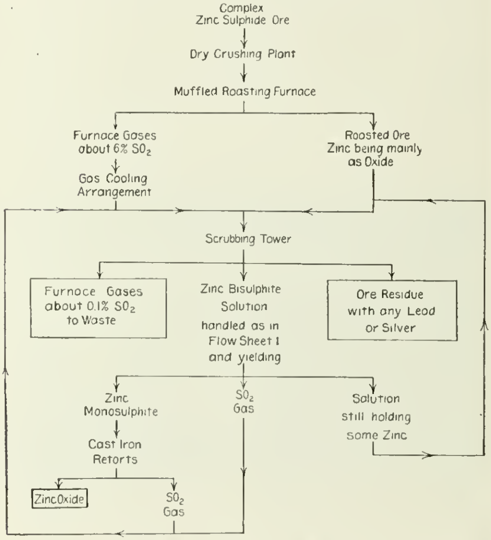
All construction and maintenance costs were high because all pipes were lead, all valves were either antimonial lead or some special brass, all tanks were lead-lined, and because all iron work had to be protected continually, the atmosphere being moist and always with traces and sometimes with large amounts of SO_2 in it.

The net result of the work, as here roughly outlined, was that no further attempt was made to use SO_2 as gas. This work had been carried out on a scale of up to about three tons per day, and the decision to abandon the use of SO_2 as gas was not arrived at till most exhaustive work had been carried out and till it was evident that commercial success was impossible, one of the principal (of the many) difficulties being that almost every tank or vessel had to be covered air-tight, therefore no operation could be easily watched or controlled.

Modification of the Process

The next procedure used is shown in flow sheet No. 2. At first sight it had many advantages, and although some objections were obvious, no vital objections appeared till the procedure was put into operation. The partly-cooled sulphur gases from the roasting furnace were passed up a scrubbing tower, down which there was fed roasted ore with water or solution from which the bulk of the zinc had been removed.

When water alone is run down a scrubbing tower, only a 1% (or less) solution of SO_2 can be obtained; but when the water also conveys zinc oxide (that is, roasted ore) which combines *chemically* with the SO_2 then a greater percentage of SO_2 can be caught, equal approximately to the percentage in the original furnace gases, in this case usually from 5 to 6%; therefore in the case of ore and water (or solution) together running down the scrubbing tower, the final solution will contain at least six times as much SO_2 as is the case when water alone is used to absorb the SO_2. It was realized that probably in spite of the efficiency of the contact arrangements in the scrubbing tower, the descending stream of ore and solution which flowed counter to the rising gas might at times leave the scrubbing tower with still an important percentage of zinc undissolved; that is, which had not yet met SO_2. It was therefore arranged to run two scrubbing towers in series, and the stream of ore and solution leaving the last scrubbing tower was to be elevated to the top of the *first* scrubbing tower (the one *nearer* the furnace); and thus the ore with most zinc in it would meet the weaker SO_2 gases, and after most of the zinc had been dissolved, the ore and solution would be elevated to meet the strong SO_2 gases (which had just left the furnace) during their passage up the first scrubbing tower.


Complex Zinc Sulphide Ore
Dry Crushing Plant
Muffled Roasting Furnace
Furnace Gases about 6% SO2
Roasted Ore Zinc being mainly as Oxide
Gas Cooling Arrangement
Scrubbing Tower
Furnace Gases about 0.1% SO2 to Waste
Zinc Bisulphite Solution handled as in Flow Sheet 1 and yielding
Ore Residue with any Lead or Silver
Zinc Monosulphite
SO2 Gas
Solution still holding some Zinc
Cast Iron Retorts
Zinc Oxide
SO2 Gas

FLOW SHEET NO. 2, SHOWING MODIFICATION OF BISULPHITE PROCESS

The ore and solution, after finally leaving the scrubbing towers, was collected in tanks, washed, and the solutions separated much the same as in cyanide work. At first the method of precipitation consisted in heating bisulphite solutions to near the boiling point so that half the SO_2 was liberated and about half the zinc, on cooling, was precipitated as an insoluble monosulphite of zinc ($ZnSO_3 \cdot xH_2O$). Heating to about 600° C. converted the latter compound to zinc oxide. The heating of this solution was carried out by waste heat, by steam through coils, by injecting live steam into the solution or by running the solution cascade-fashion down a short tower up which the combustion gases from a coke fire were drawn, necessary structural arrangements being made to discharge the boiling solution at the bottom, clear of the firebox.

All precipitation by means of heat was found to be greatly improved if a small calculated quantity of zinc oxide or calamine was added when most of the bisulphite had been decomposed. Finally, after a large amount of experimental work, it was found that the only positive method of precipitation suitable for the case in question was to work the solutions up in zinc contents till they contain 10% or more of zinc as metal and then evaporate them to dryness; that is, until on cooling the whole mass consisted of $ZnSO_47H_2O$ (ordinary sulphate of zinc) crystals.

As regards the dissolving of the zinc from the ore as outlined in flow sheet No. 2. It will be seen that there flows down a scrubbing tower a mixture of ore and solution and that this mixture flows counter to a rising current of gas. The ore and solution is fed in at the top at a fixed but variable rate by mechanical means. If *too little* ore is fed into the top of the scrubbing tower, then this ore on issuing at the bottom will have all its zinc converted into bisulphite, a considerable quantity of SO_2 will escape to waste at the top of the tower and there will soon be a shortage of SO_2. Conversely, if enough ore is fed to scrubbing tower so that practically no SO_2 goes to waste, then the ore coming out at the bottom of the tower will still contain much undissolved zinc. Because both the rate of flow of the SO_2 gas from the furnaces per unit of time and the percentage of SO_2 are continually changing, it is not possible to feed in ore at a rate so that not only is practically all the zinc converted into bisulphite, but also no SO_2 goes to waste (that is, is not neutralized by zinc oxide). For this reason the method in flow sheet No. 2 could not succeed commercially.

GENERAL DIFFICULTIES OF THE PROCESS

The general difficulties that seem to be connected with any commercial method for extracting zinc by means of sulphurous acid are briefly covered by the following statements.

The main reactions of the process are:

$ZnO + SO_2 + xH_2O = ZnSO_3xH_2O$ (zinc monosulphite)

$ZnSO_3xH_2O + SO_2 + H_2O = Zn(HSO_3)_2 + xH_2O$

When boiled, in solution, $Zn(HSO_3)_2$ yields $ZnSO_3 + SO_2 + H_2O$. At about 600° C. $ZnSO_3$ yields $ZnO + SO_2$. When formed by action of SO_2 on ZnO in presence of just about enough water required for the water of crystallization (which is really about $5H_2O$), $ZnSO_3xH_2O$ swells to about three times the volume occupied by the original ZnO. *Thus, in any case where $ZnSO_3$ is formed in the roasted ore, if there is not enough water present to dissolve it all, there is a great increase in volume.*

The solubility of $ZnSO_3$ in cold water, normally about 0.5%, is decreased by the presence of zinc oxide. In the presence of water $ZnSO_3$ is easily converted by SO_2 into zinc bisulphite, a compound which only exists in solution, but which is very soluble in water. A solution containing about 10% of zinc as bisulphite can be easily prepared. Zinc-bisulphite solutions gradually deposit $ZnSO_3$ by evolution of SO_2.

Zinc monosulphite ($ZnSO_3xH_2O$) is a crystalline compound and sets to a hard compact mass which cannot easily be broken up even with a pick ax or drill. Similarly any roasted ore containing zinc, if treated with enough SO_2 to form $ZnSO_3$ and allowed to settle for a short time, will set to a hard compact mass which is as hard as "set plaster of paris." The facility with which this $ZnSO_3$ sets hard is a point of great difficulty in commercial work.

Both in solution and in the solid state $ZnSO_3$ oxidizes rapidly to zinc sulphate. The same remark applies to the bisulphite solution; but in either case it is difficult, by atmospheric oxidation only, to convert *all* the zinc into sulphate.

The sulphur gases from the roasting furnaces leave the furnace at a temperature of from anything down to, say, 250° C. These gases cannot be brought into contact with ore and water in order to form zinc bisulphite, unless their temperature has been lowered sufficiently so that the mixture of ore and water will not be raised much above atmospheric temperature. If a mixture of ore and water be heated appreciably by the gases, then zinc bisulphite will be decomposed or not formed at all, and instead of the zinc oxide being made into the soluble bisulphite, it will remain with the ore as the almost insoluble monosulphite. This is important and brings up the question of cooling the sulphur gases.

The roasting of a complex ore is not by any means too simple an operation. In addition to zinc, lead and silver, such an ore may contain also iron, silica, copper, arsenic, antimony, etc. In general if an ore is roasted at such a temperature that practically none of the zinc remains as sulphate, then it will be found that a large percentage of the zinc present is *not* soluble in SO_2. Conversely, if roasted at a temperature very gradually rising up to but not above 650° C., then 90 to 95% of the zinc contents will be soluble in SO_2. (It is in general assumed that such ores contain about 25 to 30% of zinc.) In the foregoing case of low-temperature roasting, from 30 to nearly 50% of the zinc will be as sulphate after the roast and would therefore be soluble without any SO_2. With this low-temperature roasting, some iron will probably be water-soluble or SO_2-soluble.

In furnaces, zinc sulphate in ores is broken up into ZnO, etc., at a much lower temperature than is stated in textbooks. The conversion of $ZnSO\ xH_2O$ to ZnO can be accomplished by roasting in a reverberatory furnace better than in a muffle furnace. It might be expected that almost all would be converted into sulphate, but such is not the case. The higher the temperature to which any ore is heated during the roasting, the less readily is the ZnO dissolved by SO_2.

Complex ores containing, say, 25% zinc and as little as 8% lead, if roasted at a finishing temperature of about 850° C., will be found to have some of the ZnO mechanically protected by a glaze, presumably of lead sulphate or silicate. This mechanical occlusion of the ZnO increases with the percentage of lead present and with the temperature of the roast.

Many different makes of pumps could be used for elevating zinc-bisulphite solution, but none was found to be commercially successful in elevating ore and solution. This was one reason why ore and solution leaving one scrubbing tower could not be elevated so as to pass down another one. In this connection air-lifts failed principally on account of the setting properties of zinc [illegible].

With reference to a complex zinc-lead-silver ore containing, for example, zinc 30%, lead 10% and silver 10 oz. per ton, if, say, 84% of the zinc is extracted, then 5 units remain in the residue. But one ton of ore, after roasting and extraction of the zinc, will have lost about half its weight and 5 units of zinc will be in half a ton. The residue will assay zinc 10%, lead 20%, silver 20 oz. per ton; therefore whatever zinc is not extracted will figure more prominently as a penalty in the residue.

Sulphuric acid causes silica to pass into solution, but SO_2 does not have this effect. When silica does pass into solution, it may appear later as gelatinous silica, if for any reason the solution becomes neutral.

Traces of copper, arsenic, etc., should be removed from all bisulphite solutions before they are heated to precipitate the zinc monosulphite. The quantity of copper present may be of value, but the arsenic, antimony, etc., should be kept away from the final zinc oxide. Zinc dust is the best agent to use for this purpose.

SOME GENERAL CONCLUSIONS

Sulphurous acid can be of no utility as a solvent for zinc oxide from ores except in those localities where it is cheaper to use it on the lines indicated than to buy sulphuric acid. It is a question of geography and freights—this is important; it does not necessarily mean that, even if the ore in question is mined in quantity, it may not pay better to bring it to where acid can be bought.

If sulphurous acid (SO_2) is used as resulting from the roasting of complex zinc ores, it may be possible to attain commercial success by roasting the ore so as to produce the maximum amount of water-soluble zinc sulphate and at the same time a good percentage of the remaining zinc as soluble in SO_2 (or H_2SO_4). The portion of the zinc that is dissolved by SO_2 will yield a bisulphite solution. This solution by aëration should be oxidized to sulphate; thus all the zinc in solution will be sulphate. The neutral solutions after purification by zinc dust can be worked up in zinc contents so that a certain daily portion of the solution assaying about 10% zinc will be evaporated till the density shows that there is practically nothing but sulphate of zinc melted in its own water of crystallization. The cooled mass will solidify, and it can be roasted in a reverberatory furnace to produce zinc oxide.

If a wet method is required for any zinc ore, from a metallurgical point of view sulphuric acid will do as well as SO_2.

The question of the electrolytic precipitation of zinc from the sulphate solutions as an alternative to evaporation has been omitted purposely in this article.

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False Returns On Ores that are sent in for smelting and treatment, is a fear that seems prevalent among men operating small properties in Arizona. The Arizona State Bureau of Mines has conducted an investigation and has found that it would be utterly impracticable for any smelter or mill to so falsify its method of sampling as to give low returns and still give the shipper one half of the sample to allow check assays to be made. Bulletin No. 26 of the bureau (entitled "Mill and Smelter Sampling," by H. J. Stander) was written to show the small shipper how to sample his ores before shipment, thereby having a check on the smelters. Smelter methods are given in detail, so that the reader may determine whether, owing to the number of men who would be concerned in any falsifying system, the smelters could afford to give incorrect returns. When the Copper Queen mine, for instance ships to the Copper Queen smelter, the smelter purchases the ore precisely the same as they do the ore of the man who ships ten tons, and the sampling and umpires are done under the same conditions.

Miners' Phthisis Prevention

By A. Cooper Key*

From time to time the miners' phthisis prevention committee, formed to report upon the methods for prevention of miners' phthisis in Rand mines, has issued interim reports, and it has now published a complete statement dealing with work accomplished in the four years since its creation. Dust sampling was begun in March, 1912, and over 2,800 samples were taken to the end of that year. The work of the committee has been largely centered on carrying out numerous experiments to determine the quantity and nature of dust, the best methods of preventing its formation and laying it when it cannot be prevented and of safeguarding miners against its inhalation. Attention has been paid to medical-research work. Many inventions, patents and suggestions from various sources have been examined and tested.

Experiments, analyses and other investigations have necessarily occupied a great deal of time, and although much valuable knowledge has been gained, much still remains to be done, and the investigations of the committee are still proceeding.

NATURE AND RELATIONS OF THE DISEASE

The second chapter deals with the nature and general relations of the disease. It begins as a silicosis, which is not intrinsically an infective process. It is a condition of fibroid change in the lung, caused by mechanical irritation of the tissues, arising from the presence in the substance of the lung of very fine siliceous particles derived from dust-laden atmosphere which the miner breathes. The lung is rendered more liable to intercurrent invasions by infective processes, especially tuberculosis, which usually increases in proportion to the degree of silicosis. The majority of early cases have not this complication, and in many cases, if the affected man leave underground work, he may remain free of tuberculosis practically indefinitely. On the other hand, if underground work be continued, tuberculosis will in most cases sooner or later supervene. Although the term "silicosis" accurately defines the constant and occupational factor in the disease, the more general term, "miners' phthisis," describes better the composite character ultimately assumed. In the report an explanation is given of the general rôle which these two factors, silicosis and miners' phthisis, played in the development of the disease.

NATURE'S PROTECTIVE MECHANISM

It is also explained that the air passages, the wind pipe, bronchi and bronchial tubes, with their cilia, provide a protective mechanism against the entry of foreign particles. Much of the dust that is inhaled is entangled on the moist surfaces of the nose and throat, and if not present in an overwhelming amount, the portion of it which reaches the bronchial tubes is gradually worked upward and expelled. With dust in large quantities, the protective mechanism breaks down, many especially of the finer particles pass the protective barriers and gain access to the air vesicles. It is most important for those employed underground to keep the protective mechanism in a state of efficiency. Exercise in the open air after working hours is to be strongly recommended. Simple breathing exercises will also help greatly to maintain the normal power of chest expansion, stimulate circulation in the lungs and promote the healthy activity of the whole breathing mechanism. Dust will be got rid of that otherwise would have remained behind to do further damage. A regular annual holiday away from the influences of underground work is a very important preventive measure.

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*Box 3621, Johannesburg, South Africa.

Although detailed knowledge of the disease has been considerably extended in the past few years, the committee expresses the opinion that all recent pathological work has gone to confirm the general accuracy of the view of the origin and nature of miners' phthisis on which the work of the committee is based. Further observation is, however, necessary before the pathology of the disease can be elucidated, and in addition, experimental investigation is required. An investigation into rat silicosis is now proceeding and promises to give useful results, the rat having a high natural immunity to tuberculosis. Some amount of throwing off siliceous and pigmented particles from a silicotic lung takes place, but this clearing is not in itself capable of bringing about a restoration of those portions of the lung already seriously damaged, although the injury may to some extent be compensated for. In the committee's opinion it is never safe for a man who has once contracted a definite silicosis to resume underground work even though his health in a surface occupation may have become quite good, and his working capacity be little, if at all, impaired.

Pure tuberculosis of the lungs unaccompanied by silicosis occurred to a certain extent among underground workers, particularly in the earlier years of their mining life. Such sufferers may obviously become quite incapacitated, but they are not legally entitled to compensation under the act. This fact has, in individual cases, given rise to some amount of apparent hardship, the reason for which is not, the committee believes, generally understood among miners.

BROAD POLICY OF PREVENTION

Radiographic appearances in miners' phthisis afford the most reliable single evidence in establishing the existence and stage of the disease. But a complete opinion must be based both on X-ray appearances and clinical examination. The broad policy of prevention must (a) prevent the formation and dissemination of dust and, where this is impossible, protect men from inhaling dust and explosives fumes; (b) protect workmen against risk of infection by tuberculosis. A further important preventive measure is the adoption of a strict system of selection of recruits for underground employment. Men should have good physique and reserve of respiratory capacity. The economic wisdom of accepting men over 45 years of age for initial underground work is doubtful. All persons with tubercular taint, even if latent, should be rigorously excluded.

PREVENTING DUST AND LAYING IT

In the chapter describing methods of laying dust and preventing its formation or inhalation, it is stated that when it is considered that the most dangerous particles have a diameter of $^1/_{25000}$ in. and that to catch all the dust in sampling so dense a medium as sugar has to be used, it is clear that no respirator can be devised which will prevent passage of all dust and at the same time allow of breathing. The question of electrical blasting was closely investigated at the Meyer & Charlton; while this method has undoubted advantages, its general application at present is not practicable. Its field of usefulness appears to be limited to circumstances where it is impossible to remove men from the fumes and dust of blasting by the ordinary method of fuse firing. After thorough investigation of all possible ways and means, the conclusion is arrived at that abundance of clean water, judiciously used, is generally the most satisfactory medium at present known for dealing with dust. Special liquids, while showing no definite superiority over plain water in extracting dust, retained the dust after deposition better than water does.

The report deals at length with the most suitable methods of laying the dust produced. The latest types of water-blasts, jets, sprays and atomizers are described and illustrated. They are the result of much experiment on the part of the mines and the committee and may be looked upon as the most tangible and practical fruits of their labors. It is only possible here to give an outline. The water blast should be brought into action by the miner in charge immediately after lighting up and should be placed at a sufficient distance from the face to obviate injury from the explosion, while being at the same time near enough to lay dust and fumes at the point of origin. In the few cases where "cut and round" blasting on one shift is permitted, the use of two water blasts is advisable. In blasting in large open workings such as stopes, the use of water blasts is impracticable and ineffective. The reduction in quantity of dust obtained by the use of experimental devices was never such that the air could be considered sufficiently purified. The only way of coping with this difficulty is to sweep out such air as rapidly as possible by means of the ventilating current. Blasting, either in the solid, in large loose rocks or in order to release box holes or ore passes, should only in cases of absolute necessity be allowed during the shift, in view of the huge quantities of dust and deleterious gases released by blasting. All persons not directly employed in blasting should, as far as possible, leave the mine before blasting begins. This removal is facilitated by the practice on several mines of sending down men not actually employed in breaking ground earlier in the shift and hauling them to the surface before the beginning of blasting. Proper control and regulation of blasting conditions and hours is of most vital importance.

PRECAUTIONS IN MACHINE AND HAND DRILLING

In machine drilling wet drilling is now obligatory and may be considered the normal condition. In collaring, large quantities of water are necessary. When drilling with machines other than water-feed, the jet should be unscrewed from the hose and the collar deluged until the hole is well started, when the machine should be stopped, the jet screwed to the hose and inserted in the hole and kept there. Spraying water around and across the mouth of a hole is unsatisfactory. Detailed results are shown as regards different drills. In hand drilling care should be taken that the surrounding surfaces of rock are kept well wetted during collaring. Water should be poured in from time to time as soon as the hole is of sufficient depth to retain it; a wet swab should be used throughout. No rock should be moved or handled in any part of a mine until it has been thoroughly wetted by means of a hose attached to the supply pipe. Suitable devices should be installed throughout main airways and traveling roads, in conjunction with the general wetting of surfaces in stopes and development ends and of the broken rock

Experiments in laying dust by electrical means were tried in the lines of arrangements in the United States cement factories, but there does not appear to be any means of practically applying the method in mines in which conditions are so greatly different. Surfaces wet with Belger fluid retain their wetness for a long period, the dust accumulating on it, but always presenting a damp surface. Its use, however, is limited to airways where the air is below the point of saturation, since wet air causes the deposit to liquefy and run. In tunnels, stopes, etc., where continual watering or spraying is necessary, the Belger fluid would, with occasional reapplication, serve a useful purpose.

The report goes on to treat of dust in crusher stations, the air in which can easily be dealt with if reasonable precautions are taken. Good results depend entirely upon the adequacy of spraying arrangements and the system of exhaust ventilation. While silicosis is negligible among assayers, it undoubtedly exists among crusher-station men. A further lengthy chapter discusses ventilation. It would be an advantage to cut out old stopes from air circulation, where possible, so as to increase the amount of fresh air in places where it is wanted, and it would also be an advantage to have a special official to look after the ventilation and water service, instead of distributing the duty among a number of persons. Special attention must be paid to ventilation of close places.

How Far Have the Measures Been Effective?

The question as to how far the measures already taken to reduce the amount of dust present in the air of mines had had beneficial results could not be fully answered by reference to statistics. The disease was so insiduous and in the earlier stages the diagnosis was so difficult and uncertain that it must be some years before actual facts based on figures could be arrived at.

While it was impossible to base a statement regarding the amount of dust in the air of mines on individual samples, it could be confidently stated that the information derived from the investigation so far carried out pointed to the conclusion that conditions underground had greatly improved since the inception of the committee in 1912, when the general use of water for dust laying was inaugurated. The adoption of proper and readily applied methods of dust laying and of precautions in avoiding the inhalation of air charged with dust after blasting had led and would continue to lead in the incidence of miners' phthisis. Other factors which should conduce materially toward the same end were the extension of the practice of working only one shift per day underground and the provision of an annual holiday to miners.

The committee finds it necessary to utter a grave note of warning. Sustained efforts on the part of all concerned are imperatively necessary. While the mines generally are equipped with water and necessary appliances, there are still too many cases of carelessness and lack of proper precautions in using these appliances. This is particularly the case with natives who are ten times as numerous as the white workers, and who, owing to the discomfort caused by the use of water and the slight additional effort required, were inclined to neglect precautions when not watched. The legal and moral responsibility is a joint one falling equally on employers and workmen. The management of the mine is responsible for the provision, maintenance and continued supervision of an adequate water supply and of efficient appliances. On the workman falls the responsibility of putting these appliances in use in all cases where their employment is called for.

To the report are annexed 150 pages of appendixes, including many microphotographs, drawings, diagrams and other illustrations.

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Zinc Mines of Tonkin

Zinc is the leading metal produced in French Indo-China. During the past five years the exportation of zinc ore from Haiphong has averaged nearly 27,000 tons per year, according to a communication from Consul L. P. Briggs, Saigon, French Indo-China, in a recent issue of the *Commerce Reports* of the Department of Commerce.

Although some zinc has been mined in Annam and this mineral undoubtedly exists in the interior protectorate of Laos, practically all that is now produced in French Indo-China comes from the protectorate of Tonkin and is exported from the port of Haiphong. The zinc mines exploited at present occupy a strip about 50 mi. wide and 100 mi. long just above the delta district, a little north and a little east of the center of the protectorate. There are four well-defined zinc regions.

The Four Zinc Regions

The oldest zinc region of Tonkin is the Tuyen-Quang district near the town of the same name at the junction of the Clear and Gam Rivers. The ore from this group is carried in river steamers down the Clear and Red (Rouge) Rivers and through the canals to Haiphong.

Next in age and in recent years the most productive district is the Thai-Nguyen region above the town of this name on the Song Cau about 50 mi. east of Tuyen-Quang. This is the most extensive district, and it is situated near the center of the Tonkin zinc fields as they are at present exploited. The ore from these mines is floated in sampans down to Dap Cau, nearly 100 mi., then transferred to river steamers.

On the extreme east is the Than-Moi, or Langson, region on the upper waters of the Song Thuong and along the railway between Phu-lang-thuong and Langson. The ore from this region is transported by rail to Phu-lang-thuong, where it is loaded on river steamers.

The newest and perhaps the richest of these regions is the Chodien or Bac-kan district, east of the Song Gam, about 50 mi. above Tuyen-Quang. The ore from the Chodien mines is carried by a private railway to the Song Gam, then by sampans to Tuyen-Quang, whence it is transferred to river steamers.

These four regions include about 30 zinc concessions, of which only 11 are at present in process of exploitation.

Development of the Tonkin Zinc Industry

Although the Chinese are known to have obtained zinc from Tonkin before the French occupation, the serious exploitation of this mineral dates from 1906. In this year some coolies working on the estate of Commandant Cadars at Trang-da opposite Tuyen-Quang, discovered a vein of zinc ore. Further search proved the mountain to be rich in this mineral. Lacking the necessary capital and experience, M. Cadars formed the Société des Mines de Trang-da, with a capital of 300,000 francs ($58,000) and with its headquarters at Tuyen-Quang (later changed to 35 Rue de Clichy, Paris), for the exploitation of the first zinc mine of Tonkin. The first year this mine produced about 2,500 tons of ore. In 1909 the production had reached

8,000 tons, and since that date the annual output of this mine has remained at about 10,000 tons.

The discovery of zinc at Trang-da led to the exploitation of the old Chinese mines at Lang-hit, near Thai-Nguyen. Several mines—Lucie, Georgette, Renee, Metis, Bac-lao and Moba—were developed, and in 1909 M. Marcel Pierron, backed by the German firm of Speidel & Co., formed the Société Miniére du Tonkin, with a capital of 1,000,000 francs ($193,000) and with its main office at Haiphong (later transferred to 11 Rue Vézélay, Paris). At that time these mines produced only a few thousand tons of calamine and blende, but in 1914 their production reached 14,432 tons, and they have since held first rank among the zinc mines of Tonkin.

In 1909 also the Société Miniére de Than-moi was formed at Paris (11 Rue Vézélay) by M. Marcel Pierron, who retained 80% of the stock. Its mines are on the Song-Thuong between Phu-lang-thuong and Langson. The production of these mines has been irregular, varying from 492 tons in 1911 to 5,368 tons in 1914, but the ore is of a high grade.

In the meantime M. Cadars and others discovered three other veins near Trang-da-Kem, Con-rau and Con-rong, and in 1910 they organized for their exploitation the Société des Mines de Yenlinh, a joint-stock company with a capital of 700,000 francs and with its headquarters at Tuyen-Quang. The output of this group during the first four years averaged only about 1,100 tons per year, but in 1915 its production was about 3,000 tons, and estimates for 1916 point to about 4,000 or 5,000 tons.

THE CHARACTER OF THE ZINC ORE

Several other concessions have been taken up in the Tuyen-Quang region; but the only other mine that has been sufficiently productive to deserve mention is that of Bac-nhung, belonging to Perrin Frères, which in 1914 produced about 450 tons of ore.

The Van-lang mines in the Thai-Nguyen group began production in 1911, although the concession was not granted until the next year. It is operated by the Société d'Exploitation des Mines de Van-lang, Hanoi. The production of this mine for the years 1912 to 1914 inclusive was, respectively, 1,800, 1,500 and 1,672 tons of blende, calamine and galena. The ore is of low grade, and the mine ceased operations after the outbreak of the war.

The Cho-dien concessions were granted in 1912, but because of the inaccessibility of the mines, actual exploitation did not begin until 1914. Here the proprietor, M. G. Bault, Hanoi, was obliged to build a railway of 35 km. (about 22 mi.) from the mines to the Song-Gam at a cost of nearly a million piasters. This railroad was not completed until July, 1914. During that year about 1,900 tons was produced. During 1915 the production of these mines reached 8,600 tons. At present the Cho-dien mines are surpassing all others, and a yield of 15,000 tons is predicted for 1916. The ore is mined in the open cut in the side of a hill, and it is said that there is 80,000 tons of 52% ore in sight. This seems to be the future zinc field of Tonkin.

The grade, and sometimes the character, of the zinc ores of Tonkin vary with the different mines and even in the same mine. The most common ores are blende and calamine (zinc sulphide and hydrous silicate). These ores range from 40 to 55% in metallic zinc. Each of the mines has a reducing plant where the ores are crushed, washed and calcined and thus concentrated to 55-80% pure zinc. This concentrate is then put up in gunny sacks for shipment and sent to Haiphong, from whence it is transshipped to Europe, and recently to Japan and America.

The following table shows the character and grade of ore produced by each of these mines in 1914 and the average market price in francs per metric ton of the product delivered at Haiphong:

Mine	Character of Ore	Metallic Zinc, %	Market Price, Francs
Trang-da	Calamine	40	60 60
Kem	Calamine	45	122 88
Bac-nhung	Calamine	52	132 22
Lang-hit	Calamine and blende	50	115 00
Van-lang	Calamine, blende and galena	45	64 05
Than-moi	Calamine and blende	56	131 91
Cho-dien	Calamine	50	115 01

Up to the present the zinc ores exploited in Tonkin have been found near the surface. Outcroppings on hillsides have been exploited by opencuts followed by means of tunnels. The principal tools used in the mines are pickaxes, shovels and Decauville cars. The reduction plants make use of the best modern machinery and are generally operated by electric power generated by steam. Electric drills and dynamite sometimes assist the laborer in following up a rich vein, but on the whole mining machinery is seldom used. This has been due to the quantities of ore near the surface, the abundance and cheapness of native hand labor, the difficulty of obtaining European skilled workmen, and lack of capital. But modern mining machinery must ultimately come to Tonkin. This is a part of the problem of the future development of these mines.

The cost of production in the Tonkin zinc mines is greatly lessened by the cheapness of labor. Tonkinese coolies receive on the average 30 to 40c. local currency (15 to 20c. U. S. currency) per day. Although neither as strong nor as intelligent as the Chinese, they are diligent, faithful and apt.

The following table shows approximately the amount (U. S. currency) received for products of the mines during the years 1912 to 1914 respectively. Statistics for 1915 are not yet available, but it is certain that the amount averaged two or three times as high as in previous years:

Mine	1912	1913	1914	Mine	1912	1913	1914
Trang-da	$173,700	$105,571	$116,688	Duc-bo	$10,133		
Lang-hit	392,176	389,472	230,288	Bac-nhung		$24,511	$11,484
Than-moi	21,230	66,585	136,258	Titania		15,633	
Van-lang	25,283	23,160	21,230	Cho-dien			42,161
Yen-linh	16,405	15,440	34,586				
Clothilde-Adele	14,668			Total	653,595	640,372	592,695

The exportation of zinc from the port of Haiphong during the past three years has been as follows (in metric tons):

Port of Destination	1913	1914	1915	Port of Destination	1913	1914	1915
Dunkirk	12,936	4,991		Hongkong	9		518
Havre			500	Japan			7,089
Marseilles			17,403	United States			7,825
Antwerp	13,706	14,571					
Hambrug	1,021			Total	27,732	19,562	33,335

The chief drawback of the economic system of French Indo-China has been the lack of a loan and discount bank which could advance money to a worthy enterprise. The consequences have been that many of the firms formed to exploit the mines were backed by foreign capitalists, who held stock in these firms, advanced them money and carried their product to the refineries of Hamburg and Belgium. At the outbreak of the war these firms are said to have had long-term contracts for the products of the Tonkin mines.

The immediate effect of the war was the breaking off of all business relations between French operators and German financiers, the withdrawal of German capital and the loss of a market for Tonkin zinc. The ore already in the hands of these foreign firms was tied up, and further production was precarious. Tonnage was lacking for the zinc available for exportation. In December, 1914, some of the leading zinc producers of Tonkin were seeking a market for their product on almost any terms.

Improved Conditions—Zinc for United States

But the situation soon began to clear up. German goods in French Indo-China were sequestrated in November, 1914. The decree forbidding the exportation of zinc was put into effect in Indo-China early in 1915. The belligerent nations had become convinced that the war was not a matter of a few months, and the consequent demand for metal was unprecedented. As a result the price of zinc began to mount, until on July 1, 1915, zinc ore at Haiphong was worth two or three times as much as on July 1, 1914.

With the rise in the price of zinc and with the demand for this product made by the allies and the neutral nations, the zinc mines began to resume operations. The smaller companies found themselves confronted by two serious handicaps; namely, the lack of sufficient financial backing and the mobilization of European operators and employees. As a consequence, although production in 1915 was greater than in any previous year, the product came entirely from a few of the larger firms. The product for 1916 will probably be 50% greater than that of 1915. Under more favorable conditions it could easily be four or five times as great.

During the early part of 1915 most of the exported zinc went to France; but the export restrictions were moderated, and later in the year a good share of this ore went to Japan and the United States. Between Oct. 1, 1915, and Feb. 1, 1916, the Société Minière du Tonkin exported 9,325 tons of ore to Baltimore and 1,300 tons to Galveston via Marseilles—the first Tonkin zinc to be shipped direct to the United States. Most of the product of the Lang-hit mines is still finding a market at Baltimore, while it is understood that a Japanese firm has made contracts for the output of the mines of Tuyen-Quang.

Outlook for 1916—Future of Zinc Industry

Under the stimulus of unheard-of prices the larger zinc mines of Tonkin are now running at their utmost capacity, limited only by the difficulty and expense of installing new machinery and the practical impossibility of maintaining an efficient staff of European operators and overseers. In all the zinc fields a greatly increased production is foreseen, and the total product for 1916 is estimated at 50,000 tons. The value of such a product according to the present customs estimates will figure in the official reports of 1916 at about $1,185,000, but the market value at the present price will be at least $3,000,000.

The zinc-mining operations of Tonkin up to the present have been merely scratching the surface of the rich and extensive fields. The preliminary surveys of the country have marked on the maps the places where zinc is known to exist without much knowledge of the extent of the deposits.

The great needs of this industry are machinery, operating capital and transportation facilities. Under present conditions it is only profitable to exploit the richest ores near the surface of the easily accessible mines. Operating capital and improved methods of internal transportation would greatly enlarge the available fields, while modern machinery would enable the present mines to be worked at lower levels and would make it possible to extract the mineral from the lower grades of ore now thrown away. The question of establishing a central refining plant at Haiphong or some other place in Tonkin is now being agitated and has so many obvious advantages that it is sure to come.

The question of internal transportation belongs to the protectorate of Tonkin and the Union of French Indo-China, but the operating capital of the mines must be supplied from the outside. The mining regulations of Tonkin prescribe that a majority of the board of directors of any mining company must be French citizens or colonials. But there are two ways by which foreign capital can contribute to the development of this industry and participate in its consequent financial returns. Foreign zinc manufacturers can hold shares and form a minority of the board of directors with or without the consequent purchase of the product of the mines; or foreign capitalists can fill a long-felt want in Indo-China by establishing a loan and discount bank which will furnish the necessary capital to deserving enterprises.

Chinese Saltpeter

An American who has recently been employed with the engineering department of the Standard Oil Co. states, according to U. S. *Commerce Reports*, that he is in touch with certain Chinese who have secured a monopoly for the collection of saltpeter in three provinces. Interest appears to have been originally aroused in the subject by rumors of the probability of a large Russian demand; but this does not seem to amount to anything at present, and the attention of the promoters has been turned to a possible American market.

The price originally quoted was $33 Mexican per picul of 133⅓ lb., and at the then rate of exchange the American representative calculated this meant the possibility of delivery f.o.b. treaty port (probably Tientsin) at a figure that would compete with the rate then ruling in New York. However, the gold value of silver has since appreciated somewhat—a factor which, of course, ordinarily militates against export trade—and further investigation would probably be necessary before such a price could be accepted.

The promoters claim to be able to deliver at three weeks' notice quantities of 400 to 500 tons. They have formed a company with a capital of $525,000 to $575,000 (gold) and say they are not looking for more, this being strictly a purchasing, not an investment, opportunity.

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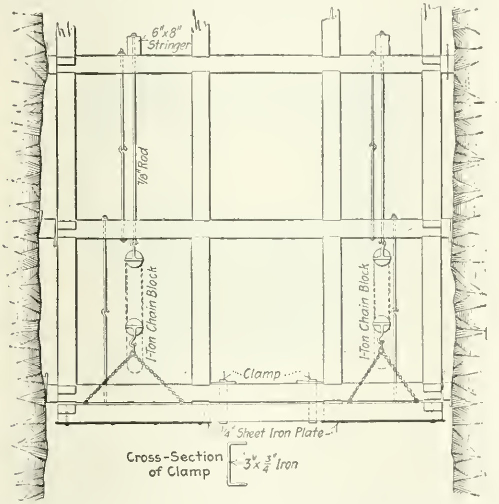
The Consolidated Interstate Callahan Mining Co., in its report for the third quarter of 1916, shows a net profit of $413,695. There was mined 38,695 tons of ore and 32,938 tons was milled, the average content being 25.7% zinc, 1.8 oz. silver per ton and 5.60% lead. The total mill recovery was 85.7%, and the recovery on the basis of metals paid for was 82.9%. The amount of zinc in the ore and concentrates shipped was 16,868,836 lb., and the lead in the two products was 1,454,562 lb. The cost of mining was $5.05 per ton extracted, and of milling, $1.252. Production is being maintained at the maximum. One dividend of $1.50 per share was made during the quarter, amounting to $697,485. A total of $4,649,900 has been paid since Apr. 1, 1915. The company has added materially to its property acreage during the quarter.

Details of Practical Mining

Rapid Shaft-Sinking with Suspended Bulkhead

By Walter Fitch, Jr.*

Extremely rapid progress in shaft-sinking has been accomplished at the property of the Chief Consolidated Mining companies' property at Homansville in the Tintic District, Utah. The suspended bulkhead and shooting set shown in the illustration permitted the timbering to be done without stopping the work in the bottom of the shaft. This was accomplished by lowering the bulkhead, by means of the chain blocks shown, a sufficient distance to allow for a set of timbers. This arrangement added greatly to the safety and speed of sinking. The shaft is 15 ft. 6 in. by 6 ft. 6 in. and is composed of two hoisting compartments 4 ft. 2 in. square each and a manway 4 ft. 2 in. by 3 ft. 2 in., all measurements inside timbers. The timbers used are 8x8-in. throughout, placed on 5-ft. centers in porphyry formations and on 6-ft. centers in the limestone formations. The shaft is lined throughout with 2x12-in. lagging.



THE SUSPENDED BULKHEAD FOR USE IN SHAFT SINKING

The work of sinking was commenced on July 8, 1916, on contract by Walter Fitch, Jr., Inc., and in the first 31 days a total distance of 256.3 ft. of sinking had been accomplished. During the succeeding 31 days 261 ft. was sunk. The shaft was sunk through porphyry and limestone. The former was unfavorable for drilling on account of sticking and the plugging of the hollow steels used, but this disadvantage was balanced by its being favorable for mucking. The limestone was a hard close-grained rock, breaking into large pieces, which made mucking difficult. From three to four Denver Clipper drills were used with $\frac{7}{8}$-in. hollow hexagon steel. A 5-ft. round of from 20 to 25 holes was drilled and shot every 12 hr. The air pressure was poor, ranging from 60 to 70 lb. Hoisting was done with two 15-cu.ft. buckets, used alternately and dumped automatically on top into a car by means of a fixed chain hooked into a ring in the bottom of the bucket which held the bottom stationary, allowing the top to tip over on an incline door and chute as the engineer slacked off on the rope. No crosshead was used in hoisting. The center compartment was lined with lagging and the bucket allowed to swing free.

Three shifts of four machinemen each were used in the bottom. They drilled or mucked as the case might be. On day shift two timbermen did all the timbering. On top the force consisted of a topman and engineer on each shift. Every man on the job received $5 a day except the topmen, who were paid $3.25. The best speed was made in mucking, only men of exceptional mucking ability being hired.

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*Contractor, Eureka, Utah.

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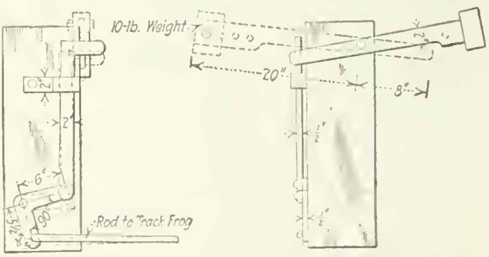
A Mine-Track Switch

By Arthur C. Daman*

The mine-track switch shown in the accompanying sketch is recommended for its simplicity, both in construction and operation. It can be made in any mine blacksmith shop. It consists primarily of $\frac{1}{2}$x2-in. strap iron and angles. It can be operated by the engineer without getting out of his car, by simply throwing the lever weight to the opposite side. The switch holds fast and is kept snug against the track by the 10-lb. weight, thus making a perfect electrical connection. In going in a reverse direction to the switch, the frog will open, raising the weight and then letting it fall back into its original position as the wheel passes by. All haulage switches in the mines of the Calumet & Arizona Copper Mining Co. are of this type, the inventor being a track man at the Junction mine.



A POSITIVE SWITCH THAT CAN BE OPERATED FROM THE CAB

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*Mining engineer, 2678 Eudora St., Denver, Colo.

Efficiency with New Mine Cars

By Fred M. Heidelberg*

Four cars that have recently been put into general use by the Copper Queen company will be of special interest to engineers interested in the principles of efficiency, since the cars tend to better working conditions and eliminate waste.

Time study of a day's work revealed that an exceedingly large portion of time was consumed by the miner's running around and hunting things with which to work and which he should have had at his side. A tool car, shown in Fig. 1, was designed, therefore, to carry all the tools a miner might need in accomplishing a day's work. Upon arriving at his level the miner inspects his tool car and ascertains that all equipment, such as machine hose, both water and air, tools, drill steel, gaskets, oil, etc., is in place. When he is sure that everything necessary to do his day's work is in its place in the car, he pushes it to his drift and begins work. The reader must admit that with this car fully equipped there will be little reason for the miner's leaving his place of work, thus eliminating a great deal of waste time. The design of the car is such that it will go on any cage in the mines. There are four compartments, counting the top platform. One of these is inclosed for carrying things easily lost or damaged and is provided with hinge and hasp so that it can be locked if necessary. The whole consturction is as light as possible, only $1\frac{3}{4}$x$1\frac{3}{4}$x$\frac{3}{16}$-in. angles, $\frac{3}{16}$-in. and $\frac{1}{4}$-in. plate being used.

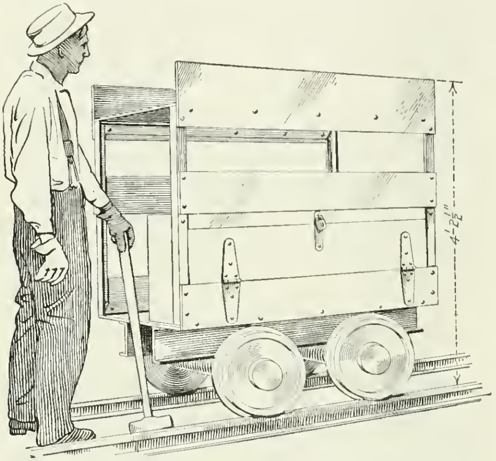

FIG. 1. FOUR-COMPARTMENT MINER'S TOOL CAR

The water car of 50 gal. capacity, illustrated by Fig. 2, was designed and built to obviate the inconvenience experienced when a water drill had to be worked in prospect drifts or where piping for water could not be conveniently put in. A great deal of piping that was formerly considered necessary could be avoided if these cars were on hand. The only work necessary to operate this car is to fill it with water at the hydrant, push it to the drift, connect air hose for pressure and water hose to the bottom of car and to the drill. Compare this simple operation to that of putting in a pipe line.

The over-all dimension of the tank is about 42 in. The cylinder is of $\frac{3}{16}$-in. steel plate, with heads of $\frac{3}{16}$-in. metal dished to a radius of 15 in. The water outlet is at the bottom and consists of a $\frac{3}{4}$-in. hose spud screwed into a $\frac{3}{4}$-in. throttle valve. There are two similar outlets on the top of the tank—one to serve as an air connection, the other for filling the tank with water. The tank rests in saddles forged from $6\frac{1}{2}$x$\frac{1}{2}$-in. plates, to which $2\frac{1}{2}$x$\frac{3}{8}$-in. straps encircling the tank are bolted. To these straps are riveted the bars that form the support for the platform on top of the tank. This platform can be of wood or steel plate as desired. The axles used were the standard timber truck axle, braced by means of $2\frac{1}{2}$x$\frac{3}{8}$-in. bars. Some of these cars have tool boxes of No. 10 iron, fastened between the straps on the tank just under the platform. It is unnecessary, however, to have a tool box on this car if a tool car is part of the miner's equipment.

Fig. 3 shows the construction of the toilet car now in use in the mines. Anyone who has worked in a mine where this class of car is not used can realize what it means in the way of sanitation and comfort. In the Copper Queen mines these cars have their stations and all men are compelled to go to these stations. At frequent intervals the cars are taken to the surface, emptied into the sewer, washed and disinfected.

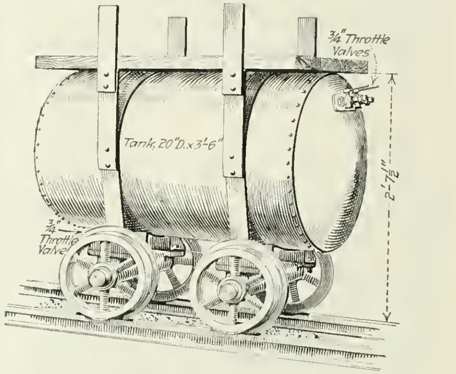

FIG. 2. DRILL-SUPPLY WATER TANK CAR

The construction of the car is simple and somewhat resembles the old-time stage coach. The body is made of No. 10 plate riveted with $\frac{5}{16}$-in. rivets. Since No. 10 plate cannot be calked, a heavy tar paper was placed in the joints before riveting. The top plate is $\frac{3}{16}$ in. bolted to the body of the car so that it can be removed when inside repairs are necessary. There are two seats in this plate, provided with hinged covers, which can be latched when closed by turning the handle. A leather gasket is provided on the cover, and a rubber covering on the seat.

The car is emptied by means of a valve on a $1\frac{1}{2}$-in. square stem. By turning the handle wheel on top of the car, the valve is raised or lowered by means of the threaded rod that works in the valve stem. A $2\frac{1}{2}$x$\frac{1}{2}$-in. bar is provided inside of the car to keep the valve stem from turning. The valve seats on the cast-iron discharge, which also serves as a guide in the sewer. The reader can see the necessity of locking this valve. The method of locking is shown. While the original design called for the attachment of the pushing handles to the sides so many men mashed their fingers in going through narrow places with the car that it was considered advisable to attach the handles to the ends.

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*Mechanical engineer, Copper Queen Mining Co., Bisbee, Ariz.

The storage-battery and blower cars are emergency cars for fire-fighting purposes and are illustrated by Fig. 4. It frequently happens that mine fires occur in inaccessible places where it is a difficult and slow process to get wires strung to them for operating a motor-driven blower. These two types of cars were designed and built so that the helmet crew could work without waiting for the installation of a motor and blower.

The batteries are always charged, and both cars are held in readiness at a central point. When a fire is discovered, the cars are rushed to the place; usually arriving ahead of the rescue crew. Thus the crew can begin constructing brattices if there is reason to believe that life is being sacrificed, or building bulkheads to confine the fire, while the electrical department is doing its utmost to string wires and install a larger blower to displace this emergency blower. One can easily see that quite an appreciable amount of time can thus be saved and perhaps life too.

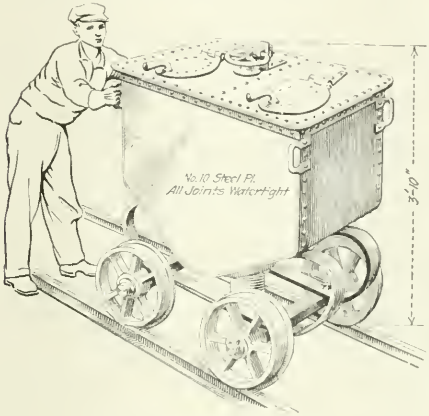

FIG. 3. MINE LATRINE CAR

Two battery cars have been constructed at the Copper Queen—one as an extra if the other should run down and need recharging. The storage capacity of each is for about two hours' running, which was deemed ample time to allow for a more permanent form of blower to be installed.

The storage-battery car is nothing more than a tray mounted on standard axles. The bottom of the tray is of 4x6-in. timber on which is nailed the 2-in. plank floor. Small strips of rubber belting are nailed over this floor in order to allow any liquid that might be displaced from the batteries to run out through holes in the 2-in. planks. A containing cage of 2x2x¼-in. L's, securely braced, is provided with four 2-in. eye-bolts so that the entire car can be picked up and placed on a truck for transportation to the shaft where it is needed. A sheet of No. 10 iron is provided around the bottom of the tray to keep the batteries in place. The batteries are of the Edison type, and the group consists of seven trays of five cells each connected in series so as to give an effective voltage of 50 volts. The leads from the group connect to a socket to allow for a quick connection with the motor.

The blower car consists of a 4x4 frame and 2-in. plank body on which is mounted a No. 4 Sturtevant blower connected directly to a 5-hp. 110-volt d.c. motor, the windings of which have been changed so as to make it a 50-volt motor. A small controller is attached for starting. When the blower car is in place, it is blocked up from the rails in order to steady it while running, and pipe is connected and led to the place where the men work.

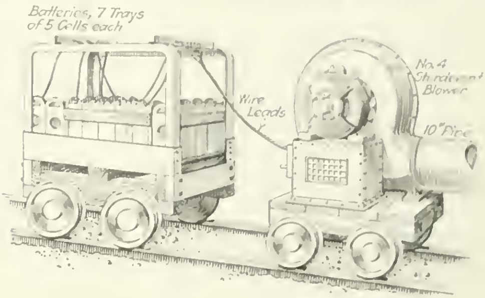

FIG. 4. STORAGE-BATTERY AND BLOWER CARS

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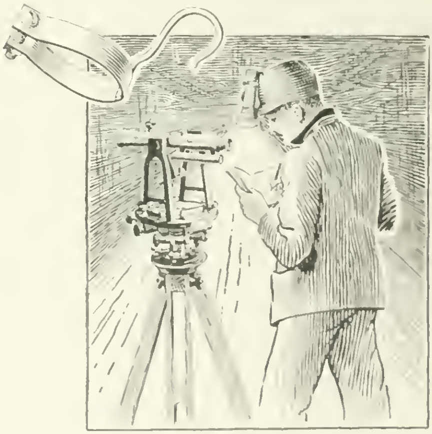
Handy Flashlight Clamp

The accompanying illustration shows a clamp for a flashlight that was described in *Coal Age*, Nov. 11, 1916. This clamp was made so as to be able to take notes and also for use in setting up a transit in a mine where safety lamps are required. It is handy and useful and is recommended to mining engineers as well as to inspectors.



THE CLAMP AND ITS USE

The flashlight can be hung on the cap or clothing. The clamp is made of tin ½ in. wide with a small bolt or screw for clamping, and a hook from an old oil pit lamp. This hook is soldered on underneath the clamp.

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A 23-Stage Centrifugal Pump is being built for an [illegible] mine by the Layne & Bowler Corporation, of Los Angeles, Calif. As the usual pump does not exceed five stages, the operation of this new pump will be followed with interest by those who have pumping problems at their mines.

Details of Milling and Smelting

Pulley Computation Chart*

By W. F. Schaphorst*

The accompanying chart will be found to be useful for determining the sizes of pulleys required for given power-transmission requirements. It removes the necessity for the use of the various formulas and is extremely flexible in its application. For example, a motor running 1,200 r.p.m. is to drive a lineshaft at 300 r.p.m. What sizes of pulleys should be used? On the slip of paper in position *A* make marks opposite the 300 and the 1,200, as shown. Then slide the slip of paper up to wherever you want it. Position *B* shows that pulleys 15 in. and 60 in. diameter respectively will do the work very well. Of course, if those diameters are considered too large, the slip can be moved a little higher and the best diameters can be chosen. No matter where the slip is placed, the ratio is always correct. The chart also lends itself readily to the solution of such a problem as—Knowing the pulley diameters and the speed of one of the pulleys, what is the speed of the other pulley? For example, pulley diameters of 8 and 50 in. are used. The speed of the 8-in. pulley is 200 r.p.m. What is the speed of the other pulley? The answer is 32 r.p.m. Try it by means of the chart. As speed of rotation and diameters bear an inverse ratio to each other it will be necessary to invert the figures when obtained or else reverse the slip of paper between position *A* and *B* in the figure.

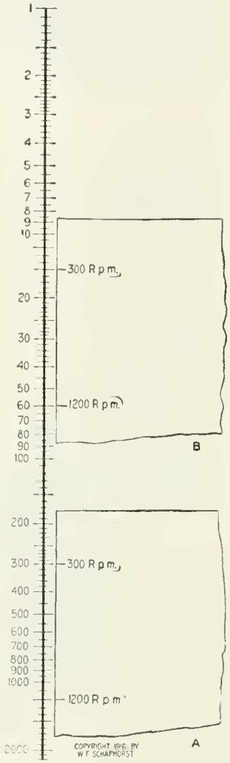

CHART TO CALCULATE PULLEY RATIOS

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Injury Through Heat and Fumes

The Texas Court of Civil Appeals has affirmed judgment in favor of an employee of a smelting company, who sustained personal injuries through existence of heat and gases in a furnace in which he was required to work before the furnace had been permitted to thoroughly cool off. He asserted liability on the theory that the company was negligent in failing to warn him of the dangers which resulted in his injury and of which he was ignorant, and the court finds that there was ample evidence to warrant the jury in its conclusion that there was such negligence. (Dill vs. Consolidated Kansas City Smelting and Refining Co., 188 Southwestern Reporter, 439.)

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Mine Rock in Tube Mills

By Charles Labbe*

In order to reduce the cost of grinding where tube mills are used, in some of them mine-rock is employed with advantage instead of pebbles, domestic or imported, but the consideration is purely a local one. Imported flint pebbles are now a very costly item in mills situated away from railroads, but are superior to any granite or porphyry of domestic production. These wear flat and give poor service, the transportation charges are the same as on flint pebbles, and from practical experience it may be said that they are economical only where they can be obtained from a hauling distance.

Mine-rock used in place of pebbles never comes in round shapes as pebbles do, but always in sharp, angular shapes. This is the main drawback, because there is a loss in efficiency in grinding off the edges; but in several places where the ore is hard, they have replaced the pebbles entirely. A few little changes have been necessary, the most important being in the preparing and handling.

In milling, tonnage is now the main consideration and ore sorting in the mine is rarely done. The sorting, if any, is done at the crushing plant, and this is usually where the pieces of ore are sorted for tube-mill use. They must be the hardest pieces and as uniform as possible—the ones approaching the round shape are to be preferred. They are either piled to one side or thrown directly into an ore car or a special bin. From the crusher room the rock is carried to the tube mill either in wheelbarrows, ore cars or through a chute. The handling being the largest expense, every possible opportunity must be taken to lessen it; by gravity fall this cost is reduced to a few cents per ton.

One of the largest mills using mine-rock as a tube-mill grinding medium is the Aurora, having a daily tonnage of over 500, with 40 stamps crushing to 4-mesh and six 6x16-ft. tube mills. The ore is elevated from the crusher to the bins by a belt conveyor, one man tending to this belt, keeping the ore bins full and picking the largest pieces of quartz (about 3-in. cube) and dropping them into a chute. On the battery floor is a car and track going from this ore-bin gate by a trestle over every tube-mill manhole and every shift (three times per day) each tube mill is stopped with the manhole at the top, the door is opened and about a ton of mine-rock is dumped in. A square sheet-iron hopper fitting the manhole facilitates the operation—less than five minutes is required for each tube mill.

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*Mechanical engineer, Johnnie, Nev.

In a mill in southern Nevada the man tending the crusher sorts the mine-rock and the hardest pieces (about 4- to 5-in. cube) are thrown into a 6-in. iron pipe having a 5-in. opening to make sure no piece will clog the pipe, the rock falling into a box within reaching distance of the tube mill. The rock is fed by hand into the scoop at regular intervals; a man standing on the platform, with one hand takes rock from the box and throws it in the scoop at nearly every revolution. The scoop is of large size and never clogs. In another mill the rock is brought near the tube mill in an ore car direct from the crusher room and is hand-fed to the scoop. There are mills where the rock is brought near the tube mill in wheelbarrows or carried in hand boxes or in ore sacks, but hand labor is expensive and costs must be figured close to compete with pebbles.

Tube mills with lifter bars handle mine-rock better than mills with continuous smooth lining, for the reason that a rock with a flat face may keep sliding on one side and not get a chance to roll and round itself up like a pebble. With the lifter bars a rock of any shape is sure to be thrown away from the lining after a travel of only a few feet.

The tubes of the first-mentioned mill have lifter bars and Komata lining and use mine-rock exclusively. At a speed of 20 r.p.m., each grinds about 85 tons per 24 hr. The lining lasts about 2 years, where in a 5x22 ft. mill running 28 r.p.m. silex lining lasts about 10 to 12 months, grinding 50 to 60 tons per day. The feed is $\frac{3}{16}$ in. from rolls, both mills making a 200-mesh product.

The cost per ton of flint pebbles is about $50 to $60 for mills in Nevada. Porphyry pebbles cost about $10. To make the change to mine rock depends on local conditions. Where a man stands by a belt and has only to push the rock off, he can sort from 15 to 20 tons per 8 hr., but if the rock has to be lifted and carried away a few feet, a few tons is all that can be figured upon and costs will rise materially.

The change is not necessarily a radical one. Many mills are reducing the feed of pebbles and replacing it with mine-rock without cutting down the grinding efficiency. Before using mine-rock exclusively in tubes at the Aurora mill, imported flint pebbles were used, several tons per day costing delivered at the mill $50 per ton, thus making just that many tons of barren rock to handle in the cyanide plant. The grinding efficiency has not suffered, because the daily tonnage has increased; the extraction has not suffered, because the rock remains longer in cyanide solution.

⁂

Preparation of Tungsten Metal

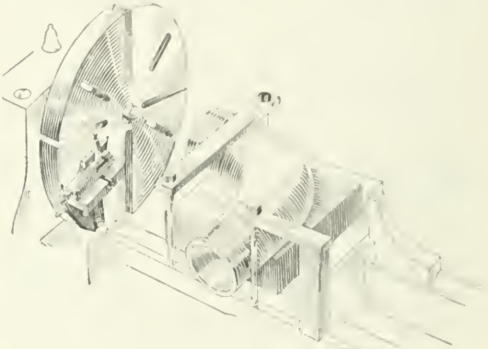
In a recent treatise on rare metals Dr Herman Fleck[1] describes the preparation of tungstic metals from ores. Concentrates are ground very fine in tube-mills and are fused on a reverberatory hearth with sodium carbonate (soda ash) and a little sodium nitrate. This disintegrates the material and the mass is then drawn, crushed and leached with hot water. Sodium tungstate is dissolved and the iron and silica remain with the insoluble. Undissolved sodium meta-tungstate is converted to normal tungstate by treating with a solution of caustic soda. The concentrated solution of sodium tungstate is heated and poured into hydrochloric acid. Tungstic acid (WO_3) is precipitated as a yellow powder. This is filtered, washed in acid-proof presses and dried.

The tungstic acid (oxide) is mixed with some pure form of carbon such as charcoal or petroleum coke and the charge is pressed into graphite crucibles and heated in coke furnaces to a high temperature. A coarse, steel gray dense tungsten is obtained that, with care, may be kept below 1% carbon content.

⁂

Threading Ends of Bent Pipe

The problem of utilizing short pieces of bent pipe is an ever present one about metallurgical plants of all kinds. Such a policy of utilization keeps down the size of the junk pile and helps toward increasing profits, besides being a great comfort in times of urgent need. Therefore the method described by H. J. Smith, in *American Machinist*, Nov. 2, 1916, and shown in the accompanying illustration, is worth while putting on record. By putting an angle plate with a small compound rest on the faceplate, the operator was enabled to use a lathe for the purpose. The pipe was fastened in blocks on the carriage, as shown in the illustration. By running the lathe backward it was possible to cut off, turn and chase the thread.

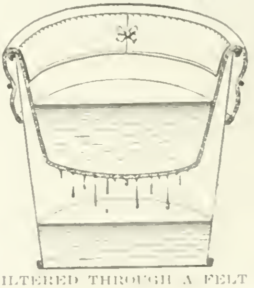


THE RIG FOR THREADING BENT PIPE

⁂

Oil Filter for a Small Plant

A tin can and a felt hat combined, as shown in the illustration, says Jan Spaander in *Power*, make a first-rate and inexpensive filter for oil, in a plant that does not justify the purchase of an expensive apparatus. If there are holes in the top of hat, pieces of felt (taken from the brim) can be stitched over them.



OIL FILTERED THROUGH A FELT HAT

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[1] Proc. Colorado Scientific Society, Denver, Colo., October, 1916.

Company Reports

Jumbo Extension Mining Co., Goldfield, Nev., in its operations for the year ended June 30, 1916, produced 35,541 dry tons of ore, averaging $31.64 per ton in gold, or a total of $1,124,487. Smelter losses were $153,703, or $4.32 per ton, leaving smelter recovery of $27.32 per ton. Last year's ore averaged $61.58, with smelter losses of $4.71 per ton. In addition to the ore mined, dump ore to the amount of 882 tons was sold, netting $1 per ton. The expenses of "smelter losses" include arbitrary deductions made by smelters, in addition to reduction charges of 5% on gold and silver and one unit of copper. The expenses of the year, including mining, transportation, taxes, construction, administration, general expenses, etc., were $562,426, or $15.82 per ton. Development work to the amount of 8,917 ft. was accomplished this year, at a cost of $6.95 per ft. Mining and development costs were $5.40 per ton. The total operating costs were $5.57 per ton. Four dividends were paid during the year—one of 5c., two of 7½c., and one of 10c.—the total aggregating $465,000. The cash balance on June 30, 1915, was $120,533, and that on June 30, 1916, was $103,274. Developments have been carried on uninterruptedly from No. 1 shaft on the 1,000-ft. level to the south and in three different directions in shaft No. 2. No new ore of commercial value has been opened up for many months, and production has come exclusively from ore reserves blocked out during 1915. The drain has been heavy, and it is apparent that, while considerable ore in sight still remains, the end of the productive life of the mine is not remote unless new ore is found in territory under exploration.

* * *

Kerr Lake Mining Co., Cobalt, Ont., during its operations for the year ended Aug. 31, 1916, showed a total production from all ores of 2,433,793 oz. of silver. This includes 61,761 oz. of silver on hand Aug. 31, 1916, according to inventory. Of the total, 1,438,600 oz. was produced from shipping ore and 595,192 oz. from low-grade ore milled by the Dominion Reduction Co., at Cobalt. The production included 1,171,799 oz. of silver from first-class ore, 175,787 oz. from first-class bullion, 83,467 oz. from second-class ore, 7,547 oz. from bullion and metallics and 995,193 oz. from mill ore.

Including drifting, crosscutting, sinking and raising, 4,057 lin.ft. of development was accomplished during the year. This is slightly less than that done during the previous year, the decrease being accounted for by the fact that more was done in the slower work of sinking and raising. Although exploratory work was distributed well over the property and a considerable amount was done at greater depth than before, discoveries of importance were few. Some additions were made to known reserves through development of extensions and side stringers. The mining cost amounted to $3.68 per ton for 58,850 tons of ore hoisted, or 8.89c. per oz. for 2,433,793 oz. of silver recovered. In spite of a gross production of 2,433,793 oz., the ore in reserve shows little diminution over that reported last year. This is partly because of extensions to the veins by development, but mostly because of the fact that production of both mill-run and high-grade was much better from nearly all the veins than estimates made from former production of blocks of equal area had indicated. As a result some of the former estimates have been revised upward. The estimated ore reserve on Sept. 1 includes 3,827,000 oz. of silver.

* * *

The Tomboy Gold Mines Co., Ltd., Telluride, Colo., in its report for the year ended June 30, 1916, shows a profit realized of £76,923, to which is to be added a balance brought forward from the last account of £20,778, making a total of £97,701. There was milled 150,488 tons of ore, from which bullion to the value of $1,074,088 has been realized, at a cost of $720,866, resulting in a profit of $353,222. If to this profit be added dividends from the Tomboy Tramway and Tunnel Co. and receipts from other sources, $29,566, the total surplus for the year's working will be shown to amount to $382,788. The average working cost for the year, including all expenses in America and London, was $4.92 per ton. The ore reserve amounts to 575,000 tons, the amount comprising 175,000 tons in the Argentine group of mines and 400,000 tons in the Montana property. The mill has established a record for the tonnage of ore treated and has run satisfactorily through the year. The cyanide plant has yielded a profit of $21,702 for the twelve months. The cyanide plant treated 132,200 tons of tailings, recovering therefrom bullion valued at $160,476 at a cost of $0.90 per ton and yielding a profit of $0.31½ per ton of tailings treated. The total income from all sources, including the ore at the mill, the concentrates produced, cyanide bullion, dividends from the Tomboy Tramway and Tunnel Co., boarding house, rent, etc., amounted to $1,103,654. Total expenses were $720,866, leaving a profit of $382,788. The cost per ton for mining and developing was $2.42; for milling expenses, $0.52; for concentrating expenses, including transportation to railway, $0.49; for water-supply expenses, $0.09; assay-office expenses, $0.02; cyanide expenses, $0.79; general expenses, $0.2; and taxes and insurance, $0.26; making a total of $4.79 per ton.

* * *

Chief Consolidated Mining Co., Eureka, Utah, in its report for the year ended Sept. 30, 1916, shows a total amount of work done of 17,950 ft. The total shipments of ore were 62,006 tons, yielding, after the payment of smelting, transportation and sampling charges, $1,153,000. The metal content of this ore per ton was 0.104 oz. of gold, 21.7 oz. of silver, 13.08% lead in lead ore, 1.95% copper in copper ore, and 30.5% zinc in zinc ore. The average gross value per ton was $31.38, the cost of smelting, freight, sampling, etc., $12.78, leaving an average net value of $18.60 per ton. The net profit after the payment of all charges was $474,247. Three dividends were paid—one on Feb. 7, dividend No. 7, amounting to $44,033.80; No. 8, on May 1, $44,148.15; and dividend No. 9, on Aug. 2 amounting to $44,149.55. The balance of cash on hand Oct. 1, 1916, was $446,970.

* * *

The Round Mountain Mining Co., Round Mountain, Nev., in its report for the year ended July 1, 1916, notes that the construction work on the Jett Creek pipe line had reached a stage permitting water to be turned into the line on June 24, 1915. The main tailings flume, 2,700 ft. long, was completed to a point requiring the use of a giant to cut a branch race into the block of ground selected for hydraulic mining during the remainder of the season. Active hydraulic mining began on July 13 and continued to Sept. 3, when the flow of water in Jett Creek had decreased to such an extent as to make it advisable to utilize it in cleaning up the bedrock that had been exposed. Gravel to the extent of 18,159 yd. was hydraulicked, yielding $36,414. Of this amount $26,997 was recovered from the boxes and $9,417 from bedrock. The total cost was $11,058, leaving a net realization of $25,356. The value per yard recovered was $2.006 and the total cost per yard $0.609, divided as follows: Hydraulicking, $0.395; bedrock cleaning, $0.214 per yd. The net realization was $1.397 per yd., representing a profit on operations of 69.6%. In November hydraulic operations were resumed with one shift. During December and January 30 days were lost. Up to Mar. 1, 1916, 5,272 yd. was handled, the value recovered being $9,204 and the total cost $5,397, leaving a net realization of $3,806. The value per yard recovered was $1.746, the cost $1.023, leaving a net realization of $0.723 per yd., representing 41.3%, of the value recovered. From Mar. 1 to July 1, 1916, 142,600 yd. of gravel was hydraulicked, yielding $48,177. Of this amount approximately $4,760 was recovered from bedrock. The total cost was $27,898, leaving a net realization of $20,279, or 42% of the total amount recovered. The value per yard recovered was $0.338, the cost $0.195, and the realization $0.143. Up to July 1, $0.338 per yd. has been recovered from the sluices and from bedrock cleaning. In addition there is estimated to be from 5,000,000 to 10,000,000 in the branch races of main tailings flume, this amount being not recoverable while active mining operations are going on. It will be cleaned up at the end of the season. Results do not call for any change in original estimate, as the latter are representative of large blocks of ground and not merely local sections. Before 1915 an average of $1.55 was recovered from all gravel washed on various sections of the property. Therefore an estimated average of $1 per yd. recovery is conservative. The results obtained this year could not be foreseen, as it is evident that a large low-grade area was encountered adjacent to ground yielding over $2 per yd. Operations in 1917 will be conducted with a view to obtaining the maximum efficiency from the water, and it is believed that hydraulicking costs will be reduced to $0.15 per yd. or less.

Correspondence and Discussion

A Cadmium Myth?

In the *Engineering and Mining Journal* of Sept. 23 there is an editorial entitled "A Cadmium Myth?" The interrogation point is necessary. There is no myth about the deleterious effect of cadmium in many cases, as the editorial frankly admits in the last paragraph.

Slush castings cannot be made successfully from cadmium-bearing spelter. A very little cadmium will spoil the spelter for this purpose, as it is impossible to obtain any uncracked castings from metal containing 0.05% or more cadmium.

In galvanizing telegraph and telephone wire, which has to stand the severe bending of the lineman's splice, it is essential that the spelter employed shall be free from cadmium, as the latter in minute proportion renders it much harder and more brittle, causing the coating to crack and peel. The hardness of spelter as shown by its resistance to compression is an accurate measure of its brittleness. The following table shows strikingly the effect of cadmium in small quantities on the hardness of spelter:

EFFECT OF CADMIUM ON HARDNESS OF SPELTER

% Cd	Load for 10% Compression, Lb. per Sq.In.	Relative
0.00	16,246	100
0.02	18,660	115
0.05	20,080	124
0.08	20,950	129
0.20	26,870	165
0.25	28,270	174
0.27	28,700	177

Cadmium dissolves in zinc up to about 1%, and all these solutions are hard and brittle. Cadmium-bearing spelter rapidly shows a brownish tarnish, and the extent of this increases with the increase of cadmium.

There is no question but that cadmium is injurious in manganese bronze. Most of the makers use the same brand of spelter for the better qualities, and it is one that is free from cadmium. Nearly all have tried other spelters containing about the same amounts of lead and iron, and in addition cadmium, but have abandoned them on account of the injurious effect on the product. I have no reliable figures on the proportion of cadmium necessary to produce these bad effects, but from my knowledge of the composition of the spelters that have proved unsatisfactory, I know it to be of the same order of figures as those found to be injurious in slush castings and telegraph and telephone-wire galvanizing.

It is frequently stated that cadmium in spelter makes no difference in the manufacture of brass, as it is all driven off in smelting. As evidence in support of this, the boiling points of cadmium and zinc are quoted. The former is 766° C. and the latter 906° C., from which it is argued that as the casting temperature of brass is much higher than the boiling point of either, the cadmium must be driven off. The boiling point of copper is 2,310°. The casting temperature of brass is from 950° to 1,100° C. An average sample of flue dust from a large brass plant contained: Zn, 26.91%; Cd, 1.01; Cu, 2.36. In other words, there was twice as much copper driven off as cadmium, although the temperature of the metal was 1,200° to 1,100° below the boiling point of copper and 200° to 300° above that of cadmium. Assuming that a 40-60 brass is to be made from pure copper and a "brass special" spelter containing 0.1% Cd, the loss in melting will be about 3%. On the basis of the flue-dust analysis already given, this would consist of: Zn, 2.7%; Cd, 0.1; Cu, 0.2. The results then are as shown in the following table:

A 40-60 BRASS MADE WITH "BRASS SPECIAL" SPELTER

	Zinc	Copper	Cadmium
Materials charged	42.7	60.2	0.17
Loss in melting	2.7	0.2	0.10
Resulting brass	40.0	60.0	0.07

The brass would contain enough cadmium to cause severe cracking if it were a slush casting or galvanized coating. Deductions from boiling points, therefore, would appear to be of little value.

The separation of cadmium from zinc and copper is difficult, and neither the textbooks nor many of the schools give directions on this point that are of any value. I have frequently known chemists of experience to report spelter as entirely free from cadmium when it actually contained a relatively large amount. In other cases they have reported from a half to a quarter of that really present. As it is even more difficult to determine cadmium in brass than in spelter, I have great doubt whether most of the statements regarding the absence of cadmium in brass are of any value.

The following analyses show that cadmium is found in brass in quantities comparable with those that cause trouble in slush castings and galvanized material: Rolled manganese bronze, 0.015% Cd; rolled or extruded manganese-bronze bar, 0.040; manganese-bronze bolt, 0.045; manganese-bronze bolt, 0.035; manganese-bronze casting, 0.060; manganese-bronze casting, 0.090; manganese-bronze casting, 0.030; drawn-brass bolt, 0.040; drawn-brass bolt, 0.030; brass ingot, 0.035; brass ingot, 0.054; brass ingot, 0.034; brass screen rim, 0.040. Fig. 1 is an illustration of the first specimen analyzed and shows severe cracking. Fig. 2 is the second and shows a curious system of reticulated cracks. Fig. 3 is the last specimen. It is the frame of a testing screen that had been kept for some months in a dry storeroom wrapped as shipped by the makers. When taken out, it was in the condition shown and had a slight irridescent tarnish, but no other sign of corrosion.

Large quantities of cadmium are admittedly injurious to brass, and the reason for this is quite obvious. The alloys of zinc and cadmium are, as already stated, very brittle, and an examination of brass containing from 1 to 3% of cadmium plainly shows a concentration of an alloy rich in zinc and cadmium along the boundaries of the brass crystals. With lower cadmium this alloy [illegible] difficult or impossible to see, but it may exist and be an element of weakness.

Season-cracking is due to overstrain from cold [illegible]. Therefore, if the strain is sufficient, cracking will occur regardless of the composition. The cracking [illegible] unless there has been some corrosion, a slight [illegible] sufficient to start the trouble. Impurities may increase the liability of cracking in any one of three ways: (1) They may so affect the brass that it is more easily strained by cold working; (2) they may increase the liability of corrosion, especially if they tend to segregate; (3) they may segregate to such an extent as to create lines of weakness in the finished material and cause it to give way locally under strains that would not affect the body of the alloy.

Cadmium does admittedly make brass more sensitive to heat treatment and is therefore likely to make it more susceptible to overstrain.

A fraction of 1% of cadmium in aluminum-zinc alloys causes disintegration from corrosion under conditions that leave a pure alloy unaffected. It is probable that it has a similar effect in copper-zinc alloys.

Cadmium in brass in large quantities segregates as a brittle alloy at the boundary of the crystals.

All these effects show that cadmium causes weakness and increases the liability of cracking. It is significant that the brasses that are most likely to contain cadmium are those that give the most trouble from season-cracking. It is a well-known fact that brass of about 40 zinc and 60 copper is more likely to season-crack than any other. As the cadmium, if present, is always introduced by the zinc, the high zinc content of this alloy gives a greater chance of high cadmium. It is usually made from the grades of spelter most likely to contain cadmium.[1] Its melting point is the lowest of any of the common brasses, and therefore a smaller proportion of the cadmium is likely to be eliminated in the making.

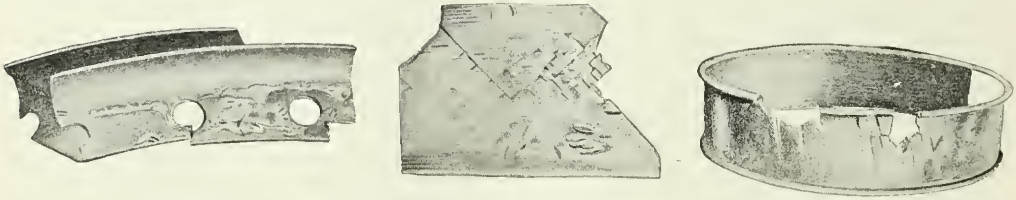
Fig. 1 Fig. 2 Fig. 3

SPECIMENS SHOWING THE EFFECT UPON BRASS OF CADMIUM IN THE SPELTER

I have shown that brass not infrequently contains an amount of cadmium that would cause serious cracking in spelter used for slush castings or galvanizing. As cadmium tends to cause brittleness and to increase the liability of corrosion in alloys, it appears reasonable to suspect that it is often a contributing agent in the failures of brass and similar alloys. GEORGE C. STONE.

New York, Oct. 9, 1916.

The Attempted Tyranny of Labor Unions

Although I have never before burst into print in the discussion of public questions, the letter of William Cullicover on "The Attempted Tyranny of Labor Unions" has prompted this reply. There are several thousand William Cullicovers throughout the country, and I believe this letter may help a little to set them thinking.

Mr. Cullicover wants to know how many feel as he does. The word "feel" is aptly used. If he had thought about his subject instead of feeling, he never would have written his article. It is a very common thing for men to appeal to the passions of their fellowmen (especially to the less intelligent) rather than to their brains. Mr. Cullicover shows that his article was written in passion by using insulting language because the editor held different opinions from his own. Consequently he appeals to the passions of his readers. Now passion has caused many a man to commit rash and senseless acts, but it never has convinced anyone.

In regard to the subject of his article, the threatened—and threatening—railroad strike, Mr. Cullicover tells a truth when he says there are only two parties involved. There are only two—the strikers and the public. The man who sits in an office and handles the financial end of railroading and the man who sits in the cab and handles the throttle are co-workers. One cannot get along without the other. Each has his job. In the United States there is only one class—the laboring class. When one set of workmen strike for higher pay, the other workmen have to pay it. For they are the consumers, or the public if you please. In the recent threatened strike the railroad managers were the public's only champions.

There are times when strikes are justified. When one set of workmen are treated unjustly by the other sets of workmen that comprise the public, they have a right to protest.

The man who uses his muscles for making a living usually voices his protests through his muscles. He throws a brick at the man who uses his brain for making a living. The one feels and the other thinks, and it is called a war between capital and labor. The man with the brain often deserves the brick, but he generally realizes more keenly than the man with the brick that it is poor policy to treat his fellow workman with injustice.

Let us quit talking about war between capital and labor. It does not exist, because labor is capital in the creation. Let us fellow workmen stop throwing bricks. Let us feel less and think more. In regard to what Mr. Cullicover calls class control, it is only natural that those best fitted for leadership should assume that position. It is the reward of brains and industry. It is as inevitable as the law of supply and demand. It is only when those at the top begin to erect unnatural barriers between themselves and their fellow workmen that classes are created. This is un-American, just as much as the blind hatred that some men hold for the capitalist.

Before we make the charge that class control exists in America, let us be sure that it does exist. I believe that there never was a country in which there is less of the so-called "class control" than in the good old U. S. A.

El Paso, Tex., Nov. 1, 1916. L. M. SHERIDAN.

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[1] Twelve samples of "brass special" spelter made by five different makers average 0.22% Cd; ranging from 0.005 to 0.430%.

Plant Fire Protection

By Frank M. Leland*

SYNOPSIS—The importance of plant fire protection is usually underestimated. It is necessary not only to have the equipment, but to have it in order for immediate use. This condition is attained only by frequent inspection and unexpected test drills. Carefulness and a respect for fire are to be drilled into the men. This latter is perhaps the best safeguard.

A large number of men operating mines, mills and smelteries have, no doubt, different methods of fire protection, most of which consist of hydrants with hose reels and hose distributed at various points about the plants. Some of these are operated by pressure pumps, but the majority are supplied by gravity pressure. Irrespective of the source of supply, the keynote to the whole system in case of fire is the condition of the hydrants, hose and fittings. Some years ago on taking charge of a plant, I made an inspection and noted that the fire hydrants did not look as though much attention had been paid to them, so I questioned the master mechanic, whose business it was to see that they were in condition for immediate use, and he said he was responsible for them. I asked him if they were all right in case of fire. He replied that they were, so I said that we would have a fire right away and pointed to the scalehouse and said to him, "Imagine that is on fire and see how soon you can have a stream on it." I noted the time he started for the hydrant nearest the scalehouse and I waited for the stream. After about two minutes I saw him start for the machine shop and pretty soon come back with a 6-in. monkey wrench and a helper carrying a length of hose. They started to screw on the hose, but it went on hard and the spanner was gone, so he sent the man for a spanner and the man went to three other hydrants before finding one. The gate valve was stuck, and he used the monkey wrench to open it up. When they finally got the stream on the scalehouse, it was a trifle over 16 min. from the time he started. He said it would not have happened only a day or two before; the men had taken that hose to wash out the locomotive boiler and had forgotten to put it back, and that particular hydrant had not been opened for a long time and the valve was stuck, and all the usual excuses for not having it in shape. There were 11 other hydrants, and we went over them all and only three of them were in shape to give immediate results. I then put some signboards on top, painted a number on each hydrant house and told him to make a report each week and put down each number on his report and be sure they were right. This he did, but I did a little inspection on my own account and generally found something deficient, so I had some blanks made out to be filled in. Even that was not satisfactory, so I finally had him put the matter up to the night watchman and we had some blanks printed containing the following headings: Number of hydrant, location, size, condition of hose and valve, nozzle in place, spanner in place and general remarks. Two copies were made out—the original to be left at the office and the carbon copy given to the master mechanic. After that I would drop around at any time and call for a stream from some hydrant selected at random, and from that time on we never had any more trouble. Since then, at any property in which I am interested, one of the first things done is to get the fire protection in shape, and it is kept so by continual inspection.

The Use of Stationary Fire Towers

Where there is a pressure of a 250-ft. head or over, I have found it best to dispense with hose and all the troubles that go with it, and build several platforms from 10 to 15 ft. high, with ladders attached, and on top place a small hydraulic giant made on the same plan as those used for hydraulic mining. They are double-jointed and swing up and down and also can be swung in a complete circle. Make them with a 1½-in. nozzle and be sure your mains are large enough to give them a good pressure; then try them out two or three times each week. This can be done with this form of hydrant better than with a hose, as there is no hose to dry out and roll up after the test, there are no spanners to lose and no one will steal the nozzle and sell it for junk. Anyone can make these if a machine shop is available, but there is a firm in San Francisco that makes them for this express purpose.

No matter what form of fire protection is used, it cannot be depended upon unless someone is made responsible, and whoever it is must try all the devices at some stated period so as to be positive that everything is in working order. I will venture the assertion that many managers who have fire-protection plants will find many a loose screw unless they have some form of inspection and tryout, and a few might find themselves in the position of my friend Jim, who was running a 20-stamp mill and a big hoisting plant in Oregon several years ago. He was showing me over the plant and pointed out where he had put pipes all about and had nice swinging hose reels where all you had to do was to take hold of the nozzle and pull the hose out and signal to the engineer to start the fire pump. I said "Fine! Pull one out and signal." He did, and the engineer turned on the steam. Nothing happened, and after waiting a few minutes, we went down to the engine room and found the engineer hammering the side of the cylinder and steam chest but to no avail; so he took off the head and found that, owing to a leaky throttle, the water had gradually rusted the cylinder and the piston which moved the valve so that they finally had to be soaked with kerosene for 24 hr. and then started with a jack. After that lesson the fire pump was tested out every day. A fire drill is a good thing, but the best protection I know of is for the boss to go around at some unexpected time, the call for a stream of water.

The Value of Carefulness

Carefulness is also an important factor, and generally speaking, when you see a man light his pipe and throw the match on the floor, even if it is a dirt floor, he should be cautioned, and should he do it again he should be discharged. In fact, any man who is the least bit careless with fire should be got rid of at once. How many times do we see a man take a nut for a candlestick and set it down on a greasy bench or on a dry pine window sill and perhaps go off and leave it? The building burns and no one knows how it happened!

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*President, Balaklala Consolidated Copper Co., Coram, Calif.

A lot of fires are started by men burning rubbish outdoors. I make it a fixed rule that no fires are to be started outdoors and that all rubbish must be hauled to the boiler; if the plant has no boiler, it must be hauled away. Water buckets placed at intervals around a building and kept full of water, which in a cold country should be made strong with salt to prevent freezing, are a good thing.

Most of the patent fire extinguishers are good if kept in condition, but generally speaking, the best insurance is careful men from the boss down to the roustabouts, and any man who shows that he is careless with fire is a good man to get rid of.

Zinc Producers' Association Proprietary, Ltd.

Some further particulars are now available regarding the organization of the Australian zinc producers to eliminate alien-enemy control and to provide an outlet for Australian zinc products. It will be recalled that the Zinc Producers' Association Proprietary, Ltd., was organized at Victoria, South Australia, on May 20, 1916, with a nominal capital of £100,000 in £1 shares.

After enumerating the various steps taken to eliminate alien-enemy control, the London *Financial Times* states that the number of directors is not to be more than 15; that each of the following companies may nominate one director: Broken Hill Associated Smelters Proprietary, Amalgamated Zinc (De Bavay's), Broken Hill South Silver Mining Co., Broken Hill Proprietary, Block 10 Co., Broken Hill Proprietary Block 14 Co., Junction North Broken Hill Mine, Broken Hill Proprietary Co., Mount Lyell Mining and Railway Co., Sulphide Corporation, British Broken Hill Proprietary Co., Zinc Corporation. The Burma Corporation, Ltd., is also mentioned as having power to nominate a director if it become a member of the company.

There is to be a London board, an advisory member of which may be appointed by the Imperial Government. The directors on Oct. 18 were: W. L. Baillieu, W. M. Hyndman, M. Cohen, G. A. Grant, A. Campbell, B. Kelly and J. L. Wharton, all of Melbourne; F. C. Howard and B. A. Moulden, both of Adelaide; D. E. McBryde, North-road, Brighton; F. A. Govett, 20 Copthall Ave., E. C.; F. A. Keating, 22 Bishopsgate, E. C.; and W. H. Woodhead, Ilyes, Rudgwick, Sussex. The British address is at Pinners Hall, Austin Friars, London, E. C., where W. S. Robinson is the statutory agent.

Chino Copper Co.

The report of the Chino Copper Co., Santa Rita, N. M., for the third quarter of 1916 shows a production of 20,606,723 lb. of copper; 6,883,403 lb. in July, 6,326,116 lb. in August and 7,397,204 lb. in September. Total amount of ore treated was 801,500 tons, or 8,712 tons per day. Average copper content was 1.89%. Recovery per ton was 25.71 lb. There was produced 62,531 dry tons of concentrates averaging 16.48% copper. Aside from that produced in milling, 44,038 lb. of copper was recovered from precipitation plants at the mine. Cost per pound of net copper, after allowing for smelter deductions and crediting miscellaneous income, was 8.17c.

Total income was $3,445,292; dividends paid, $1,957,455; net surplus, $1,487,837. Earnings are based on 25.61c. per lb. for copper. In addition to the regular quarterly dividend of $1.25 per share, an extra of $1 was paid, making a total of $2.25 paid during the quarter.

Katanga Copper

At the annual meeting of Tanganyika Concessions, Ltd., a few weeks ago, Robert Williams, managing director, made interesting statements respecting the performances and position of the Union Miniere du Haut Katanga—the operating company. Mr. Williams said in part:

The Union Miniere company has already made large profits, and although we are still unable to get the interest of these profits, to which we would be entitled in normal times, it is a great satisfaction to know that they are accumulating month by month, and will continue to do so until we return to Brussels, where they can be dealt with. I have made every endeavor to arrange some plan by which the company could get an advance on these profits—so far, without success. It has seemed to me that, as the Belgian government owns about 35% and the Tanganyika company about 40%, or 75% of the Union Miniere company between them, these two large shareholders might arrange a division of profits now, which they could agree to ratify at the first general meeting of the Union Miniere company in Brussels. These are the lines on which I have been negotiating with the Belgian government—so far, without success.

The Union Miniere company's operations have made rapid progress since the war began. When war broke out, I wrote a letter advising my colleagues of the Union Miniere company in Brussels to continue operations, as they seemed on the point of shutting down. Our Belgian colleagues agreed to my suggestion. We started these operations in London without a shilling in the company's coffers. We struggled on in the early days of the war with copper at a price which barely covered the increased expenses. It was a desperate struggle, and had it not been for the credits given us by our own employees, shipping, coal, railway and other companies, we could not possibly have weathered the storm. It was with the greatest difficulty we could sell our copper in any large quantity, but by entering into a contract for the sale of our whole output during the war on the same terms as we had formerly sold our copper in Brussels, we were enabled not only to carry on our works, but to greatly accelerate the erection of another two furnaces and our operations generally.

Increase in Copper Production

Copper has since then gone to a very high price, and as a result we have not only been able to double our furnace plant, but we are actually trebling it, with the result that at no distant date we shall be running seven furnaces, with one spare, instead of the three we started with at the beginning of the war, all of which will be paid for out of profits. The output of copper has gone on steadily increasing, as is shown by the following figures: 1911, 997 tons; 1912, 2,492 tons; 1913, 7,407 tons; 1914, 10,722 tons; 1915, 14,190 tons; 1916, 25,000 tons (estimated); and next year it will probably reach something in the neighborhood of 40,000 tons, provided the Katanga railway is rapidly equipped to deal with the traffic. This railway has been running under very difficult conditions, for want of rolling stock, and it is highly creditable to the management that it has been able to deal with the traffic so well as it has done, and equally creditable to the manager and staff of the Union Miniere company that they have been able to keep up the copper output under the circumstances. The cost of producing copper has been reduced considerably by the latest improved furnaces. These furnaces show a saving of about £5 per ton of copper at the works, which has compensated in some measure for the increased cost of shipping and other charges caused by the war. The cost of copper at the works for 1916 has been: By old furnaces, £27 16s.; by new furnaces, £22 15s.; or an average price of £25 12s. The cost of rail, freight, insurance and sundries has been £15 19s. 3d.; the total cost, delivered in England, £41 11s. 3d. In normal times and with our improved furnaces, this cost would be about £30 per ton. The entire copper production has been sold in England at an average price of £102 for 1916. When I last addressed you, I told you I believed the accumulated profits of the Union Miniere company would be £1,000,000 sterling by the end of 1916: These profits will be about double that figure.

WHEELER RECOMMENDS LEACHING

Perhaps the most important news I have is that Mr. Wheeler, in his report received a few days ago, states in the most emphatic and clear manner that there will be no difficulty in treating the low-grade ores either by concentrating and smelting or by leaching, and he recommends the leaching process and points out that by leaching we can also produce copper from our high-grade ore cheaper than by smelting; and he also recommends an installation to produce 50,000 tons of electrolytic copper per annum by the application of the hydraulic-power scheme planned by the Swiss engineers sent out by the Union Miniere company some years ago.

THE COMPANY'S RAILWAY INTERESTS

With regard to the other great asset which your company owns—namely, 90% of the Benguella railway, the other 10% being held by the Portuguese government—I have had various interviews with ministers, contractors and financiers, in connection with this railway, with a view to restarting construction from both ends; namely, from the Katanga side and from the Portuguese side. Up to the present it has been found impossible to get railway material in this country, and the Benguella railway section alone would cost about £1,200,000 extra if it were to be constructed at this time, with material coming from America; but you may depend upon it no time will be lost in carrying this railway to completion right through to the mines by the Belgians and ourselves, at the earliest possible opportunity and when it can be done with efficiency and economy. Meantime you will see from the report of the Benguella Railway Co., which has been handed to you, that that company continues to show an increasing surplus over working expenses from year to year, as is shown by the following comparisons: 1912, £20,955; 1913, £27,672; 1914) year war broke out and traffic down), £15,807; 1915, £11,066; 1916 (six months to June), £22,571. You will also see from Vice-Consul Beak's report the brilliant prospects he holds out for the future of this railway. As you are aware, the railway is being built to serve Katanga mineral traffic, and it is only when that traffic is running over it that the railway will show the big income we expect from it, which has been estimated at from £280,000 to £600,000 per annum, based on a mineral traffic of 40,000 tons of copper output per annum. I may add that this railway will, when connected to the Belgian Congo railways, add greatly to the paying capacity of these railways, as it will give a much longer haulage over these lines than they at present have. The Rhodesia-Katanga Junction Railway and Mineral Co., in which you are interested to the extent of 70%, has leased its line to the Mashonaland Railway Co. at a rental of £11,000 per annum, which is the sum required for the payment of the former company's debenture interest. Half of any sum earned above that amount is payable to the Rhodesia-Katanga Railway Co. It will thus be seen that while your company is relieved from paying the debenture interest, it is indirectly interested in the profits. The traffic for last year, as you will see, resulted in a profit of £11,066, the falling off in the earnings being due to the present conditions, in consequence of which there was a decrease in the general goods and construction material and also in the passenger traffic. An improvement, however, has already been made this year, and the figures to the end of August last show a profit for the eight months of about £17,000.

SMELTING OPERATIONS

We have not restarted smelting at the Kansanshi mine, as in the present circumstances it is quite impossible to get the necessary white and black labor to restart work on the high-grade ore, but when the time comes to continue smelting, I hope to be able to also have a plant for treating the low-grade ore, which will give good results, as we have solved the treatment of these ores. As we control the Rhodesia-Katanga company, the advances made to that company by us will be repaid as the copper is produced and sold. We intend restarting the production of copper next spring at this mine, if labor and other conditions are fovorable.

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Ray Consolidated Copper Co.

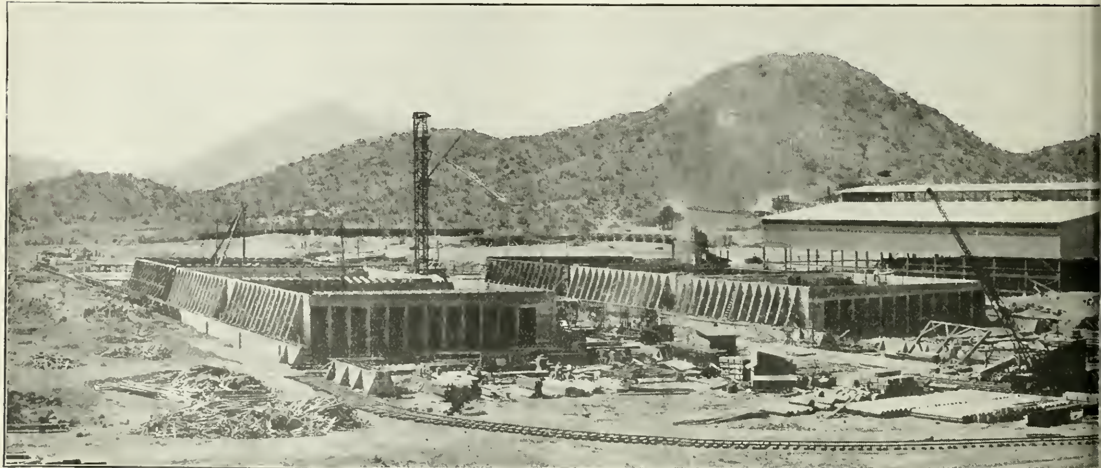
The report of the Ray Consolidated Copper Co. for the third quarter of 1916 shows a total production of 19,061,727 lb. of copper; 6,606,657 in July, 6,400,636 in August and 6,054,434 in September. In addition to copper from concentrating ores, 620,734 lb. was contained in ores shipped direct to smelter. Total ore milled was 849,100 dry tons averaging 1.571% copper. Milling cost was 54.99c. per ton, and average mining and coarse crushing costs were 83.77c. per ton.

Average cost per pound of net copper produced was 10.348c., including a charge of 12½c. per ton of ore milled for retirement of mine-development expense, and after crediting dividends of the Ray & Gila Valley R.R., revenues from gold and silver, and all miscellaneous income. Total profit was $3,299,400; dividends paid $1,182,884, leaving a net surplus of $2,116,516. Earnings are based on 27.722c. per lb. for copper. The eleventh quarterly dividend of 75c. per share was paid.

Photographs from the Field

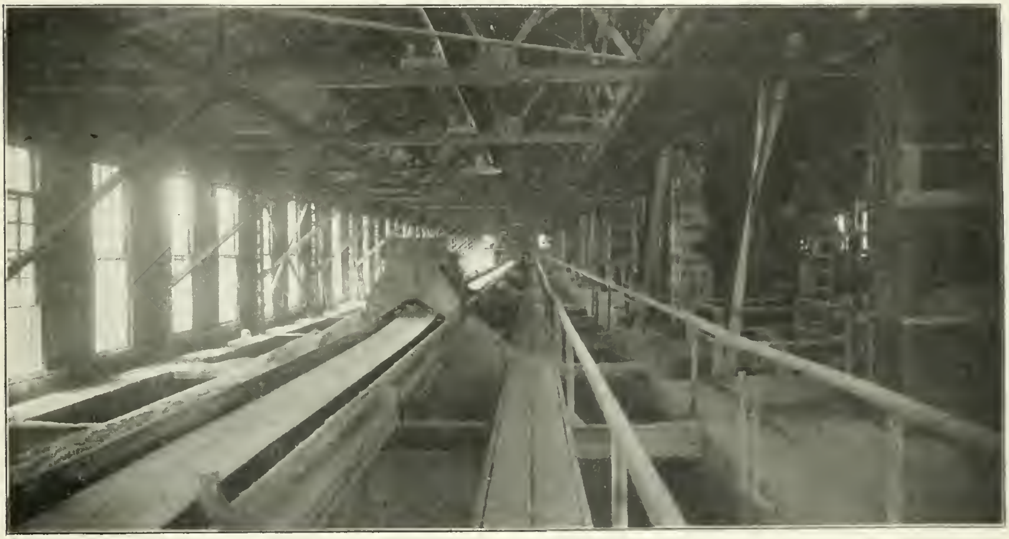
EMPIRE MINES' MINE-RESCUE TEAM WON FIRST PRIZE AT CALIFORNIA STATE FAIR

The mine-rescue team was composed of R. W. Rodda, T. Evely, C. Oates, F. Carter and F. Hooper. The Empire Mines' first-aid team won second prize in the first-aid contest; it is composed of J. Luzmoor, J. Ball, J. A. Hendricks and J. Quick; L. Prisk is the "patient"

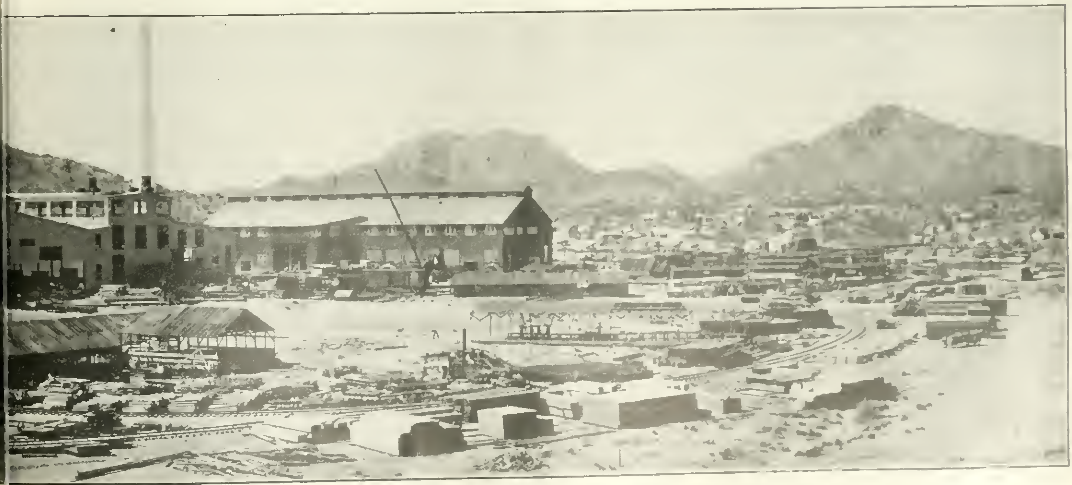


PANORAMIC VIEW—TAKEN SEPT. 16—OF 5,000-TON LEACHING PLANT UNDER

PAY DAY AND MINERS' HOMES AT ONE OF THE PATIÑO TIN MINES, UNCIA, BOLIVIA



CRUSHED-ORE STORAGE BINS AT FEDERAL LEAD CO., FLAT RIVER, MO.



CONSTRUCTION IN AJO DISTRICT, ARIZONA, FOR NEW CORNELIA COPPER CO.

The American Mining Congress

That the anthracite operators are opposed to uniform mining legislation and that the Northwest Mining Association is convinced that politics is playing a part in the location of the mining experiment station for the Northwest, were two of the important developments of the first day's session of the American Mining Congress. A representative assemblage of mining men from all the important coal and metal producing states is taking the keenest interest in the sessions of the Congress which was called to order this morning.

Interest at the morning session was concentrated on the meeting of the Uniform Mining Legislation Section. After J. G. Grossberg, of Chicago, had explained that the meeting was called with the hope that uniform mining legislation might be pressed from a conversational stage to one more promising of results Robert H. Harlin, of Seattle, representing the United Mine Workers of America, pointed out the evils of allowing the mines inspection service to be at the mercy of the political whims of each change in state administrations. He also urged that all mine foremen be required to pass a technical examination before being allowed to go on duty. He also contended that it is highly necessary for mine superintendents to be obligated to take the same examinations as the mine foremen.

During the discussion of Mr. Harlin's paper the opposition of the anthracite operators to the plan for uniform legislation developed. It seems the consensus of opinion among the operators of anthracite mines that the conditions surrounding their industry are so dissimilar that it would be impracticable to attempt to frame a set of laws which would apply to the bituminous coal industry without imposing undesirable restraints on the mining of hard coal. George S. Rice, Chief Mining Engineer of the United States Bureau of Mines, at this point, expressed the firm conviction that there are certain fundamentals which apply equally and without discrimination to the bituminous and to the anthracite industry. H. H. Stock, of Urbana, Ill., also expressed the opinion that uniform legislation is entirely feasible, and he pointed out that the need was so great as to make some action at this meeting very desirable.

Addresses of welcome from prominent Chicago men took up the greater part of the afternoon session Monday, but when the roll of the states was called to which answer was made as to the most important mining issue in the commonwealth designated, a number of matters which excited lively discussion came up. The sensation of the afternoon, however, was the presentation of a resolution by the Northwest Mining Association, represented at the convention by Sidney Norman. Despite the fact that official announcement has not been made as to the location of the Northwest Mining Experiment Station, the resolution took it for granted that Seattle had been designated. The resolution stated that politics evidently is playing a part in the location of the Northwestern station. Mr. Norman declares that Seattle is 500 mi. from any important mining region in continental United States and that its principal tributary territory is Alaska, which already has a station at Fairbanks. Due to the fact that all but 2% of the mineral production of the Northwest is produced west of the mountains, Mr. Norman contends that the station should be at Wallace or some other point near the centers of big productions.

In the responses from the states a frequent complaint was that too many laws are hampering the industry. Nearly every coal mining state, according to its representatives, is seriously in need of a system of uniform cost accounting. W. S. Bogle, an Indiana operator, made an earnest plea for the removal of legal obstacles preventing limited coöperation among those engaged in any business. He praised the broad view taken by the Federal Trade Commission on this question.

A resolution based on replies from mine operators from Tennessee was presented by A. H. Purdue. It reads as follows:

"Resolved that the greatest needs of the mining industry in Tennessee are: Coöperation among coal-mining operators, under proper control, for the purpose of securing reasonable prices; the removal of the state convicts from the mines or the state becoming a party to the proposed coöperation; a uniform system of cost accounting for the operators; improved railroad facilities into the coal field, and the area to the south and southeast, including the seaboard; and the development of the state's manufacturing industries to provide a home market for its mineral resources."

Dr. I. C. White, Chief Geologist of West Virginia, predicted that within 5 years his state would produce more bituminous coal than Pennsylvania. The crying needs at present are for more markets for coal within the state and for more coal carrying rolling stock.

Minnesota, while entirely satisfied with the development of its iron-ore tonnage, believes that the profits are not equally divided between the producers of the raw material and the manufacturers of the finished products.

South Dakota entered a bitter protest at not being able to share in the general prosperity which is coming to other mining states. With the purchasing power of gold depreciated 30%, the principal mining activity in South Dakota is laboring under a handicap.

Utah Copper Co.

The report of the Utah Copper Co. for the third quarter of 1916 shows a total production of 61,079,924 lb. of copper: 20,302,228 lb. in July, 20,315,440 lb. in August and 20,462,256 lb. in September. A total of 3,404,300 tons of ore, averaging 1.4484% copper, was treated, with an average extraction of 61.94%. Average cost of net copper produced was 6.322c. per lb. after allowing for smelter deductions and crediting miscellaneous income from Utah only, including the Bingham & Garfield Ry. earnings. Total net profit was $12,049,460, and dividends paid were $4,873,470, leaving net surplus of $7,175,990.

Earnings are based on 25,364c. per lb. for copper. The regular dividend at the rate of $6 per year was paid and an extra dividend of $1.50 per share, making a total of $3 per share for the quarter.

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Gold Value of the Far Eastern Rand, where prospected, is conservatively estimated as £450,000,000 by the government mining expert, Mr. Katze. The "Statist," of London, quotes the above figure in a recent article dealing with the importance of the region; calling attention to the fact that the ordinary run of investors in the shares of gold companies, who fix their eyes on their own pet investment, ignore the vastness of the whole proposition. The value of total gold yield of the region, from start of milling to Dec. 31, 1915, is given as £29,700,000. The total value of gold output of the Witwatersrand since discovery to Dec. 31, 1915, is given as about £454,000,000; the inference being that the future of the newer region may prove as interesting as the past of the Rand proper.

Editorials

Selling Ahead

The new practice of selling metals for delivery far ahead is going to be productive of some complications that may not be pleasant later. It has long been the custom in copper and spelter to do the business on the basis of two-month and three-month contracts. The common terms in lead, on the other hand, have been "shipment within 30 days." During the last two years, however, copper and spelter have been repeatedly sold a year ahead. Of late some business has been done in copper extending to the end of 1917.

The ideas about this are manifold. On the part of the manufacturer, if he has contracts for his own products running a year ahead he may be desirous of covering his requirements of raw material therefor and getting that off his mind. In munitions contracts with foreign governments there is no particular danger of welching on the part of their customers. For that matter, indeed, private buyers are in the main animated by the highest principles of business. If they find themselves caught in the results of bad judgment they face the music.

In the early days of the munition business there were contracts given to some new and rather irresponsible concerns, who were regarded dubiously when they came to placing their orders for copper, not so much from any question as to their good faith but rather upon the chance that they might fail in their contracts. We heard of some such copper business being taken at a premium that was considered to compensate for the risk. In general, however, the major metal business is so conducted that losses from bad debts or failure to meet obligations are negligible.

The producers who sell far ahead sow dragon's teeth of quite a different sort. If one producer be smart enough to sell all of his output for a year ahead he may stand off and rejoice. If all producers should sell all of their output for a year ahead they might do likewise. But if most producers dispose of only a part of their output the day of reckoning is sure to come. That is when the craze for buying is over, when consumers find that they have overbought and themselves come into the market as sellers and create demoralization.

What we are witnessing now in copper is exactly what we did in zinc about 12 to 15 months ago. At that time the zinc producers had disposed of most of their expected output for months ahead. It looked as though there were going to be a zinc famine, as if many consumers would have to go without their supplies. But somehow or other they managed to get what they needed and before the middle of 1916 consumers of zinc were themselves sellers and there was something like demoralization in the spelter market.

During the last week near-by copper has sold at 32½c. per lb., a sharp rise from the previous week, indicating the apparent scarcity of it and the urgency of the demand for it. It has been gossiped, however, that the foreign governments, delayed in securing transportation for all that they had previously bought, have been meeting the demand and covering themselves by new purchases for later delivery. Whether true or not, it is just such things that check extravagance and abolish the premium on near-by deliveries. It would be rather a grim joke on the American copper industry if the foreign governments were making a profit by supplying at fancy prices domestic consumers who had overstayed their market.

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Has Unionization Made Miners More Efficient?

In the October issue of the *Mining Congress Journal*, S. A. Driver answers certain arguments of the vice-president of the United Mine Workers of America regarding some earlier criticism of the attitude of unionism to the individual responsibility and efficiency of the mine workers. The union official claims that statistics show that the loss of life is about three times as great in the nonunion as it is in the union mines and that this ought to be proof positive that the U. M. W. of A. is one of the greatest agencies in the country today for the promotion of safety in mines. Mr. Driver considers that the statistician who furnished the figures on which Frank J. Hayes based his statement made a most serious error in his work.

Mr. Driver quotes figures from Bulletin 115 of the United States Bureau of Mines[1] tending to show that the deaths due to common accidents in coal mines, from 1903 to 1913 inclusive (excepting 1909), when reduced to a basis of 2,000 working hours, average about the same for six union states as for six nonunion states. He also quotes statistics compiled by Mr. Fay, showing that for a period ending Dec. 31, 1915, for which continuous records are available, there were killed by explosives for each 10,000 employees in Oklahoma, 8.60; Illinois, 3.10; Indiana, 1.20; Kansas, 6.81; Alabama, 2.70; and Colorado, 2.25; the first four being union states and the last two nonunion states.

In conclusion Mr. Driver says: "The mine-workers' organization has among its various local and general officials many men of unusual mental capacity, among whom are born leaders of men. When they devote their talents and energies to making the miner a safer and more efficient workman, a better man and citizen, the miners' union will become one of the most powerful agencies for good in the industrial world. But at present I see no reason to change my belief that its principal tenet is, *Do less and ask more for it.*"

A mere comparison of fatility rates may be useful as a measure of efficiency as regards the promotion of safety at mines, but a proper conception of efficiency would take into account the factor of production. In this connection Mr. Driver asserts (doubtless with truth and the ability to confirm the statement) that the Welsh miner as an individual workman is the peer of any miner in the world, but that the production per man is among the smallest in the world, the miner's union preventing his realizing the proper return on his ability and skill.

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[1] "Coal Mine Fatalities in the United States, 1870-1914," compiled by Albert H. Fay.

The question propounded in the caption is not one that can be answered by statistics. Figures do not lie, but skillful selection of statistics is an aid to prevaricators. The question of unionism and efficiency must be decided by each individual workman and by each employer. If the respective conclusions harmonize, the interference of any external union or nonunion influence is unwarranted and is likely to reduce efficiency, both as regards safety and production.

In this whole matter there is much food for serious thought on the part of the laboring man. Where there exists between employers a competition for the services of laborers, the result is obviously beneficial to the laborers. Where there is competition between two or more labor unions for the handling of the large sums of money represented by the weekly or monthly dues assessed upon the individual laborers (and of late some agitators have brazenly confessed such motives), the only benefit likely to accrue to the laborer is that derived from waking up to the realization that he has not been getting value received. For then he begins seriously to ask himself: "Has the union taught me to be a better miner? Has the walking delegate shown me how I can produce better results with less physical labor and less danger to myself and my fellow employees? Has the secretary of my local instructed me as to how I may win the respect and admiration of my employer and has he taught me that I should be loyal to my employer?" If the answer be affirmative in every case, then he will know in his heart that unionization has made him more efficient.

Construction, Operation and Maintenance

The construction of a mine plant, mill or smeltery is usually carried out according to plans and specifications evolved from a more or less standard practice for the many component parts. However, standard practice is often stand-pat practice and more or less indigenous to one locality. What is standard in one camp may not be applicable to another. In other words, every plant built differs in one or more details from any similar plant, even though the process for which it is built has been thoroughly standardized. This condition causes many minor changes in details during construction to adapt the practice to suit the local conditions. Foundations may not be feasibly put in according to plans. Piping diagrams often have to be switched around. Trackage cannot always be put in just as laid out. Drains may have to be changed. These are only a few of the minor details that come up in the course of the work.

In the construction of large plants or the addition of units to existing plants, the work is usually performed under the supervision of a resident engineer whose orders—in the form of plans and specifications—emanate from headquarters. He is thus on a par with the plant manager and has for his object the addition of capacity to assist the manager in producing a greater quantity of product. The engineer and his assistants are primarily construction engineers, true to the maxim, "Get the plant built." Its future successful operation is in the hands of the manager and his assistant, who live by the motto, "Turn out the product." Any suggestion from the operating department in regard to minor changes, based on experience, is received most coldly by the construction department. It is annoying, when you are rushing the fifteenth unit to completion, to go back and change the slope in the launders in the seventh, which has just been put in operation, or to renew some piping in the second, which has proved defective after several months of operation. It is usually the policy of the construction department to fall back on the fact that the launders were built "according to the blueprints," and refer the manager to headquarters. After much red tape the manager may succeed in having the change made, much to the annoyance of the engineer, who usually performs the work in as slipshod and hurried a manner as possible.

It seems senseless to build a plant and immediately start to alter it, sometimes even before it is in operation. Of course it is easy to say that the engineer should understand the details of operation for which the plant is built well enough to ferret out probable faults in design and arrange for their correction before that point in the construction is reached. Frequent inspections of the work in company with the manager would tend to reduce the necessity for later alterations. However, anyone who has ever been engaged in plant construction knows that this is impossible. Construction is the proper combination of men, material and time. This presents a problem of three variables, the solution of which gives the engineer no time for the contemplation of the future felicity of operation. When inspecting the progress of work on a mill, he does not think whether the launders will choke on the particular type of sand to be produced or whether the belting is the proper size. His mind is filled with whether all the shafting is in place, whether the throughbolts have come yet, etc.

Similarly, the manager of the units already in operation is too busy with his details to spend much time going over the progress of work in the new areas. All he wants to know is when he can put new parts into operation to increase his capacity.

It seems from these facts that there is something lacking in the organization of large plants. Someone is needed who is thoroughly familiar with all the details of operation and at the same time all the limits of construction. He should investigate all the suggestions of the manager and make all the recommendations to the engineer. He should be present continually during construction and should keep track of the plans far enough ahead to make changes in them before the time of the construction. The less standard the plant the greater should be his powers and the greater his ability. He should be the connecting link between the organizations of the two departments and should endeavor to blend them without interfering with their specific and divergent objects.

At the completion of construction, that is, when everything is built "according to the plans," he becomes a separate oragnization—the maintenance department. His motto becomes, "keep the plant running." It is his job to tell when boiler tubes need renewing, when stacks need cleaning or bearings need rebabbitting. It is up to him to make such changes as are suggested by wider experience. It has been shown by experience that maintenance is disregarded until the end of construction with attendant friction, changes and delays. The maintenance department in an advisory capacity should be always present and should take up its work actively immediately at the conclusion of construction. Much better could the maintenance department change the slope of that launder in the seventh unit and renew the leaky piping in the second than the overworked construction department.

Of course, the smaller the plant the smaller the organization and the consequent merging of the construction, operating and maintenance departments under the supervision of the manager. In the small organizations all the pitfalls mentioned melt under the guiding hand of the manager. He builds as necessary, realizing the requirements of what he is building and keeps in order what is already running and keeps his production up to the average. In large organizations, however, the maintenance department should have a distinct place as soon as work is started on the plant. As soon as units are completed by the construction department the maintenance department should be responsible for them.

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The Great Falls zinc electrolytic plant of the Anaconda Copper Mining Co. is going into operation unit by unit and already is turning out a good deal of spelter, all of which is high-grade. The expected output was sold a long way ahead before the plant went into operation, so the company does not figure much in the market at present. There seems to be but an imperfect realization of what a large zinc producer the Anaconda is going to be.

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It is about time for another revolution in Mexico, anyway. Therefore the reports of a recrudescence of the irrepressible Villa and of the preparations of Carranza for a change are not surprising. The joint commission that has been sitting at New London and Atlantic City continues to sit, but nobody expects anything of it, and the hopes of wheedling wicked Wall Street into lending Carranza a hundred million or so are not bright.

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One of the war commodities that has come down to earth again is sulphuric acid. In the acute period this fetched \$50@60 per ton. Ordinary tower acid is now down to about \$7@8 per ton, which is only a trifle in excess of what it used to be in normal times. The explanation is increased production. The consumption is still very large.

⁂

Again the threat of a railway strike is looming. The railways have been instituting actions to test the legality of the Adamson law. The brotherhoods have told them to drop those actions or face a strike on Jan. 1. Under the new tyranny the railways may not have the ancient Anglo-Saxon right of a day in court.

⁂

Present prices for copper are without any doubt the highest on record. The higher prices quoted during the Civil War were measured by a depreciated currency.

⁂

Now that the political contest is over the public is being informed what was previously known in business circles, viz., that the situation in Mexico is again very alarming.

BY THE WAY

The following simple formula was given in *Iron Age* and is intended for use in finding the individual wage rates of employees:

$$V = \left[K\left(\frac{(B(1 + i + m + ny) + R(1 \pm 2e)}{r(1 + 1.3E \pm 0.3e)(1 + 0.3P_a) + s} \times P_t + \frac{(B(1 + i + m + ny) + R(1 \pm e)}{r(1 \pm 0.6)(E \pm e)(1 + 0.3P_a) + s} \times P_d + \frac{B(1 + i + m + ny)}{r} \times P_t\right)\right]C$$

It appears to include the majority of the entering factors, and any that are omitted may be conveniently lumped either in *K* or *C*, the two "extreme" constants.

⁂

The murder of five Americans at Parral, Mex., is reported in an El Paso dispatch of Nov. 11. The information is said to have come from a source considered reliable by Gen. George Bell and was to the effect that when the Carranza commander retired from the city, he suggested that the Americans in Parral accompany him. Four did but five Americans who remained were arrested by the Villista commander, marched to the plaza and executed. The dispatch states that "Americans known to have been in Parral at time Villistas attacked were: T. G. Hawkins, A. W. Morris, Leslie Webb and Howard Gray, Alvarado Mining and Milling Co.; W. E. Palmer of Parral & Durango Ry.; Dr. T. J. Flannigan, W. E. Cowell of Guadelupe Mining Co.; C. B. Smith, and an American, whose name is unknown at the border."

⁂

Again the German submarine "Deutschland" is with us and again there are all sorts of rumors about the cargo she is going to take back to Germany. Nobody knows definitely anything about the real truth of this matter, but the *Providence Journal* claims to know, and is making public a lot of things that might be considered, in general, secrets. The *Journal* says it has secured many details concerning the cargo, and that it will consist of nine carloads of nickel, averaging 10 tons to a car, and 10 carloads of crude rubber, averaging 18 tons to a car, making a total shipment of 540 tons. According to the same source of information, there still remains in the warehouses of the Eastern Forwarding Co., of New London, a consignment of over 400 tons of crude rubber, and 200 tons of refined nickel, which is apparently stored for export by another submarine. All the nickel aboard the "Deutschland" is said to be part of a consignment purchased in November, 1914, from the International Nickel Co., at Communipaw, N. J. The *Journal* discovered that this consignment was taken by the purchasers, ostensibly German-Americans, but really men acting for the German government in this country, and transported to the storehouses of the Nassau Smelting and Refining Co. at the foot of West 29th St., North River, New York. The nickel was then transferred at various times to the New York Dock Co., in Brooklyn, where it was stored in warehouse No. 104 and placed in casks weighing from 900 to 1,400 lb. The metal was partially in ingots and largely in a form about the size of buckshot. The nickel intended for the voyage of the "Deutschland," last July, was shipped to Baltimore via Pittsburgh. The next movement of the nickel which remained after the first departure, came in the beginning of last September, and soon afterward a number of carload lots were received by the Eastern Forwarding Co., in New London.

Personals

H. F. Collins has returned from Spain and is now in London, Eng.

Ernest Marquardt, of the Associated Geological Engineers, is in Kansas.

C. T. Griswold, of the Associated Geological Engineers, is in Wyoming.

J. J. Remsen has returned from a trip to Cobalt and the Temiskaming region.

J. K. Cogswell is at the St. Anthony mine, near Fort William, Ontario, Canada.

Roger L. Wensley, of New York, is in the Southwest on professional business.

H. D. Kinney has become associated with the Mines Operating Co., at Butte, Mont.

D. W. Buckby, of Wallace, Idaho, is visiting New York. He is at the Hotel McAlpin.

L. G. E. Bignell has become one of the engineering staff of the Colorado Iron Works Co.

J. W. Astley sailed from Liverpool on Nov. 11 for New York He will be in the city about ten days.

W. Lee Tanner is chief chemist of the Bethlehem Steel Co. at its high-explosive plant, New Castle, Del.

C. M. Weld left New York for Cuba on Nov. 14. He will be there on professional business for about two weeks.

H. P. Henderson left New York on Nov. 14 for a short visit of inspection in Quebec. He will return about Nov. 20.

H. F. E. Gamm, of New York, is at Mine La Motte, Mo., where he expects to remain for several months on professional business.

Ray W. Light, of Lebanon, Penn., has been made superintedent of the bessemer department of the Cambria Steel Co., at Johnstown.

W. D. Thornton, president of the Greene Consolidated Copper Co., succeeds Thomas F. Cole as president of the Greene-Cananea Copper Co.

Edward A. Clark has withdrawn from the firm of Giles & Clark, the Giles Drilling Co., 30 Church St., New York, taking over the business.

John F. Martin has again returned to Nicaragua, after an absence of several years, as manager of La Luz & Los Angeles Mining Co. in the Prinzapolka district.

Lieutenant H. T. Durant, of the 11th Hants Regiment, is back in England from France. He lately received the honor of the military cross for services on the Somme.

L. W. Trumbull, state geologist of Wyoming, is at the convention of the American Mining Congress losing no opportunity to present the Western idea of the conservation question.

E. A. Suverkrop, Jr., and bride will sail from New York on Nov. 18 for Chile, where he will again be on the operating staff of the Chile Exploration Co. at Chuquicamata.

John Francis Manning and Edwin Walter Mills, of the Seoul Mining Co., of Chosen, are making a long visit in the United States, from which they have been absent for a good many years.

T. C. Desollars, chief engineer of the Quincy Mining Co., of Hancock, Mich., is at the Mining Congress convention to outline the efficiency ano safety system which are being used at the Quincy property.

Max Ball, of the Bureau of Mines, will stop in Chicago to attend the convention of the American Mining Congress while enroute from an inspection trip to Western oil fields to his office in Washington.

F. M. Wichman, for a number of years superintendent of the Bingham-New Haven mine at Bingham, Utah, and recently operating in Nevada City, Calif., is visiting the East. His temporary address is Montclair, N. J.

H. G. Ferguson, a geologist of the Geological Survey who is now engaged in work in the Mogollon district, will make an examination of Steeple Rock gold, silver and lead district of New Mexico before returning to Washington.

Thomas F. Cole has resigned the presidency and directorate of the Greene-Cananea Copper Co., and the board of the Inspiration Consolidated Copper Co. Mr. Cole has held the presidency of the Green-Cananea company since its organization, eight years ago.

F. L. Ransome, in charge of the section of metalliferous deposits of the Geological Survey, has returned from a two months' tour of Western mining camps. Oo this trip Mr. Ransome visited the Alta, Bisbee, Miami, Ray, Ajo, Mogollon and Magdalena mining districts. In the Ajo district Mr Ransome laid out the boundaries of the topographic map of the district which is soon to be begun.

David White, chief geologist of the United States Geological Survey, has returned from an extended trip through the oil and gas fields of Oklahoma and Arkansas. One of the objects of Mr. White's trip was to make more effective the efforts being made by the Geological Survey to secure cuttings from wells and samples of brines in the region of heavy salt beds and gypsum depositions in Oklahoma.

George S. Rice, chief mining engineer of the U. S. Bureau of Mines, was in San Francisco, Oct. 25-28, arranging for a successor to Edwin Higgins, representative of the Bureau of Mines in the California Industrial Accident Commission. Mr. Rice went to Los Angeles on Oct. 28 and will return to Washington about Nov. 15, stopping en route to visit mining centers where field investigations are in progress.

Deane P. Mitchell, mining engineer, Stanford '95, has returned to San Francisco from Siberia. Mr. Mitchell is a director of the Irtysh Corporation Ltd., developing and operating copper, zinc, lead and coal mines on the Kirghiz Steppe, southern Siberia. He believes that after the European war Siberia will rapidly develop and increase in population, attracted by unlimited natural resources and great waterways.

Sir Richard A. S. Redmayne, chief mine inspector for Great Britain, and president of the Institution of Mining and Metallurgy, has resigned the latter office, in which he will be succeeded by Edgar Taylor, past president and treasurer, who will fill out the unexpired term—to March, 1917. The action was taken in view of the Institution's inquiry into the taxation of mining profits and its proposal for the formation of a governmental department of minerals and metals, the president regarding his position as incompatible under the circumstances with his duties as a government official.

Obituary

Emil Slorer, 72 years of age, secretary and treasurer of the South Hecla Mining Co. and other mining companies in the Little Cottonwood district, died at St. Mark's Hospital, Salt Lake City, Nov. 4, 1916. The case was one of unusual and puzzling features. Mr. Storer, who was a man of considerable wealth, lost the sight of one of his eyes Tuesday. On Friday the other eye became sightless. Dr. H. Van Cott, eye specialist, was called. Dr. Van Cott said that death was undoubtedly due to an acute inflammation of the eyes. He thought that Mr. Storer had been affected with trouble of the eyes for a considerable time, but had probably not thought it serious enough to seek medical advice. The doctor declared that great pressure on the eyes was evident, otherwise Mr. Storer would not have been stricken blind. Mr. Storer came to Utah about eighteen years ago from Indianapolis. Besides Little Cottonwood properties, he was interested in many other mining camps in Utah and Nevada. He also was widely known in the West and had a wide circle of warm friends.

Societies

Mining and Metallurgical Society of America—The New York section held a meeting at the Engineers' Club, New York, on Thursday, Nov. 16, at 8 p.m., preceded by the usual dinner at 6:30 p.m. The subject was "Electric Furnace Practice."

American Institute of Mining Engineers—The sixth annual meeting of the Columbia Section, A. I. M. E., will be held at the Spokane Hotel, Spokane, Wash., Nov. 25. A dinner will be served to the members, after which the program will be followed. This includes the address of the retiring chairman, Stanly A Easton, report of the secretary-treasurer, L. K. Armstrong, election of officers, their installation, and discussion of the mining law revision, flotation and other subjects of technical interest.

American Society of Mechanical Engineers The 37th annual meeting will be held at New York, Dec. 5 to 8, 1916. A program of interesting technical papers has been prepared. Following the meeting, a public hearing will be held on the Boiler Code, Friday, Dec. 8, at 2 p.m., in the Engineering Societies Building. The hearing will continue on Saturday and into the following week, if necessary.

This hearing is in pursuance to the following recommendation of the boiler code committee to the council: "Your committee recommends that you appoint a permanent committee to make such revisions as may be found desirable in these rules, and to modify them as the state of the art advances, and that such committee should hold meetings at least once in two years at which all interested parties may be heard."

Industrial News

B. A. Brennan, formerly contract manager of the Westinghouse Machine Co. and later sales manager of the power department of the Bethlehem Steel Co., has resigned the vice-presidency of Mercantile Trust Co., of St. Louis, Mo., to accept the presidency of the Citizens Co., Inc., of Baltimore.

New Patents

United States patent specifications listed below may be obtained from "The Engineering and Mining Journal" at 25c. each. British patents are supplied at 40c. each.

Agitator for Ore Treatment. Cyrus Robinson, Mount Vernon, N. Y., assignor to Metallurgical Engineering and Process Corporation. (U. S. No. 1,204,069; Nov. 7, 1916.)

Amalgamator. Willon Percival Alderson, Timmins, Ont. (U. S. No. 1,204,231; Nov. 7, 1916.)

Concentration—Mining Machine. Sophus P. C. Borson, Salida, Colo. (U. S. No. 1,203,573; Nov. 7, 1916.)

Concentrator. Lynn W. Barber, Hetland, S. D. (U. S. No. 1,204,333; Nov. 7, 1916.)

Crusher—Gyratory Crusher. Owen E. Brown, Wilmington, Del., assignor to American Manganese Steel Co., Augusta, Me. (U. S. No. 1,202,790; Oct. 31, 1916.)

Crushing Roll. Ray C. Newhouse, Milwaukee, Wis., assignor to Allis-Chalmers Manufacturing Co., Milwaukee, Wis. (U. S. No. 1,203,901; Nov. 7, 1916.)

Dipper Tooth. John O'Fallon Clark, Jr., St. Louis, Mo., assignor to American Manganese Steel Co., Augusta, Me. (U. S. No. 1,202,806; Oct. 31, 1916.)

Drill—Rock Drill. Daniel S. Waugh, Denver, Colo., assignor to the Denver Rock Drill Manufacturing Co., Denver, Colo. (U. S. No. 1,203,284; Oct. 31, 1916.)

Flotation—Separation of Metallic Sulphide Ores. Fleury James Lyster, Broken Hill, N. S. W., assignor, by mesne assignments, to Minerals Separation American Syndicate (1913) Ltd., London, England. (U. S No. 1,203,372; Oct. 31, 1916.)

Furnace-Feeding Device — Automatic Feeding Device for Furnaces. Percy Q. Williams, Cincinnati, Ohio, assignor to the Charles Boldt Co., Cincinnati, Ohio. (U. S. No. 1,201,664; Oct. 17, 1916.)

Induction Furnace. James R. Wyatt, Philadelphia, Penn., assignor to the Ajax Metal Co., Inc., Philadelphia, Penn. (U. S. No. 1,201,671; Oct. 17, 1916.)

Lamp—Miner's Acetylene Lamp. Augie L. Hansen, Evanston, Ill., assignor to Justrite Manufacturing Co., Chicago, Ill. (U. S. No. 1,202,514; Oct. 24, 1916.)

Roasting—Ore-Roasting Furnace. John Harris, Sheffield, England. (U. S. No. 1,203,613; Nov. 7, 1916.)

Separation—Process of Gravity Liquid Separation of Iron Ores. Arthur J. Moxham, Wilmington, Del. (U. S. No. 1,203,897; Nov. 7, 1916.)

Assessments

Company	Delinq.	Sale	Amt.
Big Cottonwood, Utah	Nov. 6	Nov. 24	$0.01
Blue Bull, Nev	Oct. 16	Nov. 20	0.01
Blue Star, Ida	Sept. 25	Nov. 21	0.02
Buffalo, Ida	Nov. 15	Dec. 12	0.005
Cedar Creek, Ida	Oct. 23	Nov. 23	0.01
Christmas, Utah	Nov. 20	Dec. 16	0.005
Comet, Ida	Oct. 20	Nov. 20	0.00075
Confidence Silver, Nev	Nov. 8	Nov. 29	0.10
Cornet, Ida	Oct. 20	Nov. 20	0.00075
Cottonwood King, Utah	Nov. 14	Dec. 1	0.005
Cunapah, Utah	Nov. 8	Nov. 25	0.01
Diam. Blk., Butte, Nev	Oct. 12	Nov. 18	0.01
Diamondfield Bl'k B'tte, Nev.	Oct. 12	Nov. 18	0.01
Duluth, Ida	Oct. 18	Nov. 18	0.001
Emerald, Utah	Nov. 15	Dec. 9	0.00½
Enterprise, Ida	Oct. 19	Nov. 20	0.002
Friend, Ida	Oct. 21	Nov. 24	0.002
Hale and Norcross, Nev	Nov. 8	Nov. 29	0.03
Idaho & L. A., Ida	Oct. 16	Nov. 17	0.005
Idaho Mont, Ida	Oct. 30	Nov. 18	0.002
Idaho-Nevada, Idaho	Nov. 15	Dec. 16	0.002
Lehi Tintic, Utah	Nov. 8	Dec. 2	0.0025
LeRoy, Ida	Oct. 28	Nov. 28	0.005
Lion Gold, Utah	Nov. 13	Dec. 5	0.0025
Mary Ellen, Utah	Nov. 11	Nov. 28	0.001
Mexico G. & S., Nev.	Nov. 25	Dec. 18	0.10
Military, Ida	Oct. 25	Nov. 25	0.00025
Mines Dev., Utah	Nov. 17	Dec. 7	0.30
Monarch-Pgh., Nev	Oct. 23	Nov. 27	0.01
Naildriver, Utah	Nov. 4	Dec. 4	0.01
Nevada-Stewart, Ida	Oct. 2	Dec. 2	0.002
New Hope, Ida	Oct. 11	Dec. 11	0.002
Nonpareil, Ida	Oc. 23	Nov. 23	0.001
North Franklin, Ida	June 19	Nov. 23	0.005
North Star, Ida	Oct. 10	Dec. 5	0.001
Paloma, Utah	.....	......	0.015
Pittsburgh Cons., Utah	Nov. 17	Dec. 8	0.0175
Raven, Ida	Oct 23	Nov. 20	0.001
Rico-Argentine, Colo.	Nov. 18	Dec. 5	0.01
Seg. Belcher & Midas, Nev.	Oct. 30	Nov. 24	0.02
Selma, Utah	Nov. 4	Nov. 23	0.005
Silver Moon, Ida	Nov. 25	Dec. 23	0.005
Silver Mt., Ida	Oct. 21	Nov. 24	0.002
Sonora, Ida	Nov. 15	Dec. 6	0.004
Tobar, Nev	Nov. 2	Nov. 23	0.002
Torino, Ida	Oct. 20	Nov. 20	0.001
United Tintic, Utah	Nov. 11	Nov. 28	0.005
Utah Arizona, Ariz.	Oct. 31	Nov. 25	0.005
Utah United, Utah	Nov. 15	Dec. 4	0.01
Zuma, Utah	Oct 30	Nov 30	0.005

Editorial Correspondence

SAN FRANCISCO—Nov. 8

East Belt Mines, in Tuolumne County, are unusually active. Ten or more properties are now in operation. Columbus at Cherokee will deepen its main shaft to 500 ft. Carlotta mill stamps are dropping on good ore recently developed. Garfield mine, near Tuolumne, has contracted for 200 ft. of sinking. The Confidence will soon resume operation. The Duffield at Arrastraville, is under option and the tunnel is being cleaned out. North Star is preparing for extensive development. United Mines Co., near Tuolumne, is reported to be under negotiation with mining operators now interested in other parts of the country.

Production of Tungsten Ore and concentrates in California and western Nevada has declined on account of the reduced price and inactivity of the market. In the first half of October the mill at Atolia was running one 8-hr. shift a day and a number of small deposits were being worked in the Atolia district in San Bernardino County. The mines at Bishop, Inyo County, were extracting and treating ore regularly and the mill at Sodaville, in western Nevada, was also in steady operation. It is reported that the mines at Bishop and at Sodaville have temporarily closed and that smaller amounts of ore are being purchased by the mill at Atolia. The tungsten boom that was inaugurated in the last half of 1915 and continued into 1916, had the effect of opening up a large number of scheelite deposits and prospects. A number of the prospectors and operators made money while the boom lasted and a large amount of money was invested in the building of new mills and developing new territory. Irrespective of the gains or losses resulting from these investments and operations, a great benefit has been brought about by the corroboration of the opinion of old-time prospectors on the desert that there was enough undeveloped scheelite to supply almost any demand for tungsten ore.

Happy Camp District, situated in the far northwestern corner of Siskiyou County, is having a deserved boom in copper mining. The lack of transportation has prevented investors from undertaking development, and the prospect of railroad construction is still remote. But the transportation problem has been partially solved by the installation of freight and passenger motor trucks, running from Happy Camp to Yreka and Hornbrook. Also regular daily mail stages and an extra stage for parcel post and express, and animal-drawn freight wagons have also been put on the road. These improvements in transportation have had a stimulating effect upon the owners of both copper and gold properties and prospects. The Grey Eagle company, which recently attracted the attention of Eastern investors, has done a good deal of development and has purchased the Wright ranch, on Indian Creek, is building a road into Luther Gulch and constructing boarding and bunk houses for a large number of miners. The company is also operating the Howard-Davis copper mine on Clear Creek. The Crompton-Maddox company has disclosed good ore at 50 ft. and is developing. The Copper Mountain, the Bourse and the Bon Ton are preparing for active development. The Mohawk has been bonded to M. A. Delano, of Grants Pass, Ore. The Bradley-Stork company, operating a gold property on Independence Creek, is building a road from Klamath River to the mine, a distance of 14 mi. There are approximately 50 single claims being worked and there is an early-day activity prevalent. Altogether Happy Camp is in a way to attract the attention of wideawake investors.

Amador County Labor Strike Ended after the union learned of the determination of the mine owners to resume operation. Votes were cast at two meetings of the union, one at Jackson and the other at Sutter Creek. A majority of 17 in a total vote of 137 were in favor of returning to work. This total represents approximately one-half the striking element of the union. Western Federation officials sent from Denver advised calling off the strike, on the ground that it was not called "in accordance with the constitution of the Western Federation." A full complement of men cannot be obtained at present, but enough have shown willingness to return to prove that 1,500 men cannot be forever dominated by a handful of their fellows. It required six weeks of idleness and a loss of more than $150,000 in wages to put courage into the men not directly engaged in the strike. Possibly the report that strikebreakers would be brought in unless the former employees got busy had some effect. The almost absolute certainty that the courts would make permanent the injunction against interference of strikers probably gave them courage. At any rate more than 25% of the full complement of men expressed by petition or otherwise their desire to be taken back under the conditions and wages that obtained prior to the strike. There is no doubt that as many more would have been included but for the fact that nearly one half of the idle miners in the county left the districts immediately after the strike was called. It is expected that a large percentage of these men will return and that within a few months or even weeks, the mines will all be working full handed. The union has declared the strike off; there was nothing else to do; and now the officials of the Western Federation of Miners are reported to be saying that the strike was ill-advised. That was admitted by the secretary of the union when the strike was demanded by a majority of the 250 members of the union who were present at the strike meeting. The wonder of the whole situation is that so large a number of American citizens who have homes in the county, families to support and children to educate, should permit themselves to be frightened away from their work or persuaded to make unfair demands upon their employers. And the greater wonder is that this condition should arise when it was commonly reported that the voluntary raise in wages of last April was to have been repeated next April, possibly in January. The continued existence of a labor union which is controlled and dominated in its local affiliations by men who are not, and probably will never become, American citizens, is extremely doubtful.

BUTTE—Nov. 9

The Growth of Butte is a subject that attracts the attention not only of Butte's own citizens but of many outsiders. The payrolls of the Butte mines for October will be the largest in the history of the camp and the total will pass the $4,000,000 mark. Probably few communities of similar size can offer such a showing. Anaconda, Butte & Superior, North Butte and the Clark interests will pay to the men in the mines $2,340,000; another half million is paid by the Anaconda company to its smeltermen; adding to this the payrolls of other mining companies and those of the industries, directly or indirectly connected with mining, the total will reach the startling sum mentioned. Butte with its adjacent suburbs now has a population estimated at 100,000, which is growing by leaps and bounds and much faster than accommodations can be provided for for the newcomers. Though probably more than a thousand new buildings have been erected during the year, and numberless others are in course of construction, there is not a vacant house or room in the city at present. The hotels and rooming houses are crowded beyond their capacity. Rents are at top notch and continue soaring to unheard-of figures. Increased store rents necessitate increased prices for goods of every description, so that average living expenses have increased nearly 50% within the year. As a result, those who do not directly participate in the startling prosperity of the camp are hard pushed in their endeavor to make both ends meet. With the development of the eastern section of the Butte district and the promising results derived from it added to the already highly developed and exploited zinc resources of the camp, and the opening of new and large orebodies in the older mines on Anaconda hill, Butte is experiencing one of those old-fashioned booms, based, however, on the discovery of tangible natural resources, the existence or value of which not so very long ago was not thoroughly appreciated. Seemingly, the camp has entered a new era of prosperity and expansion, the magnitude of which it would be hard to predict.

DENVER—Nov. 9

Downtown Mines Co. at Leadville has begun regular shipments of ore. This project has been considerably delayed in being brought into production by the wholly unexpected tapping of a strong water course after the mines had been successfully unwatered. As yet, the only shipments are of high-grade manganese ore carrying a small quantity of silver, but shipments of zinc ore are counted upon to constitute the chief production when the property gets fully under way.

Revision of the Mining Law was urged at a meeting of the mining bureau of the Denver Civic Association. R. A. Parker, chairman of the mining bureau, stated that the present Federal laws had resulted in controversy, litigation and expense together with the retardation of mining development during long periods of litigation. He said that the situation had become so complicated that a thorough and intelligent investigation is an essential preliminary to the modification of the mining laws. Mr. Parker also declared that the public domain in the 11 states situated west of Kansas comprises 471,000,000 acres—13,000,000 acres in Colorado—and that the policy of the Federal Government concerning the disposal and utilization of this enormous area will be of vital concern to Colorado and the other 10 states. Bulkeley Wells will head Colorado delegation to present matter before American Mining Congress.

SALT LAKE CITY—Nov. 10

Prosperity in Mining as well as in other industries in this section is reflected by Salt Lake bank clearings. For October these aggregated $[illegible]5,16[illegible],284, an increase of $10,[illegible]1,828 over the clearings for September, and an increase of $16,018,831 over last January.

Dugway District Is More Active as a result of the beginning of work on the railroad into the Deep Creek section, adjoining Dugway on the west and separated from it by the Fish Springs Range and intervening valleys. Recently the Bullion Hill property in the Dugway district made a 33-ton shipment of high grade lead ore, carrying also copper and silver; shipment averaged 48% lead, 9 oz. silver and 1.9% copper. The shipments are made by auto truck over a 51-mi. road to Faust station on the Salt Lake route. The Bullion Hill property is owned by J. P. Nelson, A. K. Tiernan and H. H. Green, of Salt Lake. The Laurel mine, adjoining the Bullion Hill and Golconda claims in the southern end of the district, has also made a recent shipment of high-grade lead ore; the ore from this property is mainly galena but carries some rarer minerals, linarite and caledonite, basic sulphates of lead and copper. Another developing mine in the Dugway district is the Piedmont, also owned by Salt Lake men. In the Deep Creek section, the Western Utah Copper Co. is preparing its mine for shipments on completion of the railroad. On the latter four gangs are at work, the grading contract having been let to the Utah Construction Co. The railroad is expected to be operating early next year.

Ohio Copper Stockholders received the first definite details of proposed re-organization plans from the North American Liquidation Co. on Nov. 9. Some details were announced last week. A new company is proposed with 2,500,000 shares, par value $1. Underwriters to take 1,500,000 shares at par; 850,000 shares to be placed in the treasury for the purchase of the Mascotte tunnel, railroad, etc.; 150,000 shares to be retained by the company for reorganization purposes. The underwriters syndicate offers, through the shareholders' committee, to the old stockholders (1,[illegible]000 shares of Ohio issued) who deposit their stock with the New York Trust Co. the right to subscribe for 1,350,000 shares at $1 a share, each depositing shareholder having the right to subscribe and pay for the same number of shares as that deposited by him. If all old stockholders subscribe they would own the property free of all mortgage or other indebtedness and have nearly $200,000 working funds in the treasury. The underwriting syndicate will be obliged to provide and are stated to have ready on the committee's call the full amount needed to redeem the property at whatever figure may be fixed by the court. It is conceded by all that the property is at present fairly worth much more than its obligations. By the decision of the court the committee is privileged to pay into court the amount it finds due less whatever sums have been realized from the property by the trustees in bankruptcy, receivers and purchaser at the foreclosure sale. It is estimated that the amount required to acquire all assets of the company will be $1,100,000. The amount of bonds and accrued interest is $1,500,000, and net credits are $100,000. All shareholders shall be privileged to participate in the reorganization.

MORENCI, ARIZ.—Nov. 10

Strike at Arizona Copper Co. followed discharge of man for insisting on taking a longer siesta while on shift than the agreement calls for. Result is that all employees are out. When night shift of Nov. 4 went to work at the [illegible] mine and found that Don Juan or José, as the case may be, actually would not receive any pay for the two weeks he was laid off for sleeping on the job, they were astounded. It was too much. They hoisted a red handkerchief on a candle stick, fell in and marched right back again. All the company's other miners came out in sympathy, and as a consequence the A. C. workings [illegible]. Of course, the case had been gone over thoroughly by the proper grievance committee, but the decision was against Juan, or José, [illegible] the committee had been illegitimately influenced. And the "Grand Covenant" lost its binding power, if it ever had any. But the strikers are not unanimous. They are quarreling among themselves. The Americans, Spaniards and Italians want to work, but the Mexicans won't stand for it. And the Mexicans are [illegible]. So the "whites" are holding indignation meetings and such like, and for a time tried to raise the fuss to the dignity of a race war. The first flush of excitement and election now being over, however, the matter is easily recognized as a row within the ranks. The attitude of the company seems to be to keep hands off until the brethren come to some understanding among themselves as to what they want to do. Notwithstanding a great deal of talk and some apprehension to the contrary, the strike has not spread to any of the other companies operating in the district, and it looks at this time as if the trouble would be confined to its present limits.

OATMAN, ARIZ.—Nov. 8

Oatman Bureau of Mines has been organized to keep Oatman before the public as the livest gold-mining camp in the country. A publicity fund of $1,500 has already been subscribed and the following general executive committee named by President W. P. Geary: Judge P. D Overfield, vice-chairman; A. C. Eisen, secretary and treasurer; J. A. Small, cashier ot the Bank ot Oatman; W. F. Gray, of the Times Mining Co.; T. E. Fisher, of the Fisher Building; Frank E. Strong, ot the Red Lion, Empire and Aurora Mining Companies; Sam Bayles, leading merchant, and E. H. McPherson, editor of the "News." While publicity is the object aimed at, the bureau is determined that nothing but genuine publicity, without any "kick back," shall be secured. Therefore, great pains will be taken to verify and authenticate every item of news or every bit of information going out with the stamp of the Oatman Bureau of Mines upon it. "If the Oatman Bureau of Mines sends it out, it's so," has been suggested as a sort of slogan, and the motto of the bureau is to be "Everybody Helps." With this motto put into practice and the truth adhered to in its reports, the Oatman Bureau of Mines should succeed in its laudable effort of securing for Oatman the attention it deserves.

SPOKANE—Nov. 9

A Mineral Exhibit will be established by the Coeur d'Alene Mine Owners' Association in the new quarters of the Northwestern Mining Men's Association in the Spokane Hotel Building. The latter association has taken a long-term lease on a ground-floor apartment, adjoining the Silver Grill and connected with it, and is fitting it up as a permanent home for the organization, where open house will be maintained for visiting mining men. Several thousand dollars will be expended renovating the quarters and furnishing them, and the formal opening will take place the latter part of November on the return of the Spokane delegates from the American Mining Congress in Chicago. The purpose of the Northwestern Mining Men's Association, which is a reorganization of the Spokane Mining Men's Club, is to bring into closer relationship the mining men of the different districts in the surrounding territory and to endeavor to secure legislation, both state and national, beneficial to the mining industry. Secretary Bailey states that the membership includes all the prominent mine managers and owners, and in addition bankers, business and professional men—a combination of interests that assures representative influence in any movement the association may inaugurate.

WASHINGTON, D. C.—Nov. 11

Extension of Forfeiture Decree for idle Mexican mines was announced from Atlantic City on Nov. 13. Luis Cabrera, chairman of the Mexican representation, advised the American members of the Mexican-American Joint Commission that a further extension of 60 days, or until Jan. 14, had been given owners of mines in Mexico to reopen their properties. Under the terms of a decree issued several weeks ago, it was provided that such mines as were not being operated by Nov. 14 would be forfeited to the Mexican government.

Dedication of the $500,000 Building of the U. S. Bureau of Mines at Pittsburgh will take place during the week of Sept. 3, 1917, and technical and scientific societies of the country have been asked by Van. H. Manning, director of the Bureau of Mines, to hold their annual meetings at Pittsburgh at that time. The Pittsburgh branch of the Bureau of Mines is situated near the Carnegie Institute of Technology and the University of Pittsburgh. These institutions will coöperate to make the week a memorable one in the history of scientific gatherings in America. The additional benefits accruing to members of scientific societies, as a result of joint meetings at San Francisco, last year, have been the basis of much favorable comment since then. With this idea in mind Mr. Manning is hopeful that his proposal will be received with favor by many of the national technical organizations.

HOUGHTON, MICH.—Nov. 11

Output of Lake Superior District for the present year has been estimated at between 260,000,000 and 270,000,000 lb. While this is much in excess of previous productions, and considerably larger than last year's, it is locally regarded as conservative.

Mayflower-Old Colony Merger will probably be consummated shortly. There will soon be meetings of the stockholders of the Mayflower Mining Co. and of the Old Colony Copper Co. for the purpose of voting upon the merger. A new corporation with 200,000 shares is proposed. The shares in the old companies will be exchanged share for share in the new company, each company having 100,000 shares outstanding. Precedent to the proposed merger, the Old Colony treasury assets will be brought up to the amount of the Mayflower, so as to join the properties on an equal basis. This will involve an assessment on Old Colony. Officers and directors of the new company will be made up from those of the present companies. The sinking of a shaft is to be started immediately.

TORONTO—Nov. 9

The Short-Lived Calgary Oil Boom, by which so many investors were victimized, is recalled by an exemplary sentence pronounced by the district court at Calgary on George Edward Buck, a promoter found guilty of publishing a false statement regarding the well of the Black Diamond Oil Fields, Ltd. He was given a term of four years in the provincial penetentiary.

A Ruling on Excess-Profits Tax has been made by the Canadian Finance Department to the effect that all contributions by business firms and companies to the Red Cross and National Patriotic funds are to be considered as an expense against profits in calculating the amount of profits liable to taxation under the excess-profits law. As many mining and manufacturing companies have subscribed liberally to these funds this ruling will in such cases considerably reduce the amount to be collected.

The War Tax as applied to precious-metal mines appears to have been definitely settled, the basis being as follows: Capital is taken as five times the profits. Ten per cent. is allowed for depreciation and 7% for interest, and after deducting these two items from the net profits, 25% of the balance is taken by the Government. This is a moderate tax and imposes no hardship on the mines. For the last year the Dome tax was $27,500 and the Nipissing and Hollinger taxes about $70,000 each. Mines like the Porcupine Crown making a profit of $300,000 will pay only $11,500.

The Mining News

ARIZONA

Cochise County

SHATTUCK-ARIZONA (Bisbee)—October production was: Copper, 1,633,671 lb.; lead, 335,008 lb.; silver, 35,995 oz.; gold, 361 oz. Copper output for 10 months was 15,206,701 lb.

Gila County

INSPIRATION (Miami)—October copper production 11,300,000 lb. or 530,000 lb. less than in September.

Mohave County

NEW OATMAN COMPANIES recently passed upon by Arizona Corporation Commission are: Condor Mining Co., Big Otto Mining Co. and Summit Lode Mining Co.

GOLD DUST (Oatman)—Has started its mill; equipped with special machinery.

NELLIE (Oatman)—Drifting on orebody on the 350-ft. level. Sinking to the 500-ft. level will be started at once from the 350. D. F. Meiklejohn, superintendent.

Yavapai County

DUNDEE-ARIZONA (Jerome)—Shaft down to 450 ft. Will continue sinking at rate of 5 ft per day.

CONSOLIDATED ARIZONA SMELTING (Humboldt)—Development has opened good orebodies both at the De Soto and at the Blue Bell mine, particularly at the latter; gravity-water concentration and flotation has given excellent recovery. Difficulties that arose in smelting of fine concentrates have now been satisfactorily overcome. Some custom ore being smelted. G M. Colvocoresses, general manager.

Yuma County

MESSRS. LONG, McIVER AND RIDENOUR, of Oatman, are reported to be making preparations for the drilling of a copper property 8 mi. north of Parker.

CALIFORNIA

Amador County

CENTRAL EUREKA (Sutter Creek)—Assessment of 3c. per share levied to deepen 3,200-ft. shaft to 3,400 ft. Orebody on 3,100 and 3,200 levels will be explored.

PLYMOUTH CONSOLIDATED (Plymouth)—Mill is being supplied with about 350 tons of ore a day. New electric hoist working satisfactorily.

SOUTH KEYSTONE (Amador)—Machinery and other surface equipment being hauled to mine with motor truck; formerly used on the Amador Queen. J. H Colpe, manager.

CONSOLIDATED AMADOR (Sutter Creek)—Bend in shaft near 800 level now straightened; water is below 850-ft. point and shaft retimbered. Bend resulted from following vein which was common practice in early-day mining. Total of 50 men employed, about one-half on surface in construction work.

Eldorado County

WHITE QUARTZ in Diamond Springs district is being examined with idea of using it for glazing enamelware by manufacturers at Point Richmond, in Contra Costa County. Shipment of 1,000 tons arranged by John Snow.

RISING HOPE (Placerville)—New Ingersoll-Rand compressor and Pelton waterwheel and drills recently installed. George W. Engelhardt, manager.

OHIO (Placerville)—This gravel property near Smith Flat reported sold to Mr. Andrews, of Butte County, and Mr Forsythe, of Alaska; formerly owned by Fairchild & Richard, of Placerville. Work will be started immediately.

PLACERVILLE GOLD MINING CO (Placerville)—Sale of this property, embracing 23 claims and what is known as the Pacific shaft, situated in town, reported to have been made by Alexander Baring and associates, of London, to R. Chester Turner and associates, owners of the Brunswick mine at Grass Valley. The mine was closed down on account of the war, at a time when new development was in progress and after 40 years' continuous operation. Unwatering the shaft will begin immediately. Company's Sierra water system may be sold to Western States Gas and Electric Co.

Nevada County

HOOKWORM is believed by the State Bureau of Communicable Diseases to be prevalent among miners in the county; agents of the bureau are to investigate.

EL ORO (Lake City)—Unusual flow of water necessitates installation of additional pump.

INDIANA DREDGING CO. (Grass Valley)—Prospecting in Greenhorn Valley. Camp established near Missouri gulch.

GIRDETZ (Grass Valley)—Dragline scraper used by this lease to make opencut on Greenhorn Creek, in Arkansas cañon. Lease covers 3 mi. of placers extending from placer grounds of You Bet.

NORTH STAR (Grass Valley)—Thirty stamps dropping in Champion mill. Aërial tramway being installed to connect mill with Providence shaft, through which Champion ore is hoisted, and underground connection being made between Champion and Providence. Reported that 4-ft. ledge has been disclosed on 2,700 level.

DELHI (Nevada City)—Unwatering below fourth level; about 130 ft. more depth to be unwatered, using air-lift from fifth to fourth level and Worthington pump on the fourth. Expect to uncover bottom in about 10 days for development of 6-ft. vein in bottom level. Mine equipped with 20-stamp mill driven by water power. Water brought from branch of Yuba River near portal of tunnel. Tramway from top of hill to the river about 700 ft. Two Pelton water wheels in use.

San Bernardino County

AMERICAN TRONA CORPORATION (Trona)—Directors' report, issued in lieu of regular annual report, states: "The concentrating plant at Trona is now operating. The most difficult and expensive construction at the refinery at San Pedro is completed, although it will probably not be in operation before Mar. 1, 1917. The engineer considers that the concentrating plant at Trona, with additional vats, will probably treat between 500,000 and 600,000 gal. per day. About 120 tons of concentrated salts have been produced to date (October), and from now on the corporation expects to produce a minimum of 50 tons per day, which should gradually be increased to over 200 tons per day. With minor additions there should be no difficulty in producing from the refinery when finished at least 100 tons per day of high-grade potassium chloride and 50 tons per day of borax. A contract has been closed for 3,500 to 4,000 tons of Trona salts to be shipped by the end of this year at a price that should give substantial profits."

Sierra County

WIDE AWAKE (Downieville)—Gravel, recently found, prospects well. Development will be continued all winter under option to Thomas Wilson.

PRIMROSE (Sierra City)—Eight contiguous claims bonded to M. D. Cogley and W. R. Brooks. Development will be prosecuted throughout winter.

ROCK CREEK (Downieville)—Telephone line completed to mine, winter supplies laid in and outside preparations for winter progressing. Three shifts driving main tunnel ahead in bedrock. Gravel prospecting well. W. F. Copeland in charge.

Tuolumne County

RED JACKET (Groveland)—Mill equipped with electric power and power drills installed. Some good ore developed. Property in Big Oak Flat district.

DUTCH-SWEENEY (Jamestown)—Shaft now below 1,900-ft. point. From Nov. 1, 1915, to Oct. 22, 1916, development has totaled 1,867 ft. Employing 125 men; equipment modern; electric power. W. J. Loring, manager.

HARVARD (Jamestown)—Only 67 men out of 130 are retained, making what is reported to be a final cleanup before closing down. If this is the purpose, no explicit information is available as to the cause. Mine has been in constant operation for 10 years and is said to have produced more than $3,000,000. Reported that the Harvard Mining Co. will undertake development of the Erin, a neighboring property.

COLORADO

Custer County

HERMAN (Silver Cliff)—Four cars mixed sulphide ore, containing gold, silver, lead and copper, shipped weekly to Salida smelting plant. Three shifts working in mine.

Gunnison County

COLORADO COPPER CO. (Iola)—Lease and bond taken on Anaconda mine by this Denver company. Steam hoist and boiler being installed and sinking will be resumed.

DOCTOR (Almont)—Steady production high-grade zinc carbonate ore being made; 12 teams hauling to Almont. Reported strike of lead ore made recently. Mine worked many years ago for lead only.

Hinsdale County

COLORADO-UTAH MINES OPERATING CO. (Lake City)—Fine grinding machinery will be installed in milling plant. Old stope filling and dumps to be treated.

Lake County

PROGRESSIVE (Leadville)—Mine adjoining Harvard on North Fryer Hill being reopened by Warren F. Page. Work of repairing shaft and 280-ft. level under way.

Park County

BLACK CLOUD (Alma)—Lessees on this property, near London mine, have opened shoot of gold-silver-lead ore.

Routt County

KRAMER (Oak Creek)—Sinking new two-compartment shaft to cut coal beds, prospected by diamond drilling, lower than one now being worked.

Saguache County

ST. LOUIS (Bonanza)—Shaft recently sunk 100 ft.; crosscutting to vein now under way.

HANOVER (Bonanza)—Reopening old tunnel. Some good grade lead-silver ore being stoped. Mine south of upper Rawley workings.

VILLA GROVE ONYX CO. (Villagrove)—Deposit of Mexican onyx being opened. Thirty-six varieties found in these quarries, colors ranging from yellow and buff through reds and maroon to black.

San Miguel County

IMES (Sawpit)—Shoot good-grade ore opened in shaft at depth of 75 ft. Shaft sinking will be continued.

TOMBOY (Telluride)—Mill ran 29 days in October crushing 12,000 tons ore yielding $46,200 in bullion and $49,000 in concentrates; expenses $66,300; operating profit $28,900.

Summit County

MILO (Kokomo)—Being reopened by local men.

ORO LEASING CO. (Breckenridge)—Shaft down 180 ft.; crosscutting to Oro vein.

COLONEL SELLERS (Kokomo)—Car shortage has materially reduced production recently.

RILLA (Breckenridge)—West heading on Witch Hazel vein advanced 10 ft. Shoot of milling-grade ore opened. Work being done by contract.

WILSON (Kokomo)—This mill running steadily on ore from mine and on custom ore. Of latter, large tonnage received.

MAYFLOWER AND SNOWFLAKE (Kokomo)—Both properties worked by Charles Walker. Two cars ore per week shipped.

TONOPAH PLACERS CO. (Breckenridge)—Crosscutting from old Miller shaft on opposite side of gulch from Wellington mine under way in effort to find zinc-bearing vein cut in dredging.

IDAHO

Blaine County

SILVER LEAD MINING CO. (Hailey)—Property adjoining Nay Aug mine has been bonded to Darwin Utter and associates including Raymond Guyer, Peyton Block, Spokane, Wash. Development will probably be undertaken in spring.

NAY AUG (Hailey)—This old mine optioned by Raymond Guyer and associates, of Spokane, and will probably be turned over for development to the Idaho Exploration Co. About 1,000 tons of zinc ore left by former operators is immediately available but deeper horizons will be investigated and mill installed. No work will be done until spring.

Shoshone County

HECLA (Burke)—Completing new sorting plant at mine. Preparing for stoping of East vein.

MISSOULA COPPER (Mullan)—This mine, containing some low-grade copper ore, may be reopened to take advantage of the present market. C. E. Mallette interested. Assessment may be levied.

MICHIGAN

A SILVER EXPLORATION by a party of Wisconsin and Michigan men is in progress in Ontonagon County. Several drills are now at work. Some silver was found in the district now being explored a number of years ago, but at that time not enough was disclosed to warrant opening a mine.

Copper

LAKE (Ontonagon)—Driving crosscut from shaft on the Knowlton lode on fourth and sixth levels to the Butler lode.

WOLVERINE (Kearsarge)—Shipped 27,000 tons of rock in October, assuring a production of approximately 450,000 lb. of copper.

TAMARACK (Calumet)—North Tamarack branch is showing better rock and shipments are increasing. Last month 30,000 tons went to the mills from this property.

INDIANA (Rockland)—Shaft down 85 ft. on the Butler lode. Crosscut will be driven both ways to ascertain width of lode and explore other lodes in vicinity—the Knowlton and Evergreen.

ALLOUEZ (Allouez)—Production continues to increase and November will break October's record. Instead of 10,000,000 lb. for the year Allouez will possibly turn out 13,000,000 lb.

MOHAWK (Mohawk)—Increased monthly shipments to 63,000 tons, so copper output ought to reach 1,120,000 lb. Improvements contemplated in handling waste sand at mills. Turbine to be installed soon.

KEWEENAW (Mandan)—Company still unable to work its mill all of day shift for want of trammers, having only one-half the number necessary. Up to Nov. 5 about 1,000 tons had been milled. No results will be announced until a larger amount of rock has been stamped.

HOUGHTON (Houghton)—Good ore in present workings on sixth level. At the bottom, 12th level, 160 ft. of good ground is showing, but it is difficult to maintain operations as rock has to be hoisted to the sixth level, trammed 250 ft. and then hoisted to surface.

AHMEEK (Ahmeek)—Conglomerate formation recently opened in long drift shows width of 6 ft. Drifting continues in good looking rock carrying considerable mass and small barrel. Rock tonnage in October, 117,000 with copper output probable double that of early months of this year.

Iron

LAKE SUPERIOR SHIPMENTS of iron ore for October amounted to 9,116,196 tons, making a total of 57,932,846 tons up to Nov. 1. The year's shipments by water will reach 61,000,000 tons. The best previous record for a single year was in 1913, when 49,000,000 tons were moved. It is estimated that 75,000,000 tons will be required of the Lake Superior district in 1917, and preparations are already under way for moving this large tonnage. The railroads are ordering new cars and other equipment and new boats are under construction. The underground mines will stock all of the ore they can get out this winter. Some ore will be left in stock at the close of navigation at some of the mines. Several of the properties on the Menominee range, at Crystal Falls and Iron River, were unable to move everything this season, but there was much ore in stock at those two places. Some had been in the piles for years.

MANSFIELD (Crystal Falls)—J. M. Longyear is doing exploratory work here. Mine has been idle three years; some ore still in lower levels. It is believed that other deposits exist on the property. Mr. Longyear has an interest in the [illegible]. Diamond drilling is to be done.

MINNESOTA

Mesabi Range

IN THE BIWABIK DISTRICT every underground mine is being worked to capacity. Stockpiles have been shipped and ore is now being stocked for next year's delivery. The Biwabik Mining Co. has made another big find of ore; this will be stripped, part of the deposit lies under the dump of the Biwabik mine. Some diamond drilling is being carried on in the district, but not so many drills are at work as when the Oliver Iron Mining Co. was exploring a few years ago.

YORK (Nashwauk)—Coates & Tweed, operators, are to open this property. Dragline excavators have recently been put to work. About 700,000 cu.yd. of overburden will be stripped this winter. It is expected that ore will be shipped next year. An ore washing plant will be supplied by the Allis-Chalmers Manufacturing Co. Later mine will be worked from underground.

U. S. STEEL CORPORATION (Duluth)—Checks and orders aggregating $2,067,501 have been paid by the corporation into treasury of St. Louis County. Represents last half of current real-estate taxes on its holdings in the county through the Oliver Iron Mining Co., the Minnesota Steel Co. and other subsidiaries. In addition to the above the corporation also pays heavy taxes in Itasca County, where are several of its mines. Corporation is largest taxpayer in Minnesota.

MONTANA

Beaverhead County

BANNACK GOLD (Bannack)—New 200-ton mill is completed. Management states that it has enough ore of average value of $11 per ton to keep mill busy for five years.

Silver Bow County

EAST BUTTE (Butte)—October copper production 1,650,160 lb.; silver, 51,022 oz.; copper output slightly lower and silver higher than in recent months.

NORTH BUTTE (Butte)—Granite Mountain shaft now down 700 ft. below 3,000 level. Stations being cut on 3,200, 3,400 and 3,600 levels. Development of properties in eastern section of Butte district is continuing. Aim is to increase output to 2,500,000 lb. copper per month.

BUTTE & ZENITH CITY (Butte)—Showing in vein encountered in south crosscut is improving steadily. Vein is 10 ft. wide, over 2 ft. of which runs high in copper. Another vein showing copper encountered in north crosscut. The big Economic vein which is counted upon to furnish the bulk of the ore is expected to be reached by the south crosscut after another 200 ft. of driving. Mine is about 6 mi. west of Butte.

ANACONDA (Butte)—October copper output of 31,500,000 lb. was an increase of 2,100,000 lb. over September production and makes total 10 months of 282,400,600 lb. Company's activity in the Coeur d'Alene district in exploiting the Douglas mine and in making contracts in that district for purchase of 25,000 tons of zinc ore from other mines up to Jan. 1 is indicative of company's plans to extend its zinc industry into fields outside of Butte.

NEVADA

Esmeralda County

SANDSTORM-KENDALL (Goldfield)—On 350 ft. level, south drift now out beneath old lease workings and raise being driven to connect.

GREAT BEND (Goldfield)—A north crosscut from east drift, 300-ft. level, encountered ore of good grade beneath old lease workings. Regular shipments being made to sampler average $25 to $35 per ton.

GOLDFIELD CONSOLIDATED (Goldfield)—Final report for September shows 25,800 tons treated; net realization, $16,072.05; total operating costs, $5.35; net operating costs, $5.8[illegible] per ton. There was 2,255 ft. of development done at $6.83 per ft. About 200 tons per day sent to mill from old Combination tailings dump.

Lincoln County

PRINCE CONSOLIDATED (Pioche)—Mine continues to ship about 100 tons per day to smelters. Stated new mill at Bullionville working successfully and tailings from old dumps expected to yield profit of about $1 per ton.

Mineral County

NEVADA NEW MINES (Rawhide)—Stated entire face of winze in mill ore of excellent grade with occasional specimens of ruby silver at depth of 50 ft. below 600-ft. level.

Nye County

TONOPAH ORE PRODUCTION for week ended Nov. 1 was 10,176 tons, valued at $199,198, compared with 9,959 tons for week previous. Producers were: Tonopah Belmont, [illegible]; Tonopah Mining, 2,100; Tonopah Extension, [illegible]; Jim Butler, 1,050; West End, 852; Rescue-Eula 852; Halifax, 15[illegible]; MacNamara, 51 tons.

ROUND MOUNTAIN MINING (Round Mountain)—With advent of low water at placer, about 15 teams and scrapers are being used to [illegible] some of the richer material to the [illegible].

Storey County

ANDES (Gold Hill)—Saved [illegible] 350 level.

JACKET (Gold Hill)—Operated 1[illegible] stamps and two Deister tables four days; 1[illegible] and three

Deister tables, two days; cyanide plant, full week; 512 tons dump rock put in mill bins.

COMSTOCK PUMPING ASSOCIATION (Virginia)—Changed over sinking pumps in the Mexican-Ophir winze; now operating as station pumps. New vertical sinking pump installed to pump out 2,900 level.

UNION (Virginia)—Extraction from 2,500 level included 47 tons averaging $28.80. No marked change in prospecting and development on five levels. Favorable formation continues in the face of exploration drifts in Union, Sierra Nevada, Mexican, Ophir, Con. Virginia.

NEW YORK

St. Lawrence County

NORTHERN ORE CO. (Edwards)—Sinking 1,000-ft. double-compartment vertical shaft to reach territory explored last year by diamond drills; work is proceeding from surface as well as from the 400 level of No. 1 slope. Mill is treating from 150 to 200 tons daily supplied from two lenses developed by No. 1 slope. The No. 2 or White mine is now connected with No. 1 slope by drift on the 400 level and extraction is proceeding from both mines. Justice Grugan, manager.

UTAH

Beaver County

BEAVER LAKE METALS (Milford)—First car ore—copper-silver—shipped.

COPPER RANCH (Milford)—Three cars weekly being shipped from mine, 12 mi. northwest of Milford.

RED WARRIOR (Milford)—Property in Star district, adjoining Moscow, to resume operations at once. Controlled by Michigan men. Angus Buchanan, general manager.

HORN SILVER MINING, MILLING AND WATER CO. (Frisco)—Reorganized company expects to build plant to handle tailings dumps containing 50,000 to 60,000 tons; also to supply equipment to handle ores from surrounding territory.

Box Elder County

ROZELLE OIL (Brigham City)—Company drilling on edge of Great Salt Lake, near Rozelle, on west side of Promontory, struck some thick heavy oil resembling liquid elaterite or gilsonite. Wells down 150 and 165 ft. Ogden and Brigham City men interested

Juab County

TINTIC PRODUCTION for four weeks was 823 cars by about 40 shippers. Value of weekly output estimated at $250,000.

RIDGE & VALLEY (Eureka)—Production for first 10 months of 1916 about 1,000 tons. Two full faces of lead ore on 1,700 level.

LEHI TINTIC (Eureka)—Tunnel being driven for Blossom vein in 2,200 ft. Daily progress of 4 to 5 ft. being made. Property in North Tintic.

SCRANTON (Eureka)—Lessees shipped 10 cars in October. Eight cars of zinc ore and two of lead. Lead cars averaged 17 to 18% and zinc 30 to 36%. Thirty men working.

GEMINI (Eureka)—October shipments amounted to 39 cars, or approximately 2,000 tons of ore. Shipments average between 500 and 700 tons weekly; in first 10 months, 421 cars or 21,000 tons of ore shipped.

SIOUX CONSOLIDATED (Eureka)—Winze from 600 level down 100 ft. No change in formation, but mineral showing sufficient to be encouraging. Duncan & Allen, contractors, have sunk shaft 60 ft. since Oct. 17. Three shifts working.

EUREKA BULLION (Eureka)—Company, which took over old Grutli claims in east Tintic, preparing to install new equipment—compressor, 60-hp. steam boiler, etc. Old hoist will probably be used. Main shaft down 220 ft. to be sunk farther. Property near the Tintic Standard.

TINTIC STANDARD (Eureka)—Work started on new three-compartment shaft 1,700 ft. northeast of present workings. Expected to reach orebody on 1,300 level in seven months. Blower installed on lower levels where lead-silver ore is being mined and developed. Ore brings from $1,400 to $1,500 a car.

CHIEF CONSOLIDATED (Eureka)—Report for nine months shows ore sales amounting to 62,006 tons, bringing $1,153,000. Ore averaged $31.38 per ton; sampling and freight, etc., amounted to $12.78; $18.60 net from smelter; total net, $474,247. Development amounted to 17,950 ft., largely from 900 to 1,800 level. Work started on new claims known as Piñon Peak group in eastern part of district; shaft sunk and drifting done. Eureka City Mining Co. dissolved. Option on Scotia mine in West Tintic surrendered and work abandoned. Numerous additional mining claims purchased; also majority of shares in adjoining Plutus. Ground to be worked from the Chief.

Piute County

MINERAL PRODUCTS CO. (Marysvale)—Several buildings, part of headhouse, trestle, etc., at alunite mine were burned Nov. 2. Hauling from mine to mill will be done by team until repairs can be made.

Salt Lake County

MICHIGAN-UTAH (Alta)—New orebody opened by Triangle Mining Co., lessees; exposed 8 by 9 ft. and ore in face of crosscut

MONTANA-BINGHAM (Bingham)—Good progress being made in driving tunnel—face now in 4,250 ft.—in Bingham-Amalgamated ground. Expected to cut two veins.

UTAH APEX (Bingham)—Stockholders voted to reduce number of shares from 600,000, par value $5, to 125,000 shares, par value $25. At present there are 528,000 shares issued. Two dividends aggregating $195,000 have been paid this year.

CARDIFF (Salt Lake)—Larger production being made; between 100 and 150 tons daily being shipped. Ore hauled by teams to mouth of South Fork, thence by tractors to sampler at Murray. New tractors working well.

EMMA COPPER (Alta)—Shaft unwatered to second level below Bay City tunnel. Some repairs, etc., necessary before work of crosscutting for orebody will be undertaken. Materials, rail, supplies, etc., being hauled to property for winter.

ALTA CONSOLIDATED (Alta)—Robert A. Brown, formerly mine superintendent at Centennial-Eureka, in Tintic district, has been employed as superintendent to take charge of development, etc., during absence of A. O. Jacobson, general manager. Hoist installed to sink on bedded vein carrying copper, below tunnel level.

Summit County

NAILDRIVER (Park City)—Fisher lease working on vein 7 ft. wide in places. Sorting out high-grade for shipment.

COPPER APEX (Park City)—Excellent showing of ore in winze. Some ore accumulated awaiting shipment. Property recently inspected by C. P. Brooks.

AMERICAN FLAG (Park City)—Ore running well in silver and gold being mined on 1,000-ft. level from Easter vein Porphyry dike cut on 700. Worked by Park City Mines, lessees.

SILVER KING CONSOLIDATED (Park City)—New 10,200-ft tramway operating, and approximately 1,000 tons of ore carried from mine to mill and sampler. New 50-ton mill in operation. Thaynes cañon tunnel in 850 ft.

BROADWATER MILLS (Park City)—Recent tests and sampling of tailings on company's ground reported satisfactory. Force of men cleaning up preparatory to work of remodeling and making necessary changes in mill. Additional equipment to be added and capacity increased.

DALY MINING (Park City)—Planning erection 150-ton mill for completion early next summer on site of old Marsac mill. Will treat low-grade old-stope filling and dumps, also quantity zinc-lead sulphides in lower mine levels. Occasional ore shipments being made with satisfactory returns. Col. E. A. Wall, Salt Lake, president.

VIRGINIA

Spottsylvania County

VIRGINIA LEAD AND ZINC CORPORATION (Jones Store)—Good-grade lead and zinc ore being found in this property. Shaft down 250 ft. Has shipped 5,000 tons and has another 5,000 tons of shipping ore on stockpile. Much ore ing blocked out. W. Washabaugh, superintendent.

WASHINGTON

Ferry County

LONE PINE-SURPRISE MINING CO. (Republic)—This Spokane company has contracted with C. S. Cox and J. E. Henwood of Kellogg, Idaho, to sink a 500-ft. shaft on Last Chance claim. Hoist, five-drill compressor and 100-hp. boiler ordered. Last Chance orebody proven at 540-ft. level from workings of adjoining Insurgent mine.

WISCONSIN

Zinc-Lead District

UTT-THORNE (Platteville)—Subleased Harris mine and mill equipment at Mineral Point.

SPRING HILL (Linden)—A new 2-jig mill equipment has been completed on the Thomas Heathcock land.

STRAWBRIDGE (Platteville)—George Orput and Milwaukee interests negotiating for mill to equip this old producer south of Benton.

CANADA

British Columbia

BLUE BELLE (Kootenay Lake)—About 90 men working; mine being developed to fourth level.

ATHABASCA (Nelson)—A. E. Rand and partners are resuming operations on this old gold property.

ROCHER DE BOULE (Hazelton)—Lower tunnel now in over 1,500 ft. and rapid progress is being made.

UTICA (Kaslo)—Driving of 1,900-ft. crosscut tunnel at cost of $20,000 will be started at once to tap vein 350 ft. below present workings

DOME MOUNTAIN (Telkwa)—Rich find gold and silver ore made by Chisholm Bros. & Young; several tons sacked for shipment running $400 to $600 per ton.

ECHO (Silverton)—Two feet of galena ore opened in lower tunnel; drifted on for 40 ft. Tunnel in 700 ft. Property adjoins Alpha claim of Standard mine.

SULLIVAN (East Kootenay)—For the third consecutive week this mine has been largest shipper in the Kootenays to the Trail smeltery, with 3,143 tons of lead-zinc ore to its credit.

Ontario

R. A. P. SYNDICATE (Boston Creek)—Work resumed after repairs to plant.

ANCHORITE (Porcupine)—Option to the Coniagas of Cobalt extended for six months.

KRIST (Porcupine)—To be merged with the South Thompson; will be opened by new company.

DAVIDSON (Porcupine)—Crosscut on 300-ft. level has cut orebody developed on upper levels.

ROSS (Porcupine)—Diamond drilling to a depth of 2,000 ft. has been undertaken on these claims.

McINTYRE (Schumacher)—During next year expects to be able to treat 600 tons a day of $10 ore.

SCHUMACHER (Schumacher)—Has opened new vein which for short length drifted on shows $30 ore.

PORCUPINE GOLD REEFS (Porcupine)—Leased to syndicate which will shortly begin development.

ASSOCIATED GOLDFIELDS (Larder Lake)—Station being cut at 300-ft. level and shaft will be sunk 200 ft.

MAIDENS-McDONALD (Porcupine)—La Rose Consolidated given extension of option; shaft will be put down to 300-ft. level.

INSPIRATION (Porcupine)—Diamond drilling to strike continuation of the Hollinger Consolidated vein system started at two points.

CHAMBERS FERLAND (Cobalt)—Cut apparent extension of famous No. 64 vein of Nipissing, but silver content was disappointing.

LA ROSE (Cobalt)—Getting satisfactory results on Kirkland Lake property under option. Shafts will be sunk and small plant will probably be installed

ST. ANTHONY (Sturgeon Lake)—Power plant in good working order and $200,000 has been set aside for development during winter. H. H. Lavery, lately with Dome Mines in Porcupine, is in charge.

ADANAC (Cobalt)—On Nov. 4 cage accident caused death of Marion Sturgeon and another employee whose name was not ascertained, and serious injury of two other miners. Cable broke and cage fell 25 ft.

VIPOND (Schumacher)—This mine and the North Thompson have been examined with view to amalgamation. North Thompson ore will be treated in the Vipond mill to see if present mill is suitable for this class of ore.

MILLER LAKE-O'BRIEN (Gowganda)—Rich vein recently discovered has been drifted on for 120 ft. and a raise of 50 ft. put up. The ore carries 3,000 oz. per ton; average width of vein, 25 in. Shipment containing 53,000 oz. silver made.

MEXICO

SANTA GERTRUDIS (Pachuca, Hidalgo)—Milled in September, 18,993 tons; estimated profit about $21,000.

ESPERANZA (El Oro, Mex.)—September estimated operating profit $10,500. Repairing in stamp mill was to have been completed by November, when production was to be increased.

CANANEA CONSOLIDATED (Cananea)—October estimated production: Copper 6,030 000 lb.; silver 177,999 oz.; gold 915 oz. September copper output was 4,900,000 lb.

EL ORO MINING AND RY. (El Oro, Mex.)—Secretary's notice to stockholders states that in view of Carranza's decree of Sept. 16 declaring forfeited any properties failing to resume by Nov. 14, or suspending operations for an aggregate period of three months in one year thereafter, the directors instructed Manager A. F. Main to resume milling operations, "after having fortified themselves with influential advice." Cable information was received Oct. 20 stating that 70 of the 100 stamps were dropping.

TRINIDAD, B. W. I.

TRINIDAD CENTRAL OILFIELDS (Winchester House, E. C., London, Eng.)—During past year, drilling program restricted on account of shipping facilities; eight wells drilled, all producers. At Tabaquite, 1,000-ton steel storage and additional pumping machinery added. At Claxton Bay loading station on the Gulf of Paria a 4,000-ton steel storage tank has been erected. On account of inability to arrange for rail transport with government, company is building 18-mi. pipe line to connect with its submerged pipe line which extends about ½ mi. into the sea where sufficient depth is obtained for loading tank steamers.

CHILE

BRADEN (Rancagua)—September copper production was 2,970,000 lb. as against 2 616,000 lb. in August.

CHILE EXPLORATION (Chuquicamata)—September copper output, 4,038,000 lb.; August production, 3,020,000 lb.

CENTRAL CHILI (Panulcillo, Coquimbo)—Copper output for nine months of this year 2,005 long tons. Freight to New York on copper now about four times what it was prior to the war. Equipment at mine and smelting plant being improved.

The Market Report

Metal Markets

NEW YORK—Nov. 15, 1916

All of the metal markets were strong last week, and in copper, which is in an unprecedented position, there was a sharp advance. In tin also there was a sharp advance. Spelter advanced a little. Lead was stationary, but still strong.

Copper, Tin, Lead and Zinc

Copper—Again there were huge sales, the aggregate being apparently in the neighborhood of 125,000,000 lb., or about the same as in the previous week. The major business was for delivery in the second quarter of 1917. Producers are all but completely sold out for first-quarter delivery, and that position is as tight as November-December was a little while ago. As for November-December delivery at present, terms may be almost anything.

The market advanced sharply from day to day on insistent buying by domestic consumers, who had overstayed their market and were obliged to have copper, almost regardless of price, to fill contracts for goods already taken. A person needing copper called up a producer, got a price and 30 minutes to think about it. If action were not taken within that time, the opportunity was lost, other persons being desirous of getting the same copper. This illustrates how much of the business was done. The large producers endeavored to take care of their regular customers as best they could, but seldom were they able to furnish more than part of what was needed, and buyers had to seek elsewhere for the remainder. Prices were therefore at sixes and sevens. A buyer needing 3,000,000 lb. of copper and purchasing during the day might have to get it from three different quarters and at a different price in each. In most offices sales were made toward the close of the day at higher prices than at the opening.

November-December copper sold at 32½c., r.t., as early as Nov. 9. At the close of the week, it was still quoted at 32@33c., and we heard of transactions between those figures on Nov. 14. First-quarter delivery was 31c., r.t., up to Nov. 14. On Nov. 14 it was 31½c., and on Nov. 15, 32c. Second-quarter delivery, which constituted the major market, advanced from an average of about 29c. at the beginning of the week, to about 31c. at the close.

There was some business done in several quarters for delivery during the second half of 1917, but the largest producers did not enter into such contracts.

The buying of the week was almost wholly from domestic quarters. Inquiries from France were reported, but no transactions consummated.

Not all consumers were short of copper. There was reselling by some consumers, who either figured that they had overbought or thought they might take a chance later on.

There was gossip that the foreign governments were offering to sell nearby copper, previously bought, for which they had been unable to secure transportation. We could not verify this. However, there is no doubt that there is some unshipped supply of copper here that is owned abroad.

The Southern Pacific Ry. has put an embargo on copper shipments. This will check some supplies of crude copper from coming forward, but the refiners are believed to be amply provided with raw material.

The American minister to Norway cabled to the State Department, Nov. 10, that an agreemene has again been reached by the Norwegian and British Governments allowing the shipment to Norway from the United States of 3,000 tons of copper provided an equivalent amount of Norwegian copper pyrites is shipped to England.

Copper Sheets—The base price for copper sheets has advanced to 40c. Wire has also advanced, quotations now being 35@36c.

Tin—A very large business was done, especially on Monday and Tuesday when the turnover was exceptional. The supply of spot tin is very short. This condition led to a sharp advance. At the beginning, spot was 42⅞c., futures, 41½c. At the close, spot was 44⅞c., futures, 44c.

Lead—A large business was done at unchanged prices in this market, but in St. Louis there was a slightly easier tone. Canada continued to be a large buyer. There were sales to China. Inquiries were in the market from Japan and Russia, but consummation of that business was not reported.

Spelter—Business in common spelter was considerably more active. While there was some increased demand from domestic consumers, a good deal of the buying was done by speculators and by refiners. The major part of the business reported was for delivery during the first quarter of 1917, but there were some sales extending to the middle of that year. The price continued to advance. A moderate business in brass special was done and a fairly large business in high grade. At the close, high grade was quoted at 16@17c.; intermediate, 99¾% Zn, at 15@16c.; intermediate, 99.5% Zn, at 15@14c.; and brass special, at about 11½c.

Exports from Baltimore included 818,051 lb. in pieces and 615 tons in plates to Liverpool and London.

Zinc Sheets—The base price on zinc sheets has advanced. The quotations are now at $17 per 100 lb., f.o.b. Peru, Ill., less 8% discount.

Other Metals

Antimony—Spot was quoted at 13@13½c. Some of the important producers are holding for higher prices. There was a sharp advance in the London market during the week, which was reflected in this market.

Quicksilver—The market was fairly steady at $80, the same price as last week.

Aluminum—There has been no noticeable slackening of demand for this metal. At the same time, there has been no definite change in price, quotations remaining at the same figures as last week, 64½@66c. per lb. for No. 1 ingots, New York.

Nickel—Price remains the same as last week, 45@50c. per lb. Electrolytic brings an additional 5c. per lb.

Gold, Silver and Platinum

NEW YORK—Nov. 15

Gold—The holdings of gold by the Bank of England against its notes shows a decrease of £357,990 as compared with previous week's returns, according to report from Samuel Montagu & Co., London, Oct. 26, 1916.

Silver has improved and is selling on higher basis the past week owing to the improvement in the China Exchanges. Shipments from San Francisco to the East which for a time were slack have been resumed. The undertone of the market in view of the probable demand continues good to steady.

Silver—Samuel Montagu & Co., London, under date of Oct. 26, report that: Supplies have been forthcoming with such steadiness, especially from America whence some 200,000 oz. arrived this week, that buyers have been somewhat shy, and the tendency of prices has been downward, until on Oct. 24, 32⅛ was reached for the third time this month. This quotation, the lowest since Aug. 31 has seemed to encourage more activity in the demand for coinage.

The Indian Bazaars have been idle in this market. China exchanges have remained remarkably steady, regardless of the fluctuations of silver. The stock in Shanghai on Oct. 21 consisted of about 23,500,000 oz. in sycee and 16,500,000 in dollars, as compared with about 24,000,000 oz. in sycee and 16,500,000 dollars on Oct. 14 last.

The totals in Shanghai for Oct. 21, are about half of those held on Jan. 7 last, when 50,500,000 oz. in sycee and 22,380,000 dollars were reported. The difference between the amounts held at the two periods is equal to about 31,500,000 oz.

The stock in Bombay consists of 4,000 bars, as compared with 3,200 bars last week.

During the week a shipment of 200,000 oz. was made from San Francisco to Bombay.

Platinum—Market steady; quoted at $95@100.

Palladium—Unchanged at $75 per oz.

Zinc and Lead Ore Markets

Platteville, Wis., Nov. 11—Quotations of the district are according to the following figures: Base price per 2,000-lb. ton for material assaying 60% zinc advanced to $85 for premium ore and to $80 for medium grade. For material assaying 80% lead the base price per 2,000 lb. ton is $80@82. The exhaustion of reserve stock and increased demand for zinc ore stimulated prices. Shipments for the week were 3,513 tons of zinc ore, 69 tons of lead ore, and 663 tons of sulphur ore. For the year to date the figures are 112,916 tons of zinc ore, 3,791 tons of lead ore, and 27,697 tons of sulphur ore. Shipped during the week to the separating plants, 2,753 tons of zinc ore.

Joplin, Mo., Nov. 11—Price quotations per 2,000 lb.: Blende, high, $91.50, 60% zinc, premium ore, $90; medium grades, $88@81; low, $80. Calamine, per ton 40% zinc, $50@60. Average selling price, all grades of zinc, $74.91 per ton.

Lead, high price, $88.30; base, $88@84; average selling price all grades of lead, $85.70 per ton.

Shipments of the week: Blende, 7,948 tons; calamine, 182 tons; lead, 1,115 tons. Value, all ores the week, $729,710; 47 weeks, $[illegible].

Higher prices were begun on calamine Wednesday, with an advance of $[illegible] per ton, and the heavy inquiry on Thursday ripened into an advance of $10 per ton for blende on Friday and the market closed active tonight. That the market was in no measure depressed over the political uncertainty was a surprise and was gratefully accepted.

Keen and intense interest prevails in the lead situation and further slight advances were made in prices. A light mid week rain aided in permitting several mines to resume operations, even though but temporarily.

SILVER AND STERLING EXCHANGE

Nov.	Sterling Exchange	Silver New York, Cents	Silver London, Pence	Nov.	Sterling Exchange	Silver New York, Cents	Silver London, Pence
9	4.7569	71¼	34¼	13	4.7569	71¼	34 5/16
10	4.7569	71¼	34¼	14	4.7563	71¼	34 5/16
11	4.7569	71½	34 5/16	15	4.7563	71¼	34 5/16

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine.

DAILY PRICES OF METALS IN NEW YORK

Nov.	Copper Electrolytic	Tin Spot.	Lead N. Y.	Lead St. L.	Zinc St. L.
9	28¼ @29¼	42⅞	7.00	6.87½ @6.92½	10½ @11
10	29 @30	43⅜	7.00	6.87½ @6.92½	10½ @11
11	29 @30	43½	7.00	6.87½ @6.92½	10⅝ @11
13	29½ @30½	43¾	7.00	6.87½ @6.92½	10⅝ @11
14	30 @31	44¼	7.00	6.87½ @6.92½	10¾ @11
15	30½ @31½	44⅞	7.00	6.87½ @6.92½	10¾ @11

The quotations herein are our appraisal of the average markets for copper, lead, spelter and tin based on wholesale contracts for the ordinary deliveries of the trade as made by producers and agencies; and represent, to the best of our judgment, the prevailing values of the metals, reduced to basis of New York, cash, except where St. Louis is basing point.

The quotations for electrolytic copper are for cakes, ingots and wirebars. Electrolytic copper is commonly sold at prices including delivery to the consumers and is subject to discounts, etc. The price quoted for copper on "regular terms" (r.t.) is the gross price including freight to the buyer's works and is subject to a discount for cash. The difference between the price delivered and the New York cash equivalent is at present about 0.25c. on domestic business. The price of electrolytic cathodes is 0.05 to 0.10c. below that of electrolytic. Quotations for lead represent wholesale transactions in the open market for good ordinary brands. Quotations for spelter are for ordinary Prime Western brands. Only St. Louis price is given, St. Louis being basing market. We quote New York price at 17c. per 100 lb. above St. Louis.

Some current freight rates on metals per 100 lb. are: St. Louis-New York 17c.; St. Louis-Chicago, 6.3c.; St. Louis-Pittsburgh, 13.1 cents.

LONDON

Nov.	Copper Standard Spot	Copper Standard 3 Mos.	Copper Electrolytic	Tin Spot	Tin 3 Mos.	Lead Spot	Zinc Spot
9	124½	120½	148	184½	185½	30½	54½
10	124½	120½	148	185	186¼	30½	55
11			148				
13	126½	121	149	186¼	187½	30½	55½
14	128½	123½	152	188	189½	30½	56
15	129½	125	153	189½	191½		56

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2,240 lb. Copper quotations for electrolytic are subject to 3% discount. For convenience in comparison of London prices, in pounds sterling per 2,240 lb., with American prices in cents per pound the following approximate ratios are given, reckoning exchange at 4.80. £15 = 3.21c.; £20 = 4.29c.; £30 = 6.43c.; £40 = 8.57c.; £60 = 12.85c. Variations, £1 = 0.21¾ cents.

Other Ores

Molybdenum Ore—Molybdenite is still in strong demand and offerings are readily taken at $1.75 per lb. of MoS_2. Ferromolybdenum was in demand at $3.65 per lb. for forward delivery.

Antimony Ore—Continues in demand. Offerings light. At present prices foreign ores are not coming in.

Tungsten Ore—We quote the market at $17 per unit.

Charles Hardy reports under date of Nov. 14 as follows: "The past week has seen the most active business for some time. Many hundred tons have changed hands and all the ore was bought for home consumption. In former weeks when hundreds of tons were sold, a large tonnage was for abroad. Pittsburgh stocks have practically been cleared of all high-grade ore and the New York stocks have been greatly reduced. The price paid has again been $17, and at this figure further contracts were made to cover part of 1917. The demand continues very active, Europe still negotiating for our ore, but as yet unwilling to pay our prices. In the meantime, however, Great Britain has contracted for the output of several South American properties to cover not only the duration of the war, but many years after peace has been declared. Japan has issued stricter orders which make exports from there very difficult, and this country's requirements will have to rely mainly upon home production and such ores from South America that are not yet contracted for by Europe. The prospects of a continuously steady market are good. Ferrotungsten is holding at $2.60 per lb."

Iron Trade Review

NEW YORK—Nov. 15

The pig-iron market continues to reflect the somewhat excited condition of the past two weeks, and there are further sharp advances in price. These advances, however, have not had much effect in reducing the volume of buying, which seems to continue strong. The action of steel prices is much the same, advances being registered with the possibility of further ones to come and the probability of full occupation for the mills throughout 1917. The election had very little effect upon the market, buying continuing and activity remaining about as usual. The action of the market during this election time is probably unprecedented.

PITTSBURGH—Nov. 14

Railroads are placing embargoes on some or all descriptions of freight and with car shortages increased and winter weather not yet experienced, but due, the appearances are very ominous and the balance of probability seems to be that iron and steel production will be curtailed in the next two months through lack of sufficient transportation facilities. According to all appearances the steel market is as strong as it possibly could be, with prices constantly advancing and buyers importuning mills to take more business than they are willing to accept, the mills having adopted a very reserved attitude in this respect. The Steel Corporation's unfilled tonnage increased during October by 492,676 tons, the largest increase since last April, but the excess of sales over shipments by the National Tube Co. and American Sheet and Tin Plate Co., the latter having opened its books for first-half on Oct. 12, accounted for more than the total increase showing that the other corporation subsidiaries booked materially less tonnage than they shipped.

Pig Iron—Advances in the past week are $2 in bessemer and basic, $1.50 in malleable and $1 in foundry iron. Only a few lots are sold at a price, the seller thereupon advancing quotations and getting the advanced price within a day or two. The leading merchant producer of bessemer iron, which has steadfastly been out of the market during this rise, and was accordingly suspected of being oversold, has now come into the market, apparently with plenty of iron, a fact of considerable interest to the trade. The last sale of basic is 7,000 tons for first-quarter at $25, but there are rumors of $27 having been done. While furnaces sold first-half deliveries of all grades freely last August, before the present advance started, they probably still have considerable iron to sell. In foundry iron the second-half market is now open, with a fair volume of business done. We quote: Bessemer, $30; basic, foundry and malleable, $25@26, f.o.b. valley furnaces, 95c. higher delivered Pittsburgh.

Steel—An inquiry for 60,000 tons of sheet bars has just appeared, for the 24-mill tin-plate plant to be completed about next March by the Bethlehem Steel interests at Sparrows Point, Md. It had been supposed that the plant would be supplied by one of Bethlehem's own mills. There is hardly any steel offered in either billet or sheet-bar form and the producers indeed would prefer not to have some of the long-term contracts now in force. We quote prices, largely nominal, at $50 for billets and $52 for sheet bars as minimum, with forging billets at $70@75 and rods at $60@65.

Following the lead of the National Tube Co., all manufacturers of wrought-iron and steel pipe are advancing prices about $2 per ton. The new lists reducing discounts one point are dated today. Steel line pipe is likewise advanced one point. New base for discount on standard steel pipe is 68% off list.

STOCK QUOTATIONS

N. Y. EXCH.†	Nov. 14
Alaska Gold M.	12
Alaska Juneau	7
Am.Sm.&Ref.,com	116½
Am. Sm. & Ref., pf	115
Am. Sm. Sec., pf. A	99¼
Am. Sm. Sec., pf. B	94
Am. Zinc	57⅜
Am. Zinc, pf.	82
Anaconda	100¾
Batopilas Min	1¾
Bethlehem Steel	640
Bethlehem Steel, pf	150
Butte & Superior	66
Chile Cop.	25¼
Chino	67⅞
Colo.Fuel & Iron	54½
Crucible Steel	90
Dome Mines	24¼
Federal M. & S.	18
Federal M. & S., pf.	44
Great Nor., ore ctf.	43¾
Greene Cananea	51½
Homestake	130
Inspiration Con	68⅛
International Nickel	50¾
Kennecott	56
Lackawanna Steel	97¾
Miami Copper	43⅝
Nat'l Lead, com.	67⅞
National Lead, pf	112½
Nev. Consol.	28
Ontario Min	6⅝
Quicksilver	2½
Quicksilver, pf.	3½
Ray Con	34½
RepublicI.&S.,com.	84
Republic I. & S. pf.	115¼
Sloss-Sheffield	81
Tennessee Copper	23
U. S. Steel, com	122¼
U. S. Steel, pf	121¾
Utah Copper	119⅞
Va. Iron C. & C.	57½

N. Y. CURB†	Nov. 14
Buffalo Mines	1
Butte & N. Y.	2½
Butte C. & Z.	18⅞
Caledonia	.53
Can. Cop. Corpn	2 1/16
Cashboy	06
Cerro de Pasco	43¼
Con. Ariz. Sm	2 11/16
Con. Coppermines	3
Con. Nev.-Utah	5/16
Crystal Cop.	.75
First Nat. Cop.	4⅜
Florence	.70
Goldfield Con	.54
Goldfield Merger	06
Granite	40
Hecla Min	8
Howe Sound	6⅜
Jerome Verde	1 11/16
Joplin Ore & Spel	52
Kerr Lake	4¾
Magma	55
Majestic	65
McKinley-Dar-Sa	.62
Mother Lode	.37½
Nevada Hills	.21
N. Y. & Hond	17½
Nipissing Mines	9
Oro	.03½
Ray Hercules	4¼
Rochester Mines	.69
St. Joseph Lead	20¼
Standard S. L.	1 1/16
Stewart	5/16
Success	.45
Tonopah	5⅞
Tonopah Ex.	5
Tribullion	⅜
United Zinc	4¾
White Knob, pf.	2¼
White Oaks	4½
Yukon Gold	2¾

SAN FRAN.*	Nov. 14
Alta	.04
Andes	.09
Best & Belcher	.05
Bullion	01
Caledonia	26
Challenge Con	‡ 05
Confidence	.17
Cons. Imperial	01
Con. Virginia	08
Gould & Curry	03
Hale & Norcross	08
Jacket-Cr. Pt	.04
Mexican	09
Occidental	.65
Ophir	.20
Overman	02
Savage	‡ .10
Seg Belcher	02
Sierra Nevada	25
Union Con.	.54
Utah Con	02
Belmont	4 50
Jim Butler	90
MacNamara	08
Midway	.21
Mont.-Tonopah	.22
North Star	.15
Rescue Eula	26
West End Con	75
Atlanta	09
Booth	09
C.O.D. Con	03
Comb. Frac.	05
D'field B.B.	05
D'field Daisy	05
Jumbo Extension	27
Round Mountain	35
Sandstorm Kendall	03
Silver Pick	21
Central Eureka	‡ 05
Argo	.06
Ariz. Central	.05
Big Jim	1 12½
Lazy Boy	.06
Nellie	.35
Tom Reed	2.25
United Eastern	4 37½
United Western	.04

BOSTON EXCH.*	Nov. 14
Adventure	4¼
Ahmeek	116
Algomah	1⅛
Allouez	74½
Ariz. Com., ctfs.	17
Bonanza	40
Butte-Ballaklava	2½
Calumet & Ariz.	89½
Calumet & Hecla	595
Centennial	22⅜
Copper Range	75½
Daly West	2½
East Butte	17¾
Franklin	9⅞
Granby	99
Hancock	15¼
Helvetia	.30
Indiana	3½
Island Cr'k, com	62
Island Cr'k, pfd	92¼
Isle Royale	36
Keweenaw	5½
Lake	14½
La Salle	5⅛
Mason Valley	6½
Mass	17
Mayflower	3¾
Michigan	4
Mohawk	99⅞
New Arcadian	6½
New Idria	15
North Butte	23⅝
North Lake	2⅛
Ojibway	2
Old Colony	3
Old Dominion	76½
Osceola	96
Quincy	97½
St. Mary's M. L.	91½
Santa Fe	2¼
Shannon	9⅛
Shattuck-Ariz.	32½
So. Lake	6
So. Utah	.25
Superior	16
Superior & Bost.	7¼
Tamarack	44½
Trinity	7⅛
Tuolumne	.60
U. S. Smelting	75½
U. S. Smelt'g, pf.	51
Utah Apex	3⅝
Utah Con	21½
Utah Metal	7¼
Victoria	7⅜
Winona	5⅝
Wolverine	50
Wyandot	1⅞

BOSTON CURB*	Nov. 14
Alaska Mines Corp.	.87
Bingham Mines	9½
Boston Ely	70
Boston & Mont	78
Butte & Lon'n Dev	57
Calaveras	5½
Calumet-Corbin	.02
Chief Con	2¼
Cortez	.20
Crown Reserve	43
Davis-Daly	5 3/16
Eagle & Blue Bell	1¼
Houghton Copper	1½
Iron Cap Cop., pf	7
Mexican Metals	.45
Mines of America	1⅞
Mojave Tungsten	3¼
Nat. Zinc & Lead	60
Nevada-Douglas	1⅞
New Baltic	2½
New Cornelia	18
Ohio Copper	24
Oneco	.75
Rex Cons	61
Rilla	.09
United Verde Ext.	39

SALT LAKE*	Nov. 14
Big Four	1 15
Black Jack	06
Cardiff	7 25
Colorado Mining	.22
Crown Point	.05½
Daly-Judge	8 00
Emma Cop	2 50
Empire Copper	1.15
Gold Chain	17
Grand Central	60
Iron Blossom	1 65
Lower Mammoth	03½
May Day	11
Opohongo	01
Prince Con	1.35
Seven Troughs	04
Silver-King Coal'n	3 05
Silver King Con	4 15
Sioux Con.	15
So. Hecla	1.70
Uncle Sam	06
Wilbert	08
Yankee	.20

TORONTO*	Nov. 14
Bailey	07½
Beaver Con	41
Chambers Ferland	17
Coniagas	4.75
La Rose	.53
Peterson Lake	18
Right of Way	05
Seneca Superior	‡ 09
T. & Hudson Bay	73.00
Temiskaming	62
Wettlaufer-Lor	09
Dome Exten	.29
Dome Lake	59
Foley O'Brien	.70
Hollinger	6.90
Jupiter	27
McIntyre	1.88
Newray	1 04
Porcu. Crown	70
Vipond	.38
West Dome	34

STOCK QUOTATIONS—Continued

COLO. SPRINGS	Nov. 14
Doctor Jack Pot	.08¼
Elkton Con	.10
El Paso	.40
Findlay	.03
Gold Sovereign	.04
Golden Cycle	2.41
Granite	.60
Isabella	.22
Jack Pot	.04
Mary McKinney	25
Portland	1.90
Vindicator	1.50

LONDON	Oct. 31		
Alaska Mexican	£0	15s	0d
Alaska Tre'dwell	2	15	0
Burma Corp.	4	0	0
Cam & Motor	0	12	0
Camp Bird	0	7	3
El Oro	0	9	3
Esperanza	0	10	9
Mexico Mines	3	17	6
Nechi, pfd	0	13	6
Oroville	0	16	6
Santa Gert'dis	0	10	9
Tomboy	1	1	3

* Bid prices. † Closing prices. ‡ Last Quotations.

MONTHLY AVERAGE PRICES OF METALS

Silver	New York			London		
	1914	1915	1916	1914	1915	1916
January	56.572	48.855	56.775	26.553	22.731	26.960
February	57.506	48.477	56.755	26.573	22.753	26.975
March	58.067	50.241	57.935	26.788	23.708	27.597
April	58.519	50.250	64.415	26.958	23.709	30.662
May	58.175	49.915	74.269	26.704	23.570	35.477
June	56.471	49.034	65.024	25.948	23.267	31.060
July	54.678	47.519	62.940	25.219	22.597	30.000
August	54.344	47.163	66.083	25.979	22.780	31.498
September	53.290	48.680	68.515	24.260	23.591	32.584
October	50.654	49.385	67.855	23.199	23.925	32.361
November	49.082	51.714	.....	22.703	25.094	.....
Dec.	49.375	54.971	.....	22.900	26.373	.....
Year	54.811	49.684	.....	25.314	23.675	.....

New York quotations cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

Copper	New York		London			
	Electrolytic		Standard		Electrolytic	
	1915	1916	1915	1916	1915	1916
Jan	13.641	24.008	60.756	88.083	65.719	116.167
Feb	14.394	26.440	63.494	102.667	*	133.167
Mar.	14.787	26.310	66.152	107.714	*	136.000
April	16.811	27.895	75.096	124.319	*	137.389
May	18.506	28.625	77.600	135.457	*	152.522
June	19.477	26.601	82.574	112.432	95.333	137.455
July	18.796	23.865	76.011	95.119	91.409	125.500
Aug	16.941	26.120	68.673	110.283	82.333	126.304
Sept.	17.502	26.855	68.915	113.905	85.250	134.071
Oct.	17.686	27.193	72.601	122.750	88.000	142.523
Nov	18.627	.....	77.744	.....	93.273	.....
Dec.	20.133	.....	80.773	.....	100.430	.....
Year	17.275	.....	72.532	.....	.....	.....

Tin	New York		London	
	1915	1916	1915	1916
January	34.260	41.825	156.550	175.548
February	37.415	42.717	176.925	181.107
March	48.426	50.741	180.141	193.609
April	47.884	51.230	166.225	199.736
May	38.790	49.125	162.675	196.511
June	40.288	42.231	167.636	179.466
July	37.423	38.510	167.080	168.357
August	34.389	38.565	151.440	169.870
September	33.125	38.830	152.625	171.345
October	33.080	41.241	151.554	179.307
November	39.224	.....	167.670	.....
December	38.779	.....	167.000	.....
Av. year	38.590	.....	163.960	.....

Lead	New York		St. Louis		London	
	1915	1916	1915	1916	1915	1916
January	3.729	5.921	3.548	5.826	18.606	31.167
February	3.827	6.246	3.718	6.164	19.122	31.988
March	4.053	7.136	3.997	7.375	21.883	34.440
April	4.221	7.630	4.142	7.655	21.094	34.368
May	4.274	7.463	4.182	7.332	20.347	32.967
June	5.932	6.936	5.836	6.749	25.170	31.011
July	5.659	6.352	5.531	6.185	24.611	28.137
August	4.656	6.244	4.520	6.088	21.946	29.734
September	4.610	6.810	4.490	6.699	23.151	30.786
October	4.600	7.000	4.499	6.898	23.994	30.716
November	5.155		5.078	.....	26.278	.....
December	5.355	.....	5.266	.....	28.807	.....
Year	4.673	.....	4.567	.....	22.917	.....

Spelter	New York		St. Louis		London	
	1915	1916	1915	1916	1915	1916
Jan.	6.386	16.915	6.211	16.745	30.844	89.810
Feb	8.436	18.420	8.255	18.260	39.819	97.762
Mar	8.541	16.846	8.360	16.676	44.141	95.048
April	10.012	16.695	9.837	16.525	49.888	99.056
May	14.781	14.276	14.610	14.106	68.100	94.217
June	21.208	11.752	21.038	11.582	100.614	68.591
July	19.026	8.925	18.856	8.755	97.250	50.750
Aug	12.781	8.730	12.611	8.560	67.786	51.587
Sept.	13.440	8.990	13.270	8.820	67.841	52.095
Oct.	12.800	9.829	12.596	9.659	66.536	54.159
Nov.	15.962	.....	15.792		88.409	
Dec.	15.391	.....	15.221	.....	89.400	
Year	13.230	.....	13.054	.....	67.553	.....

New York and St. Louis quotations, cents per pound, London, pounds sterling per long ton. * Not reported.

Pig Iron, Pitts.	Bessemer‡		Basic‡		No. 2 Foundry	
	1915	1916	1915	1916	1915	1916
January	$14.59	$21.60	$13.45	$18.78	$13.90	$19.70
February	14.55	21.16	13.45	18.93	13.90	19.51
March	14.55	21.81	13.45	19.20	13.95	19.45
April	14.55	21.65	13.45	18.95	13.95	19.45
May	14.61	21.78	13.60	19.11	13.83	19.58
June	14.70	21.95	13.67	18.95	13.77	19.34
July	14.94	21.95	13.91	18.95	13.68	19.20
August	16.01	21.95	15.31	18.95	14.75	19.25
September	16.86	22.88	15.95	19.58	15.70	19.53
October	16.95	24.61	15.96	21.26	15.80	21.51
November	17.57	.....	16.47	.....	17.20	.....
December	19.97	.....	18.44	.....	18.95	.....
Year	$15.82	.....	$14.76	.....	$14.95	

‡ As reported by W. P. Snyder & Co.

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The Nevada Wonder Mill

By Arthur C. Damax*

SYNOPSIS—A ten-stamp cyanide mill that was constructed to handle 75 tons per day has, by some minor changes in solution handling and some small additions to tank capacity, been made to treat 155 tons per day—sometimes more. Power consumption is 27.7 kw.-hr. per ton milled, and 10 tons per day per man is handled.

The ore of the Nevada Wonder Mining Co., at Wonder, Nev., is milled by the Churchill Milling Co., which is a subsidiary controlled by the same interests.

The crushing of the ore is done with a 10x16-in. Blake crusher, ten 1,400-lb. stamps, one 6-ft. Trent chilean mill and one 5x22-ft. tube mill in closed circuit with a Dorr duplex classifier. The screens used on the batteries have ½x1-in. openings, the stamp duty being as high as 16 tons per day, with a yearly average of 15.7 tons. The ore is principally one of silver and averages between $15 and $25 per ton. The average tonnage for nine months of 1916 has been 157 tons per day, which is remarkable considering that the mill was designed for but 75 tons and only a few changes have been made in the solution equipment, and at the same time securing a recovery above 90%.

Since the excellent paper on the Churchill Milling Co.'s mill, by E. E. Carpenter, read before the American Institute of Mining Engineers, in San Francisco, 1915, some additions have been made to the mill, such as one 28x100-ft. Dorr thickener between the agitator and the stock tank; one clarifying tank, one battery storage tank and two zinc boxes. The pulp, upon leaving the agitators, has a fresh wash of barren solution in each of the four Dorr thickeners before entering the stock tank. By using a fresh barren wash for each thickener instead of the countercurrent-decantation system, the extraction is increased, but the cyanide loss is also increased. From 1,200 to 1,300 tons of solution is precipitated in the 9 zinc boxes each day. The lime is slacked and ground in a small chilean mill and added intermittently to the pulp entering the first Pachuca tank. It was found that only three tanks were needed for agitation, and at present the fourth is used as a settler, the decanted solution being precipitated. To prevent heavy material from settling on the sides of the Pachuca tank, a cut is made of the heavy sands as they flow over the edge of the funnel and carried to the next in series. Also every day a violent agitation of each Pachuca by high-pressure air is resorted to, so that very little trouble with the Pachuca has been encountered.

THE MILL OF THE CHURCHILL MILLING CO., WONDER, NEV.

The solution strength in the Pachuca tank is kept about 3½ lb. KCN and 2 lb. CaO. Lowering the strength of cyanide was tried, but a hard, white, crystalline coating formed on the zinc shavings with a resulting [illegible] increase in value of the zinc-box tailings. About 220 lb. of sodium cyanide per day is added to the Pachuca tank and 150 lb. to the clarifying tanks. By keeping the precipitation heads at about 3½ lb. KCN, no difficulty in precipitation was encountered and tails averaging less than 10c. are obtained.

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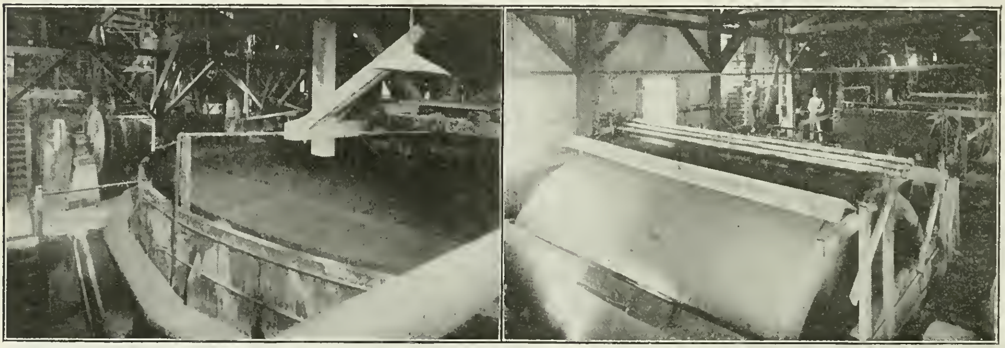
*Mining engineer, 2678 Eudora St., Denver, Colo.

The zinc shavings used are very coarse, being more than $^1/_{125}$ in. wide. The efficiency of the zinc was materially increased by clarifying the solution from the Dorr thickeners for precipitation by means of Butters filters. Unclarified, 1 lb. of zinc shavings precipitated 9 oz. of metal, but when the solution was clarified, the same amount of zinc precipitated 15.39 oz. of metal. The average consumption of snpplies per ton of ore for the first nine months of 1916 was:

CONSUMPTION OF MATERIALS IN CYANIDING

	Per Ton Milled
Sodium cyanide	2 05 lb.*
Lead acetate	1 35 lb.
Lime	3 69 lb.
Zinc	1 45 lb.
Pebbles	3 31 lb.
Fuel (heating)	1 85 gal.
Power (milling only)	27 7 kw.-hr.
Tonnage per day	157
Tons solution precipitated per day	1,200-1,300
Tons solution precipitated per ton ore, approximately	8

*1 lb. chemical, 1.05 lb. mechanical.



Tube mill and thickener

The Oliver filters

INTERIOR VIEWS OF THE CHURCHILL MILL, WONDER, NEV.

Squirrel-cage induction motors of 440 volts are used exclusively in the mill. The accompanying table shows the various motors with the load on each:

TABLE SHOWING MOTOR DISTRIBUTION

Motor	Rated Hp. of Motor	R.P.M. of Motor	Hp. to Drive Line Shaft	Hp. to Drive Individual Part	Total Hp. Load on Motor
Crusher and conveyor	20	900	6 33	..	18 75
Dorr thickener No. 5	5	1,200			1 17
10 stamps (1,400 lb.)	30	1,200	4 7	23 46	28 16
Tubemill	100	1,200	16 4	.	106 77
Dorr classifier	...	...	....	5 9	...
Chilean mill	...	...	....	36.36	...
Tubemill	...		....	48 11	.
4-in. slime pump (centrifugal)	20	900	....	...	12 9
2½-in. slime pump (centrifugal)	15	1,200	..	..	11 0
Compressor	50	1,200	5 63		46.84
Mill compressor	...	...	...	34 16	...
Vacuum pump	...	.	...	3.5	..
Zinc lathe	...	.	...	3.55	
Thickener	20	900	6 0	.....	17 00
4 Dorr thickeners and stock	...	...	....	5 00	....
Triplex and centrifugal pump	...	...	...	6.00	...
Filter	30	1,200	3.5	.	21.12
Vacuum pump	...	....	....	1 78	...
2½ - in. centrifugal pump	...	....	....	5 86	.....
Vacuum pump	..	.	....	8 80	...
3 Oliver filters	...	.	...	1 18	.
Pump	10	1,200	...	.	8 89
Triplex pump	...	...	...	5 39	.
Triplex pump	...	.		3 5	...

MILL-POWER DISTRIBUTION

	%	Kw.-Hr. for 1 Ton
Crushing and conveying	3 0	0 831
Stamps	12 0	3 324
Chilean mill	14 0	3 878
Tube mill	25 0	6 925
Agitation	23 0	6 371
Thickening and washing	5 0	1 385
Filtering	14 0	3 878
Precipitation	1 0	0 277
Refinery	0 5	0 1385
Assaying	0 5	0 1385
Surface plant	2 0	0 554
Total	100	27 7

From the mill-power table it will be seen that the crushing uses 54% of the entire power. A total of 300 hp. is represented by the motors in the mill.

The mill has an elaborate system of pipes and pump connections, thus providing for the ready interchange of solutions and pulps without any delay. All the Dorr thickeners have platforms of 2x12-in. plank encircling them, as shown in photograph. These platforms enable the millman to clean his launders or skim off any part of the thickener surface. The regular spray system is not used on the Oliver filters, but water flowing from a perforated 2-in. pipe upon a wooden shelf sprays over the pulp surface. The spray arrangement and the rubber apron used to deflect the excess surface water of the Oliver from entering the filter box are shown clearly in the illustration. By means of the rubber apron the building up of mill solutions is avoided.

The mill crew consists of three batterymen, one crusherman, three solution men, three solution helpers, three refinery men, one utility man, one mechanic and helper and the mill foreman, making a total of 16 men per day, equivalent to 10 tons per man per day.

All mill data—assay values, tonnage, etc.—are posted in the mill so as to give all millmen a knowledge of the mill results. An accurate and uptodate record is kept of all results obtained and shows very interesting details of milling.

I am indebted to E. E. Carpenter, general superintendent, and H. M. Alley, mill foreman, for the data incorporated in this article.

⁂

The Bolivian Mineral and Natural-Products Exhibit, shown at the Panama-Pacific Exposition in San Francisco, has been set up in New York as a permanent exhibit, to be maintained in connection with the new offices of the consul general, Adolfo Ballivian, on the 41st floor of the Woolworth Building.

Winona Copper-Leaching Test Plant

A 5-ton Slater-process leaching plant at Winona, Mich., has been in operation for some months and has yielded interesting results.

The ore milled by the Winona Copper Co. is an amygdaloid which greatly resembles that mined from the Baltic and other beds of the Lake Superior native-copper deposits. It carries considerable epidote, calcite, and quartz, with a limited amount of mass and barrel copper, the bulk of the metal occurring in stamp rock.

In the plant in question two classes of mill tailings have been treated, each being amenable to leaching and apparently to the same degree. Of these the first comprises the tailings from the Hardinge-mill middling tables and from the slimes middling tables, eight tables in all, and the second class consists of the tails from the middling table. The bulk of this material is discarded ordinarily in the mill tailings.

The majority of the tests have been made on a composite pulp derived from the middling tables, the results and corresponding deductions being based upon the handling of this material.

MACHINERY FOR HANDLING THE PULP

A cone classifier is used for partly dewatering the pulp, which then flows to a Dorr simplex classifier. The latter reduces it to about 20 to 22% moisture, dropping the heavy pulp directly into the feed end of a barrel agitator, where it meets with fresh leaching solution.

The agitator, an iron shell lined with acid-proof brick set in hot asphalt, is provided with two wooden baffles which are believed to assist in bringing about a good contact between the ore and the solution. The proper weight ratio of solution to ore depends upon the strength of the former, being usually about 2.5 to 1, and the solution and ore are in contact in the agitator for about 1½ hr.

The agitator discharges into the lowest stage of a three-deck Dorr classifier which washes and also dewaters the pulp, the pregnant solution being replaced at four points by barren solution.

From the lowest deck the pulp, retaining but 20 to 22% moisture consisting of barren solution, is discharged into a tailings launder, whence it is flushed to the regular mill-tailings launder by mill water from the cone classifier at the head of the system and the overflow from the upper Dorr classifier.

MACHINERY FOR HANDLING SOLUTIONS

There are five simple-diaphragm electrolytic cells built of wood and painted with an acidproof asphaltum mixture, each with a capacity corresponding to the extraction of 20 to 25 lb. of copper per 24 hr.; and in which two solutions are employed.

The catholyte solution, which passes through the cathode compartment, is a 5 to 10% solution of common salt which gradually becomes charged with sodium hydroxide.

The anolyte solution, which passes through the anode compartment, is barren leaching solution that has passed through the system and is a 5% salt solution containing also about 0.2% iron as ferrous chloride. The cathodes are of iron and the anodes of Acheson graphite. The catholyte passes through its compartment and back to its storage tank, while the anolyte passes through its corresponding compartment and through the entire leaching system at a rate sufficient to provide the required ratio of solution to ore.

In passing through the electrolytic cell the iron in the anolyte is changed from ferrous chloride to ferric chloride and a slight excess of free chlorine is also formed, as well as some other chlorine compounds such as hypochlorous acid. The aggregate of these materials constitutes the active leaching agent, or fresh leach.

The current employed is adjusted to meet the conditions. For "10-lb. ore," using five cells and a solution-ore ratio of 2.5 to 1, with six tons of dry feed per day, each cell should receive about 175 amp.

In the test plant it was found desirable to place the revolving copper precipitator above the level of the discharge of the agitator. Hence it was necessary to elevate the pregnant solution by means of a special acid-proof pump.

Where sufficient grade is available, a single-stage plant may be designed so that only the catholyte and the barren solution, neither of which appreciably attacks iron, will require to be pumped.

Since all solutions are in constant motion when the plant is in operation, storage necessitates are at a minimum. Two tanks each are provided for catholyte and anolyte: A sump tank for the former just below the level of the cells and one for the latter just below the copper precipitator, and a supply tank for each above the level of the cells. In addition to these four tanks, there is one for settling the pregnant solution before precipitation of the copper, and one between the precipitator and the barren-solution sump, acting as a copper filter and settler.

For handling fresh leach and pregnant solution, the pipes used are of acidproof fiber. For all other solutions ordinary iron pipe is satisfactory.

In the 6-ton plant, all the machinery is driven from a single countershaft and from 10 to 15 hp. is used, but it is estimated that 40 hp. would operate a 100-ton plant.

Current is supplied to the cells by a d.-c. generator, the voltage depending upon the number of cells placed in series. With five cells and a 5% salt solution for the anolyte, about 22 volts are needed.

OPERATION OF THE PLANT

To begin operations, the compartments of the electrolytic cells are filled from the respective supply tanks and, when nearly full, current is turned on. When the compartments are filled, the flow of catholyte is reduced to a minimum and a flow meter controlling the anolyte is adjusted to give the proper volume of solution.

The pumps are then started and pulp from the mill turned into the upper Dorr machine. The plant may be said to be entirely automatic when once the flow meter and the stream of mill pulp have been properly adjusted, it being believed that one man can run a 100-ton plant, doing in addition all the analytical work that may be necessary. His principal duties would be to oil the machinery, regulate the flow of pulp and solutions, supply scrap iron to the precipitator, clean up cement copper from the copper boxes and occasionally to slime out the pregnant-solution settling tank.

With a single-stage leach, handling six tons of [illegible] and 12 to 15 tons of solution per day, the extraction [illegible] about 75% on material carrying 9 to 12 lb. copper per ton, but it may be raised to 85% by allowing a longer contact between ore and leaching solution, with a consequent lower daily capacity.

With a 75% extraction in a single-stage plant, the power consumption for the regeneration of the leach is from 1.75 to 2 kw.-hr. and the iron consumption about 1.25 lb. per pound of copper produced, the salt loss in the tailings being from 20 to 22 lb. per ton of material handled, regardless of copper content.

The results attained in the tests indicate that a two-stage leaching process should be adopted; pregnant leach, partly exhausted, to be used for fresh ore, and fresh leach direct from the cells for the secondary stage of leaching.

Tests conducted in large bottles rotated at about the same rate as the barrel agitator and using pulp and solution from the 6-ton plant confirm the belief that with the proposed two-stage process the extraction on any ore will be higher, with equal solution volumes and ore weights.

About 25% of the total amount of copper extracted is removed during the first stage, and it is expected that a total extraction of 90% of the ore content can be obtained with a power consumption of from 1.5 to 1.6 kw.-hr. per pound of copper extracted, which is appreciably lower than obtained in the single-stage process. The principal extra equipment required would be an agitator and an acidproof pump to handle pregnant solution.

INSTALLATION AND OPERATING COSTS

It has been estimated that the cost of equipment for a 100-ton two-stage leaching plant at Winona, including 20 electrolytic cells, 100-kw. generator and motor, 4½x 15-ft. dewaterer, acidproof duplex machine to be used as agitator, barrel agitator, three-deck Dorr machine for washing and dewatering, woodwork and mounting classifiers, two iron pumps, one acidproof pump, tanks, pipe and pipe-fittings, 40-hp. motor, countershaft and fittings, and precipitator and fittings, will amount to approximately $25,000 as the cost of the complete plant.

Assuming the cost of power as 0.8c. per kw.-hr., with salt at $5 and scrap iron at $10 per ton respectively and with labor at an average of $3 per day, the operating costs in cents per pound of copper produced, based on an ore from which 10 lb. copper per ton is recovered, have been estimated as follows: Power for electrolysis, 1.28c.; power for machinery, 0.58c.; salt loss, 0.50c.; iron for precipitation, 0.63c.; labor, 1.35c.; supplies and repairs, 0.50c.; or a total of 4.84c. per lb. To this should be added interest and amortization on the cost of the plant, which at 12% per annum on $25,000 is calculated to amount to 1c. per lb. of copper, making the total estimated cost at Winona, 5.84c. per lb. of cement copper 75 to 80% pure.

Without any change whatever in the operation of the mill, there will be available about 100 tons per day of material carrying an average of from 10 to 12 lb. of native copper per ton, ordinarily discarded in the mill tails.

There seems to be no question regarding the feasibility of leaching Winona mill tailings to the amount of at least 100 tons per day, with an extraction approaching 90% and an operating cost of not over 5c. per lb. of cement copper produced. The total cost of the copper, refined and marketed, apparently will not exceed 7.5c. per pound.

The Calama Smeltery

SANTIAGO CORRESPONDENCE

The smeltery and mining properties of the Compañía Minera de Calama have finally been taken over by the yankees, and a property that has off and on made money for its stockholders will finally be submerged in the Chuquicamata promotion.

The mines at Chuquicamata which belonged to the Calama company have produced much copper. The smeltery at Calama is a poor thing and, with the exception of a few good machines, will undoubtedly be scrapped. In the stone age of this company some benighted manager was offered a lead water jacket and it was such a bargain that he bought it for his copper ores. It is there yet. During the Triassic they tried a leaching process and had lots of excitement and sent many telegrams to Santiago and Valparaiso about the results. At a more recent period concentration was attempted because a second-hand ball mill was offered cheap. As there was no old classifier about, classification was not attempted. Later, another attempt at concentration was made, and correspondence at the mine was seen showing that the manager ordered an Isbell vanner and thought he was ordering an Isbell table.

GENERAL VIEW OF THE CALAMA SMELTERY

During the time that options were being obtained on the Chuquicamata property, the Calama company stockholders hugged the idea that "the yankees must have our property," and this has kept the price too high until lately. However, these same stockholders were wise enough to play the Ore Trading Co. against the Chile Exploration Co., which resulted in the price being about a million pesos higher than it would otherwise have been.

The whole plant at the smeltery, except the engines, is out of doors, as it never rains. Note in the illustration that even the ball mill is not covered, and the ore was fed by hand and foot, with the assistance of a ladder. The yankees have now taken hold of the property, and we Chileans know that they will make a dividend-payer of it—even if it does taken eight times as much money as they estimate.

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The Papuan Mines Options Syndicate will increase its capital, according to the "Australian Statesman and Mining Standard," from £800 in £10 shares to £1,300, by the issue of an additional 50 shares of £10 each. The syndicate has an option over two leases, stated to be on the line of lode on which the B. H. Proprietary Block 10 Co.'s Misima lease is situated. The option is open until after Jan. 15, 1917.

Railway Geological Department

By Joel H. Watkins*

SYNOPSIS—No business organization realizes more clearly than a railroad company that "preparedness" means internal organization of commercial affairs as well as preparation for national defense. In the new order of affairs, the economic geologist is to play an important part in the adjustment of business to natural resources within the territory served by a railroad.

In recent years some of the railroads of this country have enlarged the scope of their industrial departments by adding to the staff of this branch of the service one or more economic geologists. In some instances the positions have been made permanent, requiring the whole time of the geologist, while in other cases the geologist is retained in a consulting capacity and called in only on special problems. As this is rather a new departure for railroads, it is natural that much interest has been created, and we often hear the question asked, "Why does your railroad maintain a geologist?" or "What possible use could a geologist be to a railroad?" As economic geologist for the Southern Railway Co. for nearly six years, I feel that I now have a somewhat better idea of the value of a geologist to a railroad company than I had six years ago. In response to a request from the editor of *Engineering and Mining Journal* for a discussion of this new field for the geologist, I will therefore outline briefly some of the possibilities of this work as I see them at this time.

The primary object of the Federal and various state geological surveys is to intelligently facilitate the exploration and development of the mineral resources of the country, both as a source of employment and wealth for the people and as a source of materials and revenues for the nation. Why, then, should not an economic survey of the mineral and chemical resources of territory served by a railroad be of incalculable value as an ultimate source of freight revenue?

The Function of the Geologist

Geology, chemistry and physics are so correlated and so dependent, one upon the other, that a technical knowledge of one is incomplete without a working knowledge of the other two. Economic geology has to do only with the occurrence and study of minerals and mineral substances that are of economic value. Industrial research, in the terms of Gore, is "the art of scientific discovery" in the field of industrial arts. An industrial-research laboratory in connection with a department of economic geology would be a most efficient combination in facilitating the development of both chemical and mineral industries. I know of no field wherein an institute of this kind could have a broader and more useful service than in promoting the development of the mineral and chemical resources tributary to a great railway system.

All productive industries are absolutely dependent upon original raw materials, either organic or inorganic. These materials must be transported from the position of their origin and assembled before they can be converted by the processes of manufacture into materials of useful form. It is only an intelligent knowledge of these materials and of their usefulness that will ultimately bring about their exploitation and development.

In the natural course of events many mining and chemical industries will originate along a railroad without any particular effort on the part of the railroad's employees to secure such enterprises. Other developments are brought about through the direct efforts of the railroad's employees. Were there only one railroad in a given territory, it could by no means afford to wait for the development of its latent resources through the casual activity of people who have no particular interest in the welfare of the company. But that is not the case—there are a number of good railroads in this country, traversing the same states and serving much of the same territory. Developments which, by virtue of the progress of the times, are destined sooner or later to reach a given territory must be located on some railroad. There should be much keen competition between railroads for the establishment of such permanent freight producers along their lines. Those roads which pursue a broad and liberal policy in anticipating and fostering such new enterprises are sure to grow more rapidly and more substantially. So there are more reasons than one why a railroad should take an active part in promoting the development of its own potentialities.

TABLE I. CLASSIFIED REVENUE FREIGHT TONNAGE FOR 1915

Railroad	Products of Agriculture, Tonnage %	Products of Animals, Tonnage %	Products of Mines, Tonnage %	Products of Forests, Tonnage %	Manufactures, Tonnage %
Southern	13.82	1.16	40.30	15.52	16.39
Norfolk & Western	4.18	0.69	79.13	5.58	9.52
Baltimore & Ohio	6.51	1.37	64.09	3.87	16.92
Pennsylvania	5.11	1.55	60.16	3.89	14.29
Santa Fe	26.57	5.74	38.65	7.31	14.60
Southern Pacific	21.78	3.02	37.35	15.80	14.24

The tendency in mining today seems to be toward the exploitation of large bodies of low-grade ore operated on an extensive scale, rather than toward the mining of small bodies of high-grade ore which give rich returns but are short-lived. The six great porphyry mines best illustrate this idea. The effect of such enterprises upon the freight revenues of the railroads serving them is obvious. A glance at the classified tonnage of several railroads in different parts of the country for 1915, given in Table 1, will show that the stability of the railroads is largely dependent upon a volume of low-grade freight; the unmanufactured products of the mines and forests being among the lowest rate classifications.

Railway Geological Field Work

The value of a geologist to a railroad company must be based largely upon his comprehensive knowledge of all minerals, building stones and clays tributary to its lines. An accurate and unrestricted knowledge of the economic occurrence of such mineral substances cannot be acquired by reading theories and reports prepared by others. First-hand information, which can be obtained only by hard and diligent field work, is an absolute necessity. The man with trained eye and brain, who has seen the materials as they occur in nature, not only in one place, but in many places, has a great advantage over the man who sits in his office, reads a report and wonders if the [illegible] is really there. In these days of modern railroading the word efficiency is a term familiar to all branches of the service. If efficiency or even fair results are to be expected of a geologist maintained by a railroad, he must have both the moral and financial support of his employers. That is to say, he should be given every facility for carrying forward this important work in a broad and systematic way. He should be given a staff of competent assistants with ample space and a well-equipped physical, chemical and clay-testing laboratory. He cannot know too much about the materials with which he is working.

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*Geologist, Southern Railway Co., Washington, D. C.

If a prospective client were to call upon some railroad official for advice in regard to the occurrence of some particular materials upon which a permanent industry was dependent, he would be disappointed if he were handed an out-of-date report and told that the company had no first-hand information in regard to the materials. His patronage would probably be lost. If, on the other hand, he could be taken to the company's industrial-research laboratories, shown samples and analyses of the materials he desired, maps, cross-sections and photographs of the occurrence, if the industrial engineer in charge could intelligently compare these materials with similar materials from other localities, if he could discuss uses, market conditions and cost of production, his advice would be of value and he would gain the confidence of his client. Field work, then, which gives an unrestricted first-hand knowledge of the occurrence of materials with which it is desired to work, is a most important part of an efficiency plan.

Industrial Usefulness of Materials

Next in importance to a knowledge of the occurrence of materials is a working knowledge of the usefulness of materials. That is to say, one should know the course of the raw materials from the mine to the factory. Each manufacturer's requirements should be known, also for what purpose each particular substance is best suited. Information of this kind is not vested in any one person by virtue of the position he holds, nor can it be acquired by reading press reports. It must be diligently sought after and carefully correlated and compiled. Efficient knowledge as regards the usefulness of materials requires investigations in the factory instead of in the field. Industrial plants must be visited and talk had with the chemist and the manager. As many pertinent questions must be asked as they are inclined to answer, samples taken of their materials and literature, and then a visit made to competitors. The viewpoint of the manufacturer can thus be learned, enabling the geologist to better help him solve his problems of economic production.

Some years ago, while with the Pennsylvania Railroad, I remember being struck with the importance which railroad officials attached to initiative. While discussing the qualifications of a young man who was in line for promotion, they would say for example, "He is a good engineer and knows his subject, but unfortunately he lacks initiative"; which is to say, he lacked the progressive application of his knowledge.

Assuming that the geologist's knowledge of the occurrence and usefulness of the material resources with which he is working is fairly intelligent, he can hardly afford to rest upon his laurels and wait for clients to find him out. In fact, his store of information, however complete, would be of little value if he were not in position to place it in the hands of the most responsible people. It is one thing to produce an article and another thing to sell it. He must anticipate the needs of clients and must take the initiative in placing at their disposal the confidential data which he feels they can use. Almost all railroads advertise extensively their golden industrial opportunities. It is probably a fact that if a large mineral or chemical industry were projected for a given territory, its engineers would not come to the railroad for guidance. The reason for this is that experience has taught the public that in most cases the information furnished by railroads is of such a general character as to be of little value. It is also a very hard matter to approach a manufacturer with a proposition that he has never thought of before and secure his interest. There is another and, to my mind, an infinitely better way to bring to the attention of clients the proposition desired to have them consider. The geologist's work should be of such a high standard and his personal acquaintance among engineers and chemists should be so intimate and extensive that his confidential advice would be always solicited. Geologists, mining engineers, chemical engineers and ceramic engineers represent a group of scientific men upon whose shoulders rests the responsibility of many industrial developments. More and more each year capitalists are relying upon the judgment of such trained men to insure the success of their enterprises. In order that the geologist may enjoy the privilege of a confidential acquaintanceship with such men, he must join their societies, read their literature, attend their meetings and prepare articles for their magazines. Each industrial engineer added to his list of acquaintances is a new prospect, for sooner or later one may have some economic problem with which to approach him for advice. He must make their interests his interests if he hopes to secure the coöperation so necessary in anticipating new developments. Too much emphasis cannot be laid on the importance of having a working knowledge of the fundamental requirements of the manufacturer, a wide acquaintance among research men, and a far-sighted anticipation of the progress and trend of industrial arts.

Railroads' Part in Industrial Preparedness

Probably the most vital question before the country today is the problem of organized military preparedness. The word preparedness has become a slogan in the mind of every progressive American citizen. We are beginning to realize that preparedness is equally as important to internal commercial affairs as it is to national defense. No organization appreciates this more forcibly than a railroad company. All that has been said, if sifted down, will resolve itself into the word preparedness. Anticipation, exploration, investigation, organization and conservation all insure preparedness. The geologist must be prepared to give intelligent information when the opportunity presents itself; and more than that, he must often make the opportunity.

The immediate possibilities of chemical and industrial research in this country are so great that it is useless to venture an expression as to the progress that will be made. A few of the outstanding specialties now largely under control of the research chemist which have come under observation are as follows: Clay-working materials, limestone products, coal-tar products, fertilizers, paints, refractory materials for bricks, crucibles, etc. Of equal importance, perhaps, are building stones and marbles, abrasive materials, barium compounds, cement and glass materials, graphite, slate and other roofing materials.

There is no class of industries in this country growing more rapidly and more substantially than the clay-working industries. The final test for any clay product is made in the burning. In order to give intelligent advice in regard to kaolins, shales or common clays, the geologist must first make preliminary tests of these materials in his own clay-testing laboratory. He can then go to a manufacturer with a definite proposition and convince him.

The first question that always arises in regard to coal is the question of analysis, whether it is to be consumed as fuel or in the manufacture of coke or coal-tar products. Where there are several coals to choose from, analysis is always the controlling factor. A railway geologist should have at his command a complete list of all producing coal mines along his railroad, with a number of reliable analyses of the coals from each mine, to enable intelligent comparison and show the character of the coals from which to select.

IMPORTANCE OF ELECTRICAL POWER AT LOW COST

Electrochemical and electrometallurgical industries are rapidly becoming of far-reaching importance in this country. Probably cheap electric power is the most essential thing to the success of such industries. It would be useful to have accurate detailed information on all developed and undeveloped water powers in the territory served by the railroad as well as the comparative cost of power developed with steam at the coal mine and at other points. There are many instances where hydro-electric power, of from 500 to 3,000 hp., can be developed at a very low cost, but on account of the distance from the points where it can be disposed of, the loss in transmission is too great. Such powers can often be utilized to great advantage where raw materials used in electrometallurgical and electrochemical industries are close at hand. A finished product can be produced at a minimum cost and will therefore stand transportation to greater distances.

Materials for the control and handling of high temperatures, which come under the head of refractories, have reached an output of great magnitude in recent years. This class of industries owes its progress largely to a new type of specialist now known as the engineer of refractories. Among the more important materials consumed in the manufacture of refractories are fireclay, flint clay, quartz, magnesite, asbestos, graphite and bauxite.

Under the head of abrasive materials is a long list of natural and artificial substances of varying degrees of hardness used in grinding, finishing and polishing metals, enamels, stone, glass, wood, leather and other products. Natural abrasives include emery, corundum, silica, garnet, feldspar, pumice, etc. Artificial abrasives are generally produced in the electric furnace. The properties of abrasives, including hardness, sharpness and fineness of particles, are generally determined by actual physical tests. Many new and useful materials of this class may be brought to light in the laboratory.

Lack of space prohibits the mention of other materials that might be studied profitably in the field and in the research laboratory. Such a branch of the service, however, would give the railroads a powerful control of industrial developments and would enable them to conserve their natural resources, a step extremely desirable in view of present conditions.

The Canadian Nickel Industry

In the first half of the present year the production of nickel in Ontario was 12% greater than for the corresponding period of last year, according to the report of the Ontario Bureau of Mines, an abstract of which was published in the *Toronto Globe*, Nov. 7, 1916. It is probable that the output will be greater, and the value also, during the latter half of the year. Early in the new year the smelting and refining capacity served by Ontario ore will be larger, as additions are being made to that in the United States and Britain and new plants are in course of erection in Canada. More information has recently been forthcoming with regard to the development by the British-America Nickel Corporation, which received from the British government an undertaking to accept part of its output, and in addition the bonds of the company will be guaranteed by that government. This is undoubtedly part of a plan to increase the supply of nickel for the government without dependence upon anything in foreign countries, but the exact details will not be known until the government announces them.

Not long ago it was given out that the new refinery of the International Nickel Co., at Welland, Ont., would be turning out refined metal within 12 months, and at the same time an announcement was made that within a few days actual operations on the building of another refinery for the British-America Co. would begin.

The value of the nickel produced in Canada since 1889 is shown in the accompanying table.

CANADIAN NICKEL PRODUCTION

1889	$498,286	1896	$1,188,990	1903	$5,002,204	1910	$11,181,310
1890	933,232	1897	1,399,176	1904	4,219,153	1911	10,229,623
1891	2,775,976	1898	1,820,838	1905	7,550,526	1912	13,452,463
1892	1,399,956	1899	2,067,840	1906	8,948,834	1913	14,903,032
1893	2,071,151	1900	3,327,707	1907	9,535,407	1914	13,655,381
1894	1,870,958	1901	4,594,523	1908	8,231,538	1915	20,423,348
1895	1,360,984	1902	5,025,903	1909	9,461,877	1916	*23,000,000

* Estimated.

The work of the British-America Co. will be undoubtedly of great importance and will be directed by E. P. Mathewson, one of the leading metallurgists of the continent, who has just left the Anaconda Copper Mining Co. to associate himself with this new undertaking.

The first and largest producer of nickel in the world is the International Nickel Co., which does its refining in New Jersey, but smelts matte at Sudbury, through the Canadian Copper Co., which it controls. Another corporation is the Mond Nickel Co., of Great Britain, the head of which is Sir Alfred Mond. This company also smelts its ore into matte at Coniston, Ont., and the matte is refined at Clydach, Wales, those works being greatly enlarged in 1911. The International Nickel Co. takes practically all of the 59,000,000 lb. shipped to the United States and the Mond company all of the 12,000,000 lb. that goes to Great Britain. Each of these corporations works by its own processes, which have been evolved after much experimenting and heavy outlays.

A third corporation was organized in July, 1913, under the name of the Canadian Nickel Corporation, but in the following month the name was changed to the British-America Nickel Corporation, and its plans are now taking more definite shape. The old Murray mine has been further worked, and recent developments indicate quality and extent of ore much better than anticipated. The company bought up the nickel interests of the late John R. Booth and others and now controls 17,000 acres of Sudbury land and has obtained the Canadian rights to the Hybinette process. It is claimed that with this process nickel can be produced 99% pure. The nominal capital of all the Canadian nickel companies is about $100,000,000. The capital of the International Nickel Co. is $62,000,000, but of this only $2,500,000 is in the Canadian Copper Co. The Mond Nickel Co.'s capital is £850,000, represented mostly in Great Britain. The nominal capital of the British-America Nickel Corporation is $30,000,000, but present developments may shortly result in changes in this organization's finances.

Melting Aluminum Chips

A bulletin recently published by the United States Bureau of Mines gives an account of experiments made to compare the recovery of metallic aluminum in melting down chips such as are obtained in the automobile factories in machining aluminum castings. As aluminum has sold at three times its normal price for the past year, and as a recovery of but 60% of the metal in the chips is common, and a 90% recovery is commercially possible, the preventable loss is of considerable magnitude.

The bulletin discusses the causes of the high loss in the usual method of melting chips and shows that the difficulty of getting the tiny globules of molten metal resulting from the fusion of the very fine chips to coalesce, when covered with a skin of oxide and dirt, is apparently the main cause for low recoveries. Two methods of melting can be successfully used to promote coalescence. In one the chips are kept just above the fusion point and the globules made to coalesce by hand puddling, which breaks through the skin and makes the globules unite. In this method melting is best done in an iron pot heated by an oil-fired burner.

The other is by the use of a flux which melts off the skin of dirt and oxide, producing clean globules which can unite. The flux suggested is 85% common salt, 15% fluorspar, used in large amount (20 to 30% of the weight of the chips) and mixed with the chips before charging. Much higher temperatures are required by this method than by the puddling method, so the iron-pot furnace is not practicable, and melting is best done in graphite crucibles or in a reverberatory furnace. The flux method does not require the constant hand puddling of the other method.

Since the presence of dirt and oxide causes low recoveries, the necessity for care and cleanliness in the collection and storage of chips is emphasized. Chips wet with cutting compound will oxidize superficially on storage, but by drying the chips by centrifuging this can be prevented. Perfectly clean chips can be melted without much loss by either method, while very dirty chips cannot be handled at all so as to give the high recoveries of clean chips, although the two methods mentioned gave better results on dirty chips than any others tried. Care and cleanliness in the collection of chips in the machine shop producing them will give chips from which a high percentage of metal can be recovered.

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Inspection Trip of Spanish Engineers, as noted in "Revista Minera," has for its object the study of progress at the principal centers of the iron and steel, shipbuilding and electrical industries of the United States. The party, consisting of various experts, engineers and managers of establishments in the Province of Vizcaya, recently sailed for New York. Among them are Don Mariano Zubiria and Don Remigio de Eguren and the mining engineers, Don Juan Urrutia y Zulueta and Don Manuel Ocharan.

Foreign Trade in Lead and Zinc

Imports of lead and zinc during September, 1916, are reported by the Department of Commerce as follows:

Articles and Countries	Contents, Lb.
Lead ore:	
Canada	204,200
Mexico	2,516,372
Peru	84,891
Salvador	264
Chile	1,289,920
	4,095,647
Lead in base bullion and bullion:	
Guatemala	30,400
Mexico	505,732
Peru	7,533
	543,665
Lead, pigs, bars and old:	
England	800
Mexico	1,778,353
Barbados	2,423
Other British West Indies	283
Danish West Indies	1,579
	1,783,438

The actual tonnage of lead ore imported in September was 11,016.

The imports of zinc ore amounted to 14,950 tons in September. The countries of origin and the metal contents were as follows:

Countries	Contents, Lb.
Canada	849,050
Salvador	7,677
Mexico	7,551,560
China	15,433
Australia	1,495,550
	9,919,070

Zinc in blocks, pigs, etc., was imported as follows (in pounds):

Canada	1,155
Costa Rica	1,102
Mexico	6,613
Cuba	21,992
	30,862

Imports of zinc dust in September amounted to 95,543 lb. from Japan.

Exports of lead and zinc during September were as follows (in pounds):

Lead, pig, bars, etc:	
Produced from domestic ore	31,266,557
Produced from foreign ore	1,444,000
Zinc, pigs, bars, etc.:	
Produced from domestic ore	32,894,269
Produced from foreign ore	1,930,000
Zinc plates and sheets	5,616,366

Injury to an Employee at Ore Crusher

By A. L. H. Street*

In upholding a judgment denying the liability of an ore company for fatal injury to an employee while at work at an ore crusher, the Utah Supreme Court holds in the case of Virend vs. Utah Ore-Sampling Co., 160 Pacific Reporter, 115, that decedent must be deemed to have assumed all risks of injury naturally incidental to his work, so far as those dangers were obvious to one of his experience; and that no judgment could be awarded against the employer on account of the accident in the absence of proof as to the cause thereof, if the cause was left as a matter of conjecture as between conditions for which the employed would be liable and conditions for which he would not be legally responsible.

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*Attorney at law, 829 Security Building, Minneapolis, Minn.

Manganese Ores of Bukowina*

SYNOPSIS—The manganese deposits of Bukowina are not such as to be susceptible of profitable exploitation in normal times and with low-priced mineral. In the event of high prices and necessity, however, such as exist at the present, these deposits may be of great value. The ores are mined, milled and concentrated according to standard practice, the costs of operation indicating the probabilities for profits.

Toward the close of the year preceding the outbreak of the war some time was spent in the Bukowina, Austria, visiting the manganese-ore deposits of the Dorna Vatra district, and in view of the importance of knowledge of these supplies, a description of them will be of interest.

Before the war broke out, the world's annual consumption of 50% manganese ore was 2 to 2½ million tons, practically all of which was produced in the Caucasus, India and Brazil, in the proportion of five, four and one. The closing of the Dardanelles stopped shipments of Caucasian ore, leaving the output of India and Brazil at the disposal of the Allies and the United States; the production of India going principally to the Allies, while the mineral from South America was taken mostly by the United States. For 1912-13 Germany used 511,000 and 680,000 tons of manganese ore respectively, coming from Russia, India, Brazil and Spain. In 1912 Germany produced 17,000,000 tons, and in 1913 18,000,000 tons of steel. At the present time her output of steel is estimated at about 15,000,000 tons per annum. A part of the manganese-ore imports, probably 25% of the total, was used for the production of ferromanganese for export.

In 1911 Austria imported 78,790 tons of manganese ore, of which 52,143 tons came from Russia. This empire will probably be producing steel now at the same rate as in 1911, say about 2½ million tons per annum. The blockade of the Central Powers and the cutting of railway communication between Russia and Austria now prevent the importation of manganese ore suitable for ferromanganese production from the usual sources of supply.

German and Austrian Manganese Production

Before the high-grade ores from Russia, India and Brazil were placed on the market, a number of manganese-ore deposits were worked in Germany, but during recent years they could not, by reason of their pockety character, compete in price with the imported ores, and at the time the war broke out their production was negligible. There are, however, a number of manganiferous iron-ore deposits in Germany, the mineral from which is largely used for the manufacture of spiegeleisen. During 1911 the total production of these deposits amounted to more than 3 million tons, containing up to 20% of manganese, of which, however, only 300,000 tons had contents of 20% and over, the greater part giving from 2 to 12% of manganese.

As in Germany, and probably for the same reason, the production of manganese ores in Austria-Hungary never appears to have been on a large scale. From several publications a few particulars of manganese-ore occurrence in that empire have been found, other than those of the Dorna Vatra district. These include Carniola at Vigunsica, Bohemia at Platten, Istria at Kroglje, Styria at Kaskogerl, Hungary at Felso-Visso, and in Bosnia at Cevljanovio and Derazevic, near Serajevo. The average annual output of manganese ore for 1909-13 was: Austria, 15,165 tons; Bosnia and Herzegovina, 1,150 tons; Hungary, 13,737 tons.

Situation of the Deposits

The manganese orebodies are situated on the slopes of the Carpathian Mountains in the neighborhood of the town of Dorna Vatra, a watering place near the frontier between Bukowina and Roumania. The principal deposit, that of Arschitza, is 3 km. to the southeast of the village of Jacobeni, and the others, of less importance, known as Orata, Oitza, Kilibaba, Putchos and Valaputna, occur to the north of Jacobeni; while those of Teresia, Rosch and Sara Dorna lie in a southerly direction, near the Roumanian frontier. The district is wooded and mountainous, varying in altitude between 800 m. and 1,300 m. The roads are good, and railway communication is maintained to the Austrian steel works by a standard-gage line running from Dorna Vatra to Hatna, where it joins the main line between Lemberg, Czernowitz and Bucharest. The climate is good in summer, but rigorous during the winter, which extends from December to early May.

Geology and Occurrence of the Ore

Information regarding the geology of South Bukowina was first published by A. Alth, in an article in von Leonard's "Jahrbüch für Mineralogie," in 1848, while later, F. Herbig wrote a treatise on the minerals of the state, which was printed at Czernowitz in 1851. In that year B. Cotta visited the district with Manz, and afterward wrote a paper on the ore deposits of South Bukowina. In 1876 B. Walter wrote on the same subject in the "Jahrbuch der K.K. Geologischen Reichs-anstalt," and about the same time C. M. Paul prepared a geological map of Bukowina.

The manganese and iron ore are shown on the geological map of Paul as extending over a length of 30 km. along the sides of the Bistritz Valley, in a southeasterly direction from Kirlibaba to Sara Dorna on the Roumanian frontier. The most important strata in the district were crystalline metamorphic rocks, which included hornblende schists and were denominated upper mica schists, to distinguish them from the lower mica schists to the northeast, which included quartzite and chlorite members. To the west were narrow exposures of Lower Trias and Carboniferous age.

In the upper mica schists a band of great thickness of a siliceous schistose rock occurred, which in places outcropped on the flanks of the mountains and elsewhere cut across them. The siliceous schist inclosed, in many places, lenticular bodies varying in size up to a maximum of 100 m. in length and 40 m. in width, containing oxides of manganese and iron, which had attained a greatest development on the slopes of the mountains where the rock had been most exposed to the action of organic agencies, and was not far removed from the [illegible] wall which, from its impervious character, had kept the meteoric waters in the siliceous schist.

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*Excerpt from an article by Herbert K. Scott, presented at the annual meeting of the Iron and Steel Institute, London, September, 1916.

In the center of the manganiferous zone and 3 km. from Jacobeni were the principal deposits of Arschitza and Argestru. At these places three principal lenses of ore had been developed, which had a northwest strike and at the surface appeared to be closely associated, but in depth became thinner and spread out in fan shape. The middle lens had an inclination of 30°, while the others dipped from 40° to 50°. On the west side of the Argestru Valley, evidence of a fourth lens was visible, which showed mica schists at both the foot and the hanging wall.

THE ARSCHITZA DEPOSITS

At the Teresia quarry, to the southeast of Dorna Vatra, a large lenticular mass of ore, which at the surface was 150 m. in length and 30 m. in thickness, had been quarried. The dip of the orebody was about 20° in its strike southeast. It rested on the mica schist at Arschitza. At Rosch, Sara Dorna and Valaputna, deposits of a similar character occurred and were examined, but in each case the work carried out was limited in extent, and little information regarding their geological characteristics was available.

At Arschitza, a large quarry had been made at the summit of a hill and iron and manganese ore were being excavated—the first, it was said, to supply the blast furnace at Jacobeni, and the second for export. It follows, therefore, that only the most siliceous parts of the orebody were visible at the surface, but it was possible to see the segregated masses and small lenses of manganese and iron ores in the open working.

With regard to these deposits Beck, quoting Cotta and Walter, says:

> The Arschitza deposit is 40 m. thick, being inclosed in mica schists that are either horizontal or dip northeast at 30°. Directly beneath is a bed of siliceous schist 6 to 20 m. thick, lying upon a hornblende-mica schist. Above the ore is a much-decomposed brownish-yellow hornblende schist. The ore deposit consists of a mixture of pyrolusite, some hausmannite, brown hematite and quartz. This mass shows distinct bedding even when decomposed, and in places its primary composition is disclosed, especially at another mine, the Oitza, near the Transylvania boundary. The deposit is in such cases seen to be built up of beds from 0.1 to 2 m. thick of manganese silicate of grayish-green to flesh color and with interspersed portions of rose colored manganese spar and quartz and layers of a yellowish-green mica-hornblende schist. The transformation of the rhodonite into the more highly oxidized manganese ores and into quartz is traceable step by step through every gradation, the alteration starting along cracks and fissures. The hornblende schist when decomposed provides the intermingled brown hematite.

By reason of the irregular occurrence of the merchantable mineral in the orebody and the large amount of low-grade ore, it had been found in practice that an average of 50% of the poor mineral was left in pillars in the stopes, while of the remainder, half was packed in the stopes, leaving only 25% of the total orebody available for the dressing plant. The specific weight of first-quality washed ore was found to be 4.20, while that of the manganese waste was 2.81.

Deducting the consumption of the deposits necessary to produce 200,000 tons of mineral already excavated and assuming only 25% of that remaining as merchantable ore, calculations showed that over 150,000 tons of mineral could be mined from the lenses above No. 1 level, a quantity which would guarantee an output of 50,000 tons per annum for three years, while further quantities both of the oxide and carbonate ore would no doubt be proved at lower levels.

As with most mineral deposits, the exploitation of the Arschitza and Teresia properties began by open working. The irregular dissemination of the merchantable ore in the siliceous schist made it necessary, however, to remove a large amount of sterile material, and consequently quarrying gave place at no great depth to mining proper at the Arschitza mine. This was carried out for some time by making narrow crosscuts from the surface to the orebody and extracting the mineral without any prearranged plan or regular filling.

Later, the form of overhand stoping in use in 1913 was introduced. Crosscuts were driven into the mountain side at vertical intervals up to 30 m., but in practice this distance was found too great, and in several places sublevels had been made to facilitate the breaking of the ore. Probably owing to the irregular shape of the orebodies, the main roads along the strike and across them to the foot wall were very sinuous, which increased the cost of mining and made transit for men and materials difficult.

The ore was extracted by making rooms to a height of 2½ m. from the crosscuts in the parts of the orebody containing merchantable ore. As the extraction progressed, these were filled with the ferruginous low-grade ore found with merchantable mineral. The timber used was spruce, with which the surrounding country was covered, and while not of great strength, it was easily obtained, straight and cheap.

When the material on the level of the drift was extracted, a rise was built through the filling and another slice of the orebody was taken out in the same manner as below. Owing to the irregular occurrence of the merchantable mineral in the orebody, good judgment was required in locating it and determining where the pillars of poor ground should be left. In some places the good mineral was so plentiful that filling was introduced from other parts of the mine. The mineral was dropped into hoppers, in the stopes, which were fitted with doors. Thence it was fed into trucks and trammed to the surface.

During the day-shift the ore was broken by hand drilling, but at night current was supplied from the central station at Jacobeni, which drove two electric percussion drills and a single-stage compressor which operated several jackhamers. The electrically operated drills were used for main roads, and the jackhamers operated in the stopes.

At the surface the mineral was discharged into piles that were picked over by girls to separate the type known as "stufen," which was sold to glass and chemical works, and a proportion of the better quality ore, which was disposed of without further treatment. The peroxide ore amounted to 1% and the raw mineral to 9% of the total output, the remaining 90% going direct to the dressing plant.

THE MINING COSTS

According to the official figures provided by the management, the average cost of mining the ore for the seven years before 1913 had been 9.4 kr. per ton (about 7s. 10d.), but this figure would no doubt be reduced if the mine were operated on a larger scale. The ore was carried from the mine over light railways to the dressing plant. It was proposed to establish an aërial ropeway for this work, which would be more efficient and transport the mineral at a cost, including depreciation, of 0.8 kr. (about 8d.) per ton.

The dressing plant was about 1¼ km. north of the Jacobeni railway station and near the River Bistritz, from which it took the water for power purposes. The plant was put in operation in 1902. When constructed, it was in three sections, but only two of them were in use in 1913, the first being adapted for the small ore and the second for the lumpy material.

In the first section of the plant all the mineral was passed through chilled rolls, which fed into a double trommel with 1- and 8-mm. openings. The mineral passing through the smaller holes went directly to the settling pits, where it was accumulated as manganese mud, while the +8-mm. ore passed to the boot of an elevator, which took it to a second set of rolls before being sized with the —8-mm. stuff in five trommels of 2- to 12-mm. openings. In the second section the ore was first passed through a trommel from which the +21-mm. material went through chilled rolls and discharged into a bucket conveyor, which elevated it to a point where it joined the rest of the ore from the first trommel. This was afterward sized in four trommels, and the +18-mm. ore was trammed to the elevator of the first section of the plant, where it was passed through the second set of chilled rolls and subsequently sized at that end of the plant.

After being sized, the mineral was discharged into trolleys of 800-kg. capacity, which were carried by an electrically operated lift to the upper story, where the mineral was distributed to the pockets of the different jigs below. These were 20 in number, two of each size from 2 to 12 mm., and four each for the 15- and 18-mm. stuff. They were of the two-compartment type and gave a first and second product, and tailings that were known and sold as manganese waste.

The official returns of the plant showed an average output per day of 42 tons of washed ore, 45 tons of manganese waste, 23 tons of manganese mud and 10 tons of tailings going to the river—a total of 120 tons per day. The average of the different official analyses of the mineral produced at the mine showed in the dry ore 30.3% manganese and 0.34% phosphorus. The accompanying table shows the analysis of the plant output:

ANALYSIS OF PLANT OUTPUT

	——Washed Ore——				
	First Grade, %	Second Grade, %	Average %	Manganese Waste, %	Manganese Mud, %
Manganese	44.80	41.90	42.90	27.90	28.20
Iron	11.70	12.24	12.06	17.04	12.12
Silica	5.50	8.05	7.20	20.30	29.10
Phosphorous	0.365	0.430	0.41	0.534	0.390

From the particulars of the output of the plant and analyses of the different qualities of ore, it was clear that 37.5% of the total output known as manganese waste contained only 28% manganese and upward of 20% of silica, compared with the 7 or 8% in the washed ore, and was consequently sold at a low rate. A cursory examination of this material suggested the idea of subjecting it to further treatment in order, if possible, to produce a third grade of washed ore and tailings lower in manganese. The result of a test made along these lines, with material containing 25.8% manganese and 32.9% silica reduced to I. M. M. +5- and 10-mesh size, showed that while by hand separation 33% of the total weight gave 34.6% manganese and 17.9% silica, by panning the I. M. M. —20-mesh mineral, only 13.15% was separated, which gave 36.16% manganese. This unsatisfactory result was due to the slight difference in the specific weight of the constituent pieces of the waste, which varied between 2.63 and 2.99. From an examination of the accounts from 1906, to 1912 inclusive, the cost of washing the ore appeared to have averaged 1.5 kr., or 1s. 3d., per ton of run-of-mine ore.

Cost of Ore and the Selling Price

The cost of the mineral at Jacobeni averaged 12.9 kr. (10s. 9d.) per ton. The ore was disposed of to several firms, all of which are in Moravia and Austrian Silesia. The Witkowitz Co., which, with the Krama Industry Co., made ferromanganese for the Austrian market, purchased the washed ore and manganese waste, the former on a 46 and the latter on a 28% manganese basis, with a phosphorus penalty in both cases. The Austrian Mining and Ironworks Co. purchased the manganese mud, which it worked up at its Tryznietz plant in a rotary furnace with burnt pyrites and hot-blast stove flue dust. The Albert Hahn Co. took the selected crude ore, which was used in the manufacture of basic pig iron. The basis of sale for the mud was 28% and for the raw ore, 37% manganese with a phosphorus penalty.

Glass works and chemical works utilized the selected ore, that for the former being on a 65 and for the latter on a 70 to 75% manganese-peroxide basis. The different qualities of ore realized at Jacobeni the following prices per ton: Washed ore, 19.90 to 23.60 kr.; manganese waste, 5.50 to 5.80 kr.; manganese mud, 5 kr.; selected crude ore, 11.90 kr.; peroxide for glass works, 30 kr.; and peroxide ore for chemical works, 50 kr. The average amount per ton realized at that time was 10.9 kr., or 9s. 1d., which compared with the cost of 10s. 9d. showed a loss of 1s. 8d. per ton.

The railway rates from Jacobeni to the steel works ranged from 17.1 to 18.8 kr. (14s. 6d. to 15s. 8d.) per ton. The selling price of manganese ore in 1913 was below the average, so it is estimated that with higher prices and more energetic development of the property it could be made remunerative even in peace times. With the enhanced prices that must obtain in Austria under present conditions, the property would without doubt be very remanerative and valuable, but since the occupation of Jacobeni by the Russian troops at the end of June, this source of supply can probably no longer be considered available to the Central Powers.

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Reclaiming Zinc from Galvanized Iron

The New Jersey Chemical Co., of 115 Willow St., Trenton, N. J., is reclaiming zinc from galvanized iron scrap by a process invented by Thomas A. Shegog, the nature of which is not disclosed. A photograph of a part of the plant shows, however, that it is a hydrometallurgical process, and the statement is made that the zinc is recovered in the form of oxide.

Many years ago galvanized scrap was treated commercially by Philadelphia by J. Richards, who dissolved the zinc by dilute chlorhydric acid and crystallized zinc chloride from the solution, which was sold.

It is possible to precipitate zinc oxide from a solution of zinc chloride by means of magnesia, magnesium chloride being formed, from which magnesia may be regenerated. A process for doing this is described by Edmond Hennebelle, of Paris, France, in U. S. Patent 1.201.786. There is some interesting chemistry in this.

After precipitating the zinc and filtering off the solution of magnesium chloride, the specific gravity of the latter is not more than 30° Bé. The solution is boiled down so as to get $MgCl_2 + 6H_2O$. That salt is heated in a furnace to 165° (probably centigrade), at which temperature it is decomposed into HCl and MgO. This decomposition progresses up to 250°, when steam is injected into the mixture, which contains a large proportion of oxychloride. The temperature is then gradually raised to 550-600°. There is then evolved under the action of air and steam, which, however, must be suitably regulated, a mixture of chlorine and hydrochloric acid, which are condensed together in suitable apparatus. This chlorinated hydrochloric acid serves for dissolving a fresh lot of zinc, while the residual magnesia is used for its precipitation as oxide.

It would be interesting to have some working details of this process. To what extent, if any, is the precipitated zinc oxide contaminated by oxychloride? What are the losses of chlorhydric acid and magnesia?

Barytes and Strontium in 1915

The report on barytes and strontium in 1915, prepared by James M. Hill, of the United States Geological Survey, is unusually complete. In addition to the usual statistics on production, etc., the methods of mining and preparation for market are described, as well as the geological and commercial features of the principal known deposits in the different states. There is also a map showing the locations of deposits of barytes and strontium ore and works manufacturing barium products. Lists are given with names and addresses of companies, firms and individuals who are able to supply crude barytes: those who manufacture ground barytes; those who manufacture lithopone (approximately 70% barium sulphate, 25 to 29% zinc sulphide and 1 to 5% zinc oxide; made by mixing hot solutions of barium sulphide and zinc sulphate); and those who manufacture various barium chemicals, such as the binoxide or peroxide (BaO_2, used by some manufacturers in the preparation of oxygen and of hydrogen peroxide), carbonate, chloride, hydroxide, nitrate and sulphate (artificially produced and known as "blanc-fixe" or "blanc-fix," for use as a finer pigment than ground barytes). Crude barium sulphide, or "black ash," is sold to many makers of lithophone, etc., who are not equipped to roast barytes.

The high freight rates from the Central and Southern States to the principal markets gave European barytes an advantage; but the demand in the latter part of 1914 stimulated domestic production.

The marketed output of crude barytes in 1915 is reported in short tons as: Georgia, 31,027; Kentucky, 7,753; Missouri, 39,113; Tennessee, 25,074; and other states, 5,580. For the two preceding years only the Missouri and Tennessee production was reported separately, being 33,317 and 10,113 tons respectively in 1914 and 31,131 and 2,098 tons in 1913. The total marketed production was 108,547 tons, as compared with 52,747 in 1914 and 45,298 in 1913; the average prices per ton, f.o.b. cars at points of production, were $3.51, $2.95 and $3.45, for the corresponding years. The apparent stocks of crude barytes held at the mines at the end of December, 1915, were 9,676 tons. Of these 6,500 tons were held in Tennessee, 2,500 in Georgia and the remainder scattered in small quantities in Alabama, Alaska, California. North Carolina, South Carolina and Virginia.

According to figures compiled by the Department of Commerce, 2,504 short tons of unmanufactured barytes (presumably crude ore) were imported in 1915. The imports for the years immediately preceding were, respectively, 24,423 tons, 35,840 tons, 26,186 tons and 20,214 tons. The average of the reported values is $1.85 per short ton, presumably at mines where produced.

The figures reported for apparent consumption of crude barytes are obtained by adding the marketed production and the imports. Of the marketed production, approximately 50% was used by grinders, 40% by manufacturers of lithopone and 10% by makers of barium chemicals.

Zinc Mining Near Edwards, N. Y.

In a recent article published in *Economic Geology*, David H. Newland[1] describes a new zinc-producing district near Edwards, St. Lawrence County, N. Y. The existence of zinc ores in Edwards township has been known since the early part of the last century, some of the localities being mentioned by Ebenezer Emmons in his preliminary report on the geology of the second district of New York, published in 1838. No work of consequence was done, however, until the Northern Ore Co. started to prospect the orebody now being exploited.

Development work has been in progress for some time, but the first ore shipments on a commercial scale were made in 1915. The output thus far has been from a single mine, situated just outside of Edwards village, on the road to Trout Lake. The deposit is opened by an incline to a depth of 525 ft., the dip ranging from 25 to 60°. A series of levels, at intervals of 100 ft. or less, follow the ore to a maximum distance of about 600 ft. A second orebody on the hanging-wall side appears at the surface. At different levels this has been reached by crosscuts and drifted on to a maximum distance of 250 ft. Another shaft had been sunk on a third body 800 ft. away, but at the time of the inspection in the summer of 1915 no ore had been produced from this source.

The Edwards district is known as a producer of fibrous talc, used extensively in the paper industry. In Edwards township and in Fowler township (adjoining it on the west) are several places where talc and blende deposits occur; both lying within the same belt of crystalline limestones and in places closely associated with each other, as is the case near Sylvia Lake, south of the village of Fowler.

The zinc outcrops occur mainly along the contact of Precambrian limestones of the Grenville series and the bordering granites and schists. The prevailing shape of the orebodies is lenticular, appearing on the surface as bands or stripes of ore in the limestone and thinning out at either extremity, sometimes with a rounded outline and occasionally without any regular form.

At the main shaft of the Northern Ore Co. the ore outcrops on the eastern side of a low limestone ridge as a solid band of mixed blende and pyrite, with well-defined parallel walls. At the surface the ore is 4 ft. thick, and it increases to a maximum of 14 ft. on the 200-ft. level, below which it thins down, but still persists at the 500-ft. level. As a rule the walls are sharply defined and on one wall, at least, the ore always breaks cleanly from the limestone.

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[1] Assistant state geologist, State Education Building, Albany, N. Y.

At the north shaft the deposit consists of a zone of limestone heavily charged with serpentine. It carries blende and pyrite in bunches and disseminated grains, in a gangue that is largely serpentine. The zone is irregular and in the widest parts is about 15 ft. across. Though somewhat brecciated at the surface, the deposit seems to have the form of a shoot. Some movement of the mass is indicated by slickensides. A deposit of similar nature exists at the property of the Dominion company near Sylvia Lake. It was opened years ago for iron ore, existing as a hematite cap to the sulphides found less than 100 ft. from the surface.

Most of the blende of the Edwards district is the dark variety known as "black jack." In occasional outcrops a lighter brownish-yellow variety is found, free of iron. In the darker ores pyrite always occurs and necessitates milling treatment, even where the percentage of zinc is high. The pyrite is scattered through the ores in roundish particles of uniform size, usually similar to those of the blende, and ranges from a few per cent. to one-third or one-half of the total mass. Galena occurs to the extent of a fraction of 1%, but is seldom visible in specimens; but at the north shaft a few pieces of ore showed cleavages of galena an inch or so across. On the Balmat vein near Sylvia Lake part of the ore is mixed blende, pyrite and galena, with quite as much lead as zinc. This deposit was worked in a small way about 75 years ago, presumably for the silver which the galena carries; but the ore was apparently too complex for successful treatment.

A selected specimen of zinc ore from the deposit of the Northern Ore Co. showed on analysis: SiO_2 5.69%, Al_2O_3 0.36%, CaO 1.45%, MgO 0.61%, BaO 1.46%, Zn 51.43%, Fe 5.80%, S 30.86%. The CO_2, H_2O, Cd and Mn were not determined, but were present in amounts of less than 1% each.

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Dynamiting a Deep Well to Increase the Flow

By G. F. Alderson*

The dynamiting of an oil or gas well is no rare occurrence, but the "shooting" of a water well near Kennett Square, Penn., was the rather unusual performance of the American Glycerin Co. a short time ago. The well, which was 600 ft. deep, started at the top of a hill with an elevation of about 460 ft. above sea level. After drilling through 84 ft. of stiff clay and hardpan, solid rock was encountered with successive strata as follows:

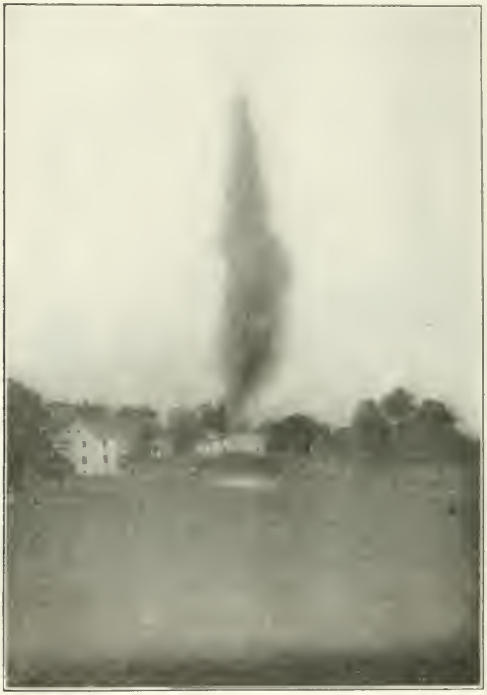
SUCCESSIVE STRATA OF SOLID ROCK

	Ft.		Ft.
Sand rock	121 0	Blue granite broken	10 0
Flint rock	90 0	Gray granite with green serpentine seams	2 0
Blue granite	17 5	Gray granite	40 0
White quartz	1 2	Blue granite	3 0
Gray granite	47 8	Gray granite	72 0
Blue granite	17 5	Bastard granite	84 0
Gray granite with quartz seams	10 0	Total	516 0

An 8-in. steel casing was sunk to solid rock and thoroughly grouted to exclude all surface drainage, as it was especially desirous to obtain all the supply from groundwater sources. The hole through the rock was 6 in. diameter. The nature of the rock, as shown by the foregoing record, gave little indication of water-bearing qualities, although numerous crevices were encountered.

After drilling to a depth of 600 ft. the well was tested to determine its flow. This test indicated a flow of $3\frac{1}{3}$ gal. per min., a supply entirely too small. The excessive cost of pumping equipment and upkeep made a deeper well impracticable, so it was decided to discharge a quantity of nitroglycerin in the well with the hopes that it would shatter some water-bearing stratum.

From all indications it seemed probable that the stream then supplying the well entered at about the 320-ft. level. Just below this point the well was bridged, which was accomplished by rolling a piece of stiff wire into a ball a little larger than the bore of the well, forcing this ball to the desired depth, and then introducing concrete until a solid bridge was formed just below the level at which it was desired to set off the charge. A special type of solidified nitroglycerin, which is commonly used for shooting oil wells, was used in the charge, which consisted of 190 quarts. The explosive was packed in tin tubes $5\frac{3}{4}$ in. diameter and 7 ft. long. These tubes were then placed in the well one above another, and the whole was discharged by dropping a jack squib down the well.



SHOOTING THE WELL

The illustration shows what happened. An immense column of water 500 ft. high was blown from the well. Following the shot the well was again tested. This test proved that there had been a material increase in the flow of water. The test pump working continuously for seven hours pumped in that time about 10,000 gal. After the seven hours of pumping, the water was still discharging at the same rate as when the test first started. Only the breaking of the pump rod prevented an exhaustive test to determine exactly the amount of the increase.

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*Civil engineer, Kennett Square, Penn.

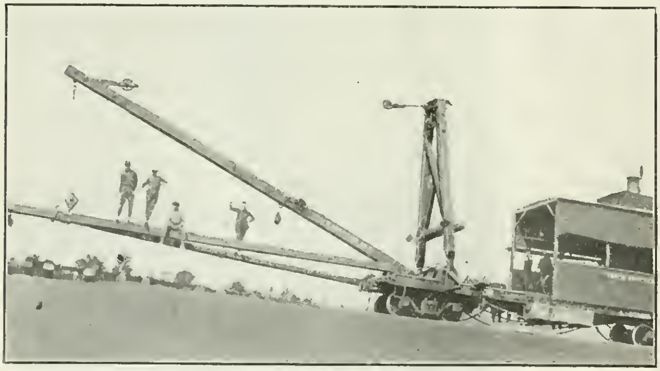
Details of Practical Mining

A Useful Track Shifter

By L. A. Rossman*

The largest stripping contract now in progress on the Mesabi Range is at the Hill Annex mine at Gilbert, Minn. This property is being opened up by the Great Northern Iron Ore Properties, and the overburden is being stripped on contract by A. Guthrie & Co., of St. Paul, Minn. The present contract calls for the removal of 8,500,000 cu.yd., and even this amount may be increased.

Where so much material is to be removed, the problem of dumps is a serious one. The dumps at this property now extend three or four miles in length and are of varying width. This necessitates a constant shifting of tracks to the edge of the dump. This shifting was formerly done by hand, but a machine has been devised and is now doing the work for the Guthrie company.



TRACK SHIFTER FOR STRIPPING OPERATIONS

This machine is the result of several years of experimentation, as the contractors started to work on it several years ago when engaged in railroad operations in the West. A number of types were evolved, but the present one has given the best satisfaction. The contrivance resembles a wrecker in its general appearance. There is a boom about 40 ft. in length, and a wire rope which is attached through its pulleys is fastened to the track for the purpose of lifting it up. On a level with the base of the machine is a side boom by which the track may be pulled sideways if desired. The operation is to attach the rope from both booms. The regular boom lifts to the required height, while the side boom is used to swing the track over to the desired place. There is one hoist of regular type and a horizontal boiler which furnishes the steam. The machine is self-propelled in the same manner as a steam shovel.

This device can throw a track over 6 ft. at a time, though the work must be done gradually to avoid either bending or twisting the rails. The method followed is to shift a track over 4 or 6 ft. and then move back 30 ft. and make a like move. The shifter has moved as much as 3,000 ft. of track a distance of 10 ft. in half a day, or more than forty men could do in a whole shift. While the machine requires but few men to operate, it will do as much work as 40 or 50 men and was a great labor saver during the last summer, when common labor was very hard to obtain. The apparatus has been attracting considerable attention from the mining men on the Mesabi Range, and it has a wide range of applicability.

⁂

Stopes Filled by Flushed Sand*

Mine managers seeking for ideas on the economy of mine timber by stope filling may find something helpful in the following experience in India:

A river bed not far from the mine furnished a plentiful supply of clean sand, which was screened and dumped into a small bin of 20 tons' capacity sunk just below the level of the surface. The bin gate discharged the sand into an inclined trough terminating in a vertical funnel opening into a 5-in. drill-hole casing. At the upper end of the trough a 5-in. water pipe equipped with a controlling valve discharged a water jet tangentially with the trough surface, thus flushing the sand discharged from the bin gate into the drill-hole casing. A 6,400-gal. tank furnished the water supply at a head of 33 ft. When sand-flushing was first tried at this mine, the depth of works filled was 231 ft. and the horizontal distance traveled by the sand was 11,300 ft., which is believed about the maximum possible. For this distance the proportion of water to sand was about 3.3 to 1. After a fortnight's trial, long-distance working was abandoned and the horizontal distance reduced to only about 700 ft., which required a proportion of water to sand of only 1.16 to 1. The velocity of the flushing mixture was about 24.3 ft. per second, flushing away about 2.34 tons per minute.

Arrived at the workings to be filled, which at this mine are only 8 ft. high, the sand was retained in place by barricades made of rough 2-in. plank nailed to posts 2 ft. apart and covered by untarred brattice cloth. The water thus filtered through the brattice cloth and, before reaching the pump sump, was strained through two more filters of the same material, thus avoiding wear on the pump due to sand. A Worthington pump of 10,000 gal. per hour capacity was used.

The flow of sand and water into the trough was regulated by a man at the sand bin, who was in telephonic communication with the man at the working in process of being filled.

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*Grand Rapids, Minn.

*Abstract from "Hydraulic Storage at an Indian Colliery," by R. S. Davies, in "The Iron and Coal Trades Review," Nov. 3, 1916.

The pipes showed little wear—probably because of the screening out of all hard lumps from the sand before discharging it into the storage bin.

Owing to the low cost of labor in India—women were employed to carry the sand in baskets from the river to the bin—the total cost per ton of sand flushed was only 4½d.

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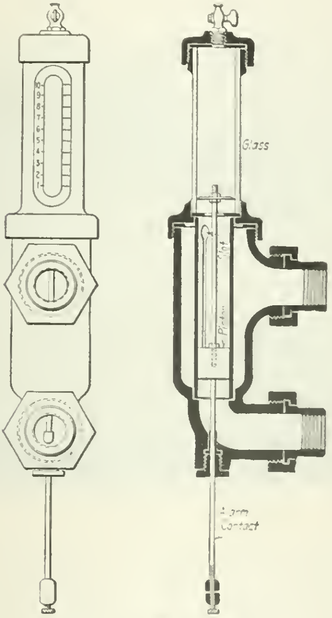
Vaughan Flow Meter

A meter designed for indicating the flow of liquids in pipes is the Vaughan, made and sold by the Spray Engineering Co., Boston. It is shown in section in the accompanying illustration. The instrument consists of a cylindrical chamber with suitable pipe connections inclosing a slotted tube through which the liquid must pass.



THE VAUGHAN FLOW METER

Inclosed in the slotted tube is a piston which, as the liquid is turned on, is carried up until the exposed area of the slots is sufficient to allow the flow of the liquid up to the capacity of the indicator. An index is attached to the upper end of the piston rod, which extends up into a glass tube at the top of the cylindrical chamber. The glass tube is in a protecting cover, corresponding to the movement of the piston, to be noted. A scale on the side of the case enables the determination of the amount of flow in gallons per minute.

An electric contact consisting of an adjustable brass rod set through an insulated stuffing-box at the bottom of the chamber can be connected to a lamp or bell, calling attention when the flow has fallen below a fixed minimum. Contact is established where the piston rests on the brass rod. The flow is directly proportional to the area of the slots in the inclosed tube, or to the rise or fall of the piston.

Under test the indicator gives practically straight-line calibration over a large range, and the loss of head in operating the instrument has been found to be negligible, not exceeding 0.001 lb. per sq.in. with a capacity of 15 gal per min.

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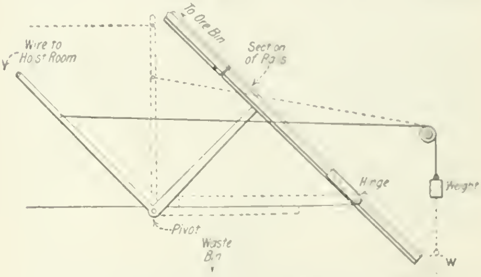
Changing Guide Rail at Head of Inclined Shaft

By L. J. Hubbard*

At the B. A. C. mine at Brownsville, Yuba County, Calif., the ore and waste are hoisted from the same compartment of an inclined shaft. The waste bin is above the collar of the shaft, while the ore bin is farther up. In hoisting ore and waste, this condition necessitated the hoistman removing or putting in a pair of short rails each time a change was made from ore to waste, or vice versa. This was a great inconvenience and caused considerable loss of time. The mine foreman evolved the device shown in the accompanying sketch, which has given entire satisfaction. The heavy lines show the position when hoisting to the ore bin and the dotted line the position when dumping into the waste bin.



LEVER FOR CHANGING POSITION OF GUIDE RAIL

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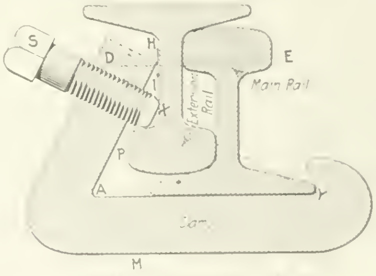
An Extension Rail Clamp

By S. Ford Eaton†

In incline shaft-sinking operations the type of clamp illustrated has given excellent service. The principal feature of difference from the clamp ordinarily used is the angle at J. Instead of being a right angle, it [illegible] the direction of pressure exerted by the set-screw S [illegible]



A RAIL CLAMP THAT HOLDS

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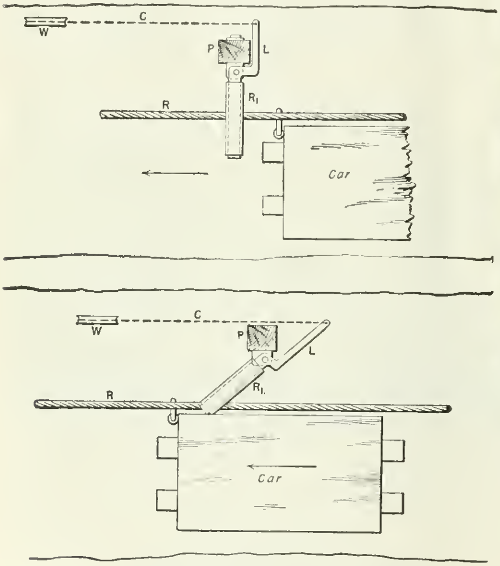
*Superintendent, B. A. C. mine, Brownsville, Yuba Co., Calif.

†Foreman, Ventrett Mining Co., [illegible]

indicated by the dotted line XY, in line with the point of contact Y of the clamp and flange of the permanent, or main, rail. When A is a right angle, the line of pressure is approximately DE. This being the case, when the screw is tightened it has a marked tendency to slide down the web of the extension rail toward the ball (indicated by the arrow HI). This causes the rails to be forced out of position, and oftentimes the screw breaks. This clamp, if properly constructed, can be swung onto the rails at any point, there being ample clearance at the point P, as shown by the arc PM.

Trouble Saver on Rope Haulage

According to an account published in *Coal Age*, Nov. 11, 1916, trouble developed on a side-rope haulage wherever a slight hollow in the road was reached, through the stress of the rope pulling it out of the jiggers on the cars. When this happened where the cars were far apart it had the effect of leaving one particular car standing on the track. The following one was quite liable to push it off the track, causing a wreck. Sometimes five or six cars would get piled up together before the haulagemen could find out where the trouble was.



DEVICE TO PREVENT THE ROPE FROM RISING

As a means of obviating this difficulty the small appliance shown in the accompanying illustration was erected. The upper drawing shows a car approaching the appliance and the lower one the car passing and deflecting the arm.

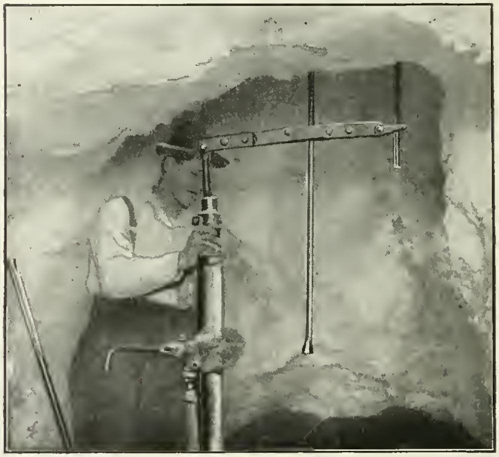
Post P, a strong one, has bolted to it a lever L, one arm of which projects behind the post, and the other in front of it and at least 6 in. beyond the line of the rope and 3 to 4 in. higher than its normal position. The front arm has a piece of pipe R_1 fastened to it, which serves as a roller when the rope is running up against the arm. Attached to the arm at the rear of the post is a chain C which passes over the wheel W and is attached to a counterbalancing weight.

In operation the arm R_1 projects over the running rope and prevents it from rising above the limit fixed. It does this without putting any perceptible stress on the working of the haulage. An approaching car pushes the arm aside, but the counterbalance exerting itself tends to draw the lever back, keeping the arm tight against the side of the car and above the rope. As soon as the car has passed the arm springs out into its original position.

Drill-Steel Puller

By A. C. Daman*

One of the main causes of delay and trouble in drilling is the sticking of drill steel in the holes. I have seen miners work for hours trying to remove a piece of steel and then give up. The accompanying illustration shows a successful drill-steel puller, and its simplicity makes it a handy device in mines. Two different lever arms are obtainable by means of a revolving center swivel.



THE WILSON DRILL-STEEL PULLER

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Casehardening with Cyanide—For many purposes a thin, hardened outer surface is required on wrought iron or steel articles. This can be quickly secured after finishing by the use of potassium cyanide. All iron and steel, roughly speaking, will absorb carbon when at a temperature of from 800 to 850° C., or, in smithy terms, from bright to cherry red. This is taken advantage of in surface hardening, the metal being heated to this point, preferably in some form of muffle, even rough. At this stage the metal can be plunged into a bath of melted cyanide or rubbed with a lump of cyanide held in a pair of tongs until the metal becomes dull red, after which reheating to the hardening temperature and immersing immediately in cold water to secure the greatest hardness possible. Properly done, this should turn a file. A better plan, where the size and shape of the articles permit, is to coat a piece of leather with powdered cyanide and press the heated articles on this, repeating the heating and pressing several times, afterward reheating and quenching. For deep casehardening the usual method of packing and heating for several hours must be adopted.—"The Practical Engineer," London.

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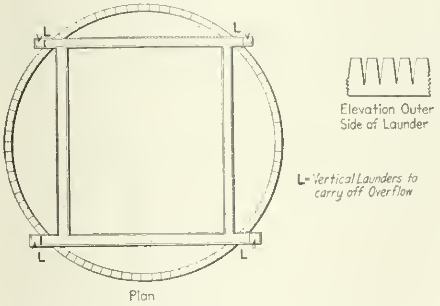
*2678 Eudora St., Denver, Colo.

Details of Milling and Smelting

Altering Dorr Agitators

In a Western milling plant, three Dorr agitators were installed along with other cyaniding machinery. After the plant was put into operation, it was found that the gold went into solution so readily in the crushing department that no agitation was necessary, and further, that the settling capacity of the plant was decidedly insufficient. It was decided to change the three agitators into thickeners. This was done by extending the feed launders from the sides to the centers of the tanks, removing the revolving pulp-distributing arms, providing an outlet in the center of the bottom of each tank and adding decanting launders. The latter consisted of four straight launders in the shape of a rectangle on each tank, as shown in the illustration. This form of construction is much simpler than the usual annular launder at the top of the tank. A row of notches was cut along the outer side of each launder, but not to the bottom, permitting the clear liquid on top of the tank to flow through them and along the launders to the vertical discharge launders at the corners. In addition to being easier and cheaper to construct than the circular launders, the rectangular form served a direct purpose. The composition of the ore was such that an excessive amount of foam collected on top of the thickeners, the foam containing an appreciable percentage of soluble matter. The rectangular launder arrangement made a trap in which this foam was caught and from which it was skimmed at regular intervals.


L
L
L
L
Elevation Outer Side of Launder
L-Vertical Launders to carry off Overflow
Plan

ARRANGEMENT OF LAUNDERS IN THICKENING TANK

⁂

Arsenical Flue-Dust Treatment

In the application of a newly devised process the arsenical material is first sulphated, without alkaline bisulphate fusion, simply by being thoroughly mixed with sulphuric acid slightly in excess of that quantity necessarily absorbed by constituent substances with which the acid can combine. A cheapening of this stage of the process may be made by subjecting the material to the action of sulphurous gases with subsequent oxidation, thus diminishing the amount of sulphuric acid required.

The mass is then subjected to a gentle heat, with stirring, for such a length of time that when cold, it may be pulverized by rolls or other suitable means. After pulverization the material is transported to a flue or hearth, where it is maintained in a current of air or gas at an even heat above the boiling point of sulphuric acid and below the point of decomposition of the metallic sulphates.

If an air current is used, the arsenic is volatilized in combination with sulphuric acid and can be precipitated by a water spray or by electric precipitation, in a condensing chamber into which the fumes are led. This separation depends upon the fact that the sulphuric-acid compounds of arsenic are volatile at this low temperature, and owing to the neutral or acid condition of the remainder of the mass, the volatilized arsenic oxide cannot recombine with the mass. Only a small amount of arsenic will remain in the original material after this operation—usually from 0.3 to 0.6 of 1%.

The valuable metals remaining in the mass are recovered by subsequent treatment. The mass is roasted until sulphate of iron is partly decomposed, when the mass is leached with hot water, thus dissolving out the sulphates of Zn, Cd, Cu, Fe, Ag, Bi and small amounts of Sb and As, which may be precipitated and recovered by well-known means.

This process is the invention of Duncan Anderson, Jr., of San Francisco, Calif., granted U. S. Pat. No. 1,198,095 on Sept. 12, 1916.

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Copper-Refining Process

An invention designed to simplify copper-refining methods has been patented by B. A. Garred, of New York, under U. S. Pat. No. 1,198,434, of Sept. 19, 1916. For the melting furnace is substituted a coal-dust fired cupola furnace, whereby, it is claimed, the operation is placed under perfect control. For the slow method of wood poling is substituted a blast-poling process whereby the disseminated reducing agents, such as charcoal or sawdust, are made to permeate the entire mass of molten metal, thereby reducing the time of poling to a minimum.

The copper is introduced to the cupola furnace through a charge opening 12 to 15 ft. above its hearth, at which level the heaps of impure copper are always maintained. Just above the level of the molten copper on the hearth is a chambered offset to the furnace, in which combustion of the coal dust takes place, and the resulting flames impinge on the metal.

The furnace spout is situated opposite this combustion chamber, and from it the molten copper discharges into the top of a charcoal-filled tower. Thus, as the molten copper percolates to the bottom of the tower, the work of the first stage of the poling is accomplished.

From the charcoal tower the copper flows into the poling furnace. The latter is similar to the conventional converter in form, equipped with the usual pouring spout and with the ordinary hood for fume collection.

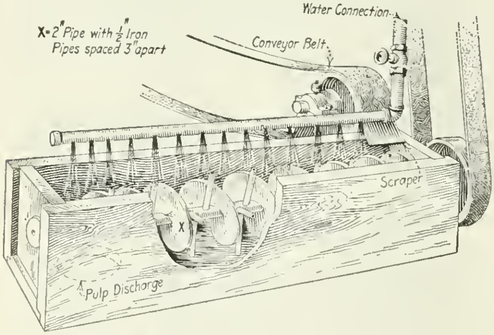
The molten copper, however, is introduced through an axial opening at one side, while the bath is maintained in a molten condition by a coal-dust blast. The blast nozzle is stationary, and its introduction into the poling furnace at any rotating position is allowed by an arc-shaped slot in one end. Instead of the air blast from tuyeres, as in the usual copper converter, the blast is maintained by a reducing gas, such as illuminating gas or hydrogen, into which gas stream fixed quantities of coal dust or sawdust are fed by a screw conveyor. In this way an intimate contact of the reducing agent with the agitated copper particles is quickly accomplished and the poling brought to an end.

The poling operation is made continuous by employing two rotary poling furnaces set close together and served by the one cupola and receiving charcoal tower. Thus, while one furnace is blowing and pouring, the other is receiving the continuous discharge from the tower and is ready to start blowing by the time its mate has finished pouring.

A Mechanical Disintegrater

By Arthur C. Damax[*]

The mechanical disintegrater used at the Nevada Packard mill was designed by J. W. Wilkey. Formerly the pulp, containing about 20% moisture, was dumped on the tailings pile with sufficient water added to wash it away, keeping the end of the conveyor clear. To conserve the water supply this disintegrater was made, and the pulp is mixed to a flowing consistency, with a material reduction in water needed. The spiral screw, which also has ½-in. iron pipe 10 in. long to mix the pulp and water, is revolved by the conveyor motor.



A MECHANICAL DISINEGRATOR

Hydraulic Classifiers at Inspiration Mill

In the discussion upon the paper of Dr. Rudolph Gahl on flotation at the Inspiration mill, presented at the Arizona meeting of the A. I. M. E., David Cole asked why hydraulic classifiers were installed. Dr. Gahl replied, and in defense of the installation pointed out that the expense of operating these classifiers is very low, the principal cost item being labor for their attendance. In addition it requires a very small settling capacity to settle the table tailings. At the Inspiration mill it is accomplished by three 60-ft. Dorr settling tanks, with an additional tank installed for the purpose of keeping the coarsest sand out of the Dorr tanks. This small installation handles more than 7,000 tons per day. As the reclamation is accomplished right at the foot of the mill, the reclaimed water does not have to be lifted very high, and the reclaimed cost for this water is, therefore, low. In other words, the benefit derived from the installation of hydraulic classifiers does not need to be very great to make them pay.

It is true that in operating the test mill, satisfactory recoveries were obtained in spite of the fact that the whole of the flotation-machine tailings were put on the tables without preliminary classification. It was realized, however, that the table tailings (at least the coarser sizes) were not so low in their copper contents as it was hoped to have them some day. It was known, furthermore, that by grinding finer, the coarser screen sizes could be reduced in copper. As grinding finer than to a certain point is an economical impossibility, it was proposed to make different sizes and to send them to separate tables. This separation was to be accomplished in hydraulic classifiers. The coarser tailings, or perhaps only middlings from the tables, could then be reground and reconcentrated.

Progress at Ajo Leaching Plant

With nearly 1,200 men on the payroll, the construction work on the 5,000-ton leaching plant of the New Cornelia Copper Co. is progressing rapidly. Conditions on Nov. 2, 1916, were as follows:

At the mine the stripping of the orebody and excavation for the extension of the railroad have greatly changed the original appearance. With the completion of the cut and fill between Hill No. 1 and Hill No. 2 and the extension of the tracks to Hill No. 3, the mining end will be prepared to deliver its daily tonnage of ore to the leaching plant. The track connecting the orebody with the crushing plant is rapidly nearing completion.

The building for the coarse- or primary-crushing plant has been erected; the crane for handling the crusher parts is in operation; the four No. 8 crushers are in place, while 25% of the No. 24 has been erected. The trestle and the tailings track to this building are being completed.

At the fine-crushing plant the steel building has been erected but has not yet been riveted. This is to inclose 12 Symons disk crushers; four of these have been placed, six are being set up and two are in transit.

In the leaching department seven of the 12 leaching tanks have been lined with lead, while the concrete work on all has been completed. Two of the six central structures that are to contain the pumps and launders have the concrete work finished. The electrolytic-tank house is to contain 152 electrolytic tanks; 122 are erected, of which 76 are completely lead-lined. The solution sumps, one at each of this buildings, have the concrete work completed.

The power plant, which is being built by C. C. Moore & Co., of San Francisco, is to contain five 875-hp. Stirling boilers. The boilers have all been pleced, one of them being about 50% bricked. At the town site, the tile on the first 22 American houses are in place and the work is rapidly nearing completion. Sewer pipe and water lines have been laid. About 25% of the tile on the permanent railroad station has been laid.

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[*] Mining engineer, 2678 Eudora St., Denver, Colo.

The Assayer and Chemist

Laboratory Efficiency

By Byron M. Johnson*

Time-saving devices in the assay laboratory are very valuable, as there are so many processes involved that a minute saved here and there soon amounts to hours.

There are just so many steps to be performed, so the question resolves itself into: How can the time of these individual operations be cut down? In all laboratory work, there is a certain routine that always exists, and one is likely to get into the rut and remain there unless one is wide-awake and continually on the lookout for short methods and time-saving devices.

Some, and perhaps all, of the hints given here may be known to many, but let us hope that someone will find one at least that he has not heard of or used and thereby may be benefitted.

Sheets of thin wrapping paper about 9 in. square used in lieu of the small sample pan for pulps ready for mixing and weighing. They are easily handled, eliminating all chance of salting as they will not permit of stacking, though a little more bench room may be required.

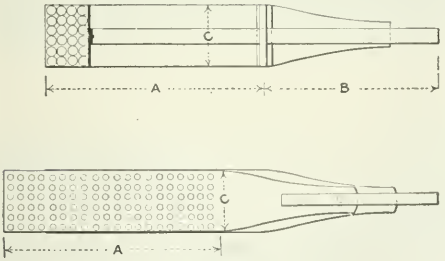

FIG. 1. LOADING TRAY FOR CUPELS

A common bar shaker consisting of a glass and an aluminum receptacle is useful for the thorough mixing of pulp. The mixing of all samples can be done at one time where papers are used instead of pans, and then the samples are ready for weighing. Mixing thus is easier than using a cloth, is more uniform and is done in about half the time. After the weighing operation has been completed, the shaker is again used in mixing the pulp and flux, instead of the spatula. Much time can be saved here also.

Loading trays for placing cupels in the muffle and buttons in the hot cupels. Figs. 1 and 2 show these. They are made of sheet iron of a thickness depending upon the furnace used; that is, ordinary cupelling muffles only will permit of a thinner metal than the hot crucible furnace.

The first tray (see Fig. 1) is so constructed that its length *A* will be the length of the muffle, its width *C* such that it will just take a row of cupels packed tightly together to avoid rearranging them when they are placed in the muffle. In this way a full muffle may be loaded in an instant and the same with the lead buttons. *B* is of arbitrary length, about 12 in. being very convenient.

Considerable care should be exercised making the second tray. First, the holes should be exactly centered, and then they should be drilled or punched from the under side and the edges allowed to project quite a little way so that the lead buttons will not be pushed out of place while loading them into the hot cupels. When the tray is loaded and ready for the furnace, place it carefully over the cupels in the muffle, pull out the lower plate and all of the buttons will drop into their own cupels. This is one of the best time savers that I have ever used in my laboratory, not to consider the intense heat that is thus avoided.

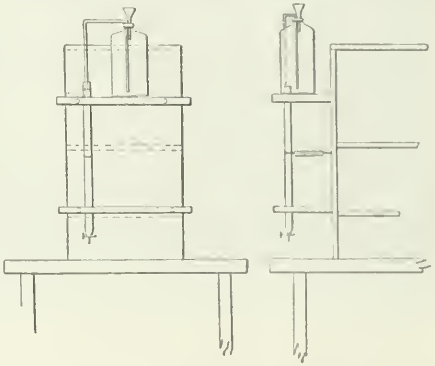

FIG. 2. A SIPHON FOR PARTING ACID

Referring to Fig. 2 which is a continuous siphon used in filling parting cups with acid, the sketch is sufficient to explain the apparatus. Any reservoir can be used, but as rubber tubing must be avoided, a one-way burette is the most convenient.

A sheet-metal tray for parting cups with sides at such a height that when the tray is placed on the hot plate, all the cups will rest on the plate, eliminating the necessity of their removal. Annealing may be performed in the same tray in case one desires to anneal in the furnace, though personally I prefer the use of a small hot-blast lamp as the life of the cups is much greater.

With the devices described, I have been able to save from one to two hours a day on heavy days' running, thereby cutting fuel consumption and labor costs, which are very high in this vicinity.

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Cerium Salts May Be Purified from other rare-earth metals by oxidizing cerous nitrate or sulphate in neutral solution with alkaline persulphates. A little silver nitrate should be added to the solution (the silver salt serving only as a catalyst), after which the reaction proceeds until all the cerous compound is changed to ceric. In neutral solution all other rare-earth metals remain in solution while almost all the ceric precipitates as a basic salt (Journ. Soc. Chem. Ind., May 31, 1916).

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*Mining and metallurgical engineer, Oatman, Ariz.

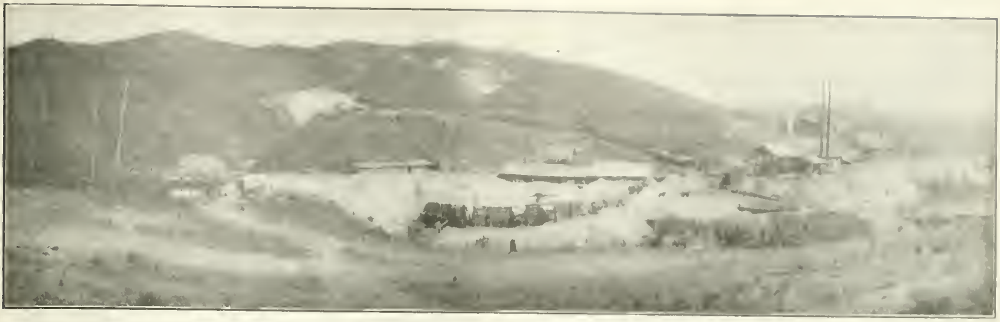
Photographs from the Field

Looking up "Discovery Gulch," at the Matahambre mine, shortly after its development was started by the present operator, Manuel Luciano Diaz, of Habana. The opening of this rich copper mine in the Province of Pinar del Rio started a mining activity in Cuba comparable to the excitement caused by the United Verde Extension's developments in our own country. The discovery is said to have been made by a deer hunter who during a rainstorm took shelter under an overhanging ledge—about the only copper exposure on the entire 710 hectares of the Matahambre property

An early panoramic view of the Matahambre development. There are few rock exposures in this region, the hills being covered with drift and grassed over. The country was practically denuded of timber about five years ago by a cyclone; the trunks of many dead trees stil stand, as may be better noted in the top illustration

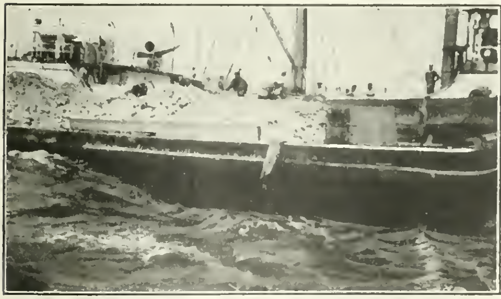
Santa Lucia, the port of the Matahambre mine, is about 8 km. in an air line and is now being connected with the mine by an aërial tramway. Many improvements have been made at the port, as will be observed by comparison with the illustration on the opposite page

SOME EARLY VIEWS AT THE MATAHAMBRE COPPER MINE IN WESTERN CUBA

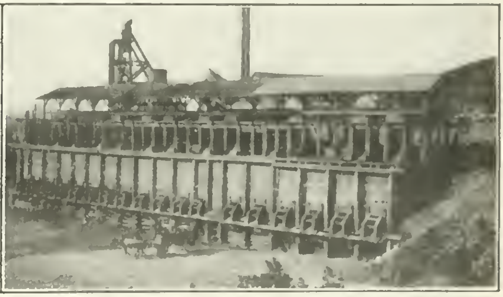


A recent panorama at the Matahambre copper mine. The headframe and principal mine buildings are at the right. The dark horizontal line in the right center background is the preliminary grading for a 200-ton mill that has been ordered to treat the second-class ore; the first-class ore is shipped to the United States. The white patches near the top of the hill are gloryholes from which waste is drawn for stope filling. The larger white patch at the left is a dump from one of the tunnels a short distance below "discovery." Shaft at extreme right is now about 700 ft deep

The new assay office and staff house at Matahambre



Loading ore on steamer from lighters



Headframe and new ore bins at the mine

The Matahambre ore is now hauled in wagons to the port of Santa Lucia, pending the completion of the aerial tramway and storage bins. A 1,350-hp. power plant is also to be built at the port. A long channel has been d[illegible] the ore out to steamers in the open roadstead

LATE VIEWS OF THE MATAHAMBRE MINE, IN PINAR DEL RIO, CUBA

Correspondence and Discussion

Lead Smelting Practice

In writing of the Scotch hearth practice in the Mississippi Valley, in the *Journal* of Oct. 7, Arthur S. Dwight, in his article on "Lead-Smelting Practice in the United States," says on page 677:

> The unsanitary feature of these processes, the large production of lead fumes, difficult to recover and re-treat, and the fact that the gray slags from the hearths have to be put through the blast furnace with sufficient amount of flux to make the same amount of slag that would have been made in a direct smelting of the original concentrates have militated against the hearths.

Mr. Dwight misses the advantages of the mechanical hearth in the paragraph quoted. The sanitary features as to lead fumes are perfect. The flue dust and baghouse fume are returned to the hearth and are treated with as good or better recovery in lead as the lead concentrates.

The loss of sulphur on the hearth by volatilization is 93%, making the hearth a most efficient desulphurizer and consequently reducing the production of matte in the blast furnace to the minimum; in fact, raw matte must be added to the blast furnace to give the necessary matte fall. The low matte fall reduces losses in lead and cost of re-roasting and smelting the mattes.

The amount of blast-furnace slag produced by the hearth is small and, were it not for the presence of magnesia contained in the gray slag, would be still lower. The low slag fall per ton of original concentrates reduces to a minimum the loss of lead in the slags and also the cost of fluxing and smelting of the blast-furnace charge.

As a matter of fact, based on our mechanical-hearth practice for the last two years, one ton of 70% concentrates together with its production of flue dust and baghouse fume, which is returned to the hearth, produces 79% of the total lead contents in the concentrates as pig lead and 584 lb. gray slag, which is the only product sent to the blast furnace. This gray slag analyzes: Pb, 45%; SiO_2, 10; FeO, 15; CaO, 8; MgO, 4 to 5; S, 3 to 3.3%. The actual matte produced from the 584 lb. of gray slag, representing one ton of original concentrates together with its production of flue dust and fume, is less than 50 lb.—equal to a matte fall of 4 to 4½% of the blast-furnace charge—and is due to a further volatilization of sulphur in the blast furnace resulting from the well-known reactions of PbS, PbO and $PbSO_4$ contained in the gray slag.

To summarize: One ton of 70% concentrates together with the resulting flue dust and fume produces 1,106 lb. pig lead, equal to 79% of the lead in the original concentrates. One ton of concentrates produces 584 lb. of gray slag which, properly fluxed and smelted in the blast furnace, produces less than 500 lb. of slag and less than 50 lb. matte.

Comparing these results with the single roast of the Dwight & Lloyd machine and smelting the resulting sinter in the blast furnace, it is found that one ton of original concentrates produces about 1,500 lb. of slag and 500 lb. of matte. The double roast will, no doubt, reduce the production of slag and matte to less than half of this amount, but the mechanical-hearth practice still shows a much less production of slag and matte.

An important smelting company in the Mississippi Valley has recognized the merits of the St. Louis mechanical hearth and is now making a large installation of this type of furnace, to be operated in connection with its large plant of D. & L. machines. HERMAN GARLICHS.

St. Louis, Nov. 6, 1916.

Having been favored by Herman Garlichs with an advance copy of his critique on my article on "Lead-Smelting Practice" in the *Journal* of Oct. 7, 1916, I take the opportunity to forward my reply so that it may appear simultaneously with Mr. Garlichs' letter.

Mr. Garlichs cannot have read my article very carefully, for the context clearly shows that the sentence he has quoted did not refer to the Newnam mechanical hearth, but to the old Scotch-hearth practice, before Mr. Newnam introduced his improvements. The next succeeding sentences led up to the first mention of the mechanical hearth, which I said "promises to save the Scotch hearth from extinction." My remarks were intended to be general in character and distinctly appreciative rather than critical.

The additional data furnished by Mr. Garlichs are interesting, but it hardly seems just to compare the amount of slag-fall in the two processes when the material under treatment is widely different. The slag-fall of 500 lb., which he cites, represented a ton of 70% Pb concentrates treated by the hearth and blast furnace, while the slag-fall of 1,500 lb. represented a ton of concentrates averaging under 65% Pb treated by sintering and blast furnace. This latter grade is entirely out of economical reach of the hearth, as I understand Mr. Garlichs himself admits. As I stated in my article, 70% Pb is probably the economical point of division between the two modes of treatment.

The ores of southeastern Missouri, which are here under discussion, have a dolomite gangue, so that the amount of CaO + MgO is the measure of the slag which must finally be made in the smelting operation. Every unit of residual CaO + MgO which the concentrates contain will cause a theoretical slag-fall of at least 5 units in the final smelting operation, and on account of the desirabiilty of keeping the MgO reasonably low in the slag clean limestone will probably be added, bringing the practical ratio of slag-fall much higher than 5. Taking Mr. Garlichs' own analysis of gray slag, a ton of his concentrates contained 47 lb. CaO and 26 lb. MgO, or a total of 73 lb. CaO + MgO. This he says made 584 lb. gray slag and ultimately about 500 lb. blast-furnace slag. Thus every unit of residual CaO + MgO in the concentrates made 6.9 units final slag. It must be evident, therefore, that as the Pb grade of the concentrates drops and the Pb is replaced by dolomite, the slag-fall must increase at a high ratio. Hence, in making a comparison of processes, it would be only fair to figure on concentrates with the same analysis. It makes no difference in the mathematics of the fluxing problem whether the flux is added to the gray slag to smelt it, or whether the flux is mixed with the original concentrates being fed to the sintering machines. It is the number of pounds of the refractory elements in the ton of concentrates which will be the measure of the minimum slag-fall in the final smelting.

The increase in quantity of flotation concentrates now being produced in the district under discussion is tending to lower the average grade of the output. These flotation concentrates carry only 40% to 50% Pb and therefore cannot be economically treated on the hearths. A small proportion of very high-grade concentrates may possibly be made which can be advantageously treated on the hearths, but it looks as though the bulk of the tonnage would fall below the critical point of 70% Pb.

New York, Nov. 16, 1916. ARTHUR S. DWIGHT.

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Flotation Test on an Antimony Gold Ore

In reference to the article on "Flotation Tests on an Antimony Gold Ore," in the *Journal* of Nov. 4, 1916, p. 820, I would like to note that the tests discussed were made by E. Clark Will, of Kennecott, Alaska, and me.

Kellogg, Idaho, Nov. 9, 1916. EARL R. PILGRIM.

⁂

Standard Map Conventions

I should like to suggest that the publication, in the *Journal*, of a list of standard conventions for mining maps —both topographical and geological—as well as underground maps, would be of value to many engineers, since there is considerable variation in those now employed at different places. E. B. WOOD.

Bonanza, Calif., Nov. 10, 1916.

[We believe this suggestion is an excellent one. We would like very much to have all engineers interested in this subject, send us their ideas, whereupon we will take pleasure in formulating them and publishing such a list in graphic form.—Editor.].

⁂

Flotation-Efficiency Problem

Suppose the case of a complex ore containing lead and nearly as much iron as the zinc content. The material is treated by the magnetic and ordinary wet-dressing process, resulting in a saving of 70% of the mineral values. Now, presuming that the flotation process is added to the mill equipment, what is its stage in the whole operation of ore treatment? If the tailings are handled, the result is a mixture which must go through the dry and wet mills again to separate out the lead and the worthless iron from the zinc. If the mixture cannot be treated as a separate proposition, but must simply be added to the fresh sizings and handled with them, the proposition of savings made by the flotation process becomes a mathematical problem that on its face does not seem to come out.

If, on the other hand, the crushed ore goes first to the flotation tanks and thence travels the ordinary route provided by a combined dry and wet mill, I can understand how the percentages lost in the tailings are saved. But there are theoretical objections to that method also; and, freely confessing my ignorance and mental fog, I am venturing to ask you to explain in your columns.

Chicago, Ill., Nov. 15, 1916. GRISWOLD KEMPTON.

Montana Section, A. I. M. E.

At the semi-annual meeting of the Montana section, A. I. M. E., recently held in Butte, Dr. L. D. Ricketts, president of the Institute, was the principal speaker. His subject was committee work applied to technical research, which he developed by showing how historical developments in mining and metallurgy have been evolved mainly by cooperative work in the study of intricate problems. For illustration he mentioned the development of cheaper mining methods at Butte and gave an interesting account of the development of some features of flotation practice. In concluding, Dr. Ricketts suggested that local sections of the Institute select men to study special problems, believing as he did, that such coöperative work among such men would produce important results.

B. B. Thayer, vice-president of the Anaconda Copper Co., gave an interesting account of a trip to South America in company with Dr. Ricketts, Reno H. Sales and others. He expressed a belief in the great future of the country and urged the study of Spanish.

Dr. F. G. Cottrell prophesied that future advances in science would be largely concerned with gases, stating that at Anaconda, for instance, the weight of gaseous products wasted through the stack was twenty times the weight of the slag.

Frederick W. Laist, general manager at Anaconda, discussed features of dust losses at the plant, flotation-practice features, and called attention to the small quantities sometimes dealt with by modern metallurgist—quantities that would have been disregarded not long ago.

C. L. Berrien, assistant general superintendent of the Anaconda mines, made clear how the cut-and-fill system of mining was the only feasible method in Butte because of the necessity of supporting the surface. He said that cost systems which had been introduced for the comparison of the original square-set method with the latest cut-and-fill method showed that a saving of from 15c. to 58c. per ton mined was being saved by the latter. Fifteen per cent. of the square-set stopes had been shifted to the cut-and-fill system in 60 days and the real saving had not yet been shown.

Other speakers were C. W. Goodale, who recalled incidents of the Arizona trip; H. S. Ware, who voiced the appreciation of the Montana members of the hospitality enjoyed in Arizona; Reno H. Sales, who spoke on South American mining; F. E. Marcy and C. R. Kuzell.

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Butte & Superior Mining Co.

The report of the Butte & Superior Mining Co., Butte, Mont., for the third quarter of 1916 shows a total of 136,130 tons of ore milled, with an average of 15.57% zinc and 6.607 oz. silver per ton. Of zinc concentrates 37,333 tons was produced, carrying 39,519,432 lb. of zinc and 21.5 oz. silver per ton. The recovery of zinc in concentrates was 93.314%. Mining cost was $1.9137 per ton, and milling cost, $2.1691 per ton.

Total net income was $1,936,527, and after deducting all expenses, amounting to $988,626, profit of $947,901 remains. Average price used in estimating returns on spelter was 8.3111c. per lb. The regular quarterly dividend was raised from 75c. to $1.25 per share, at which rate dividend was paid on Sept. 30, together with an extra of $5 per share.

Pinar del Rio Copper Region

By Richard H. Vail

SYNOPSIS—Impressions of a brief trip through Cuba's new copper district in the western province of Pinar del Rio. Matahambre the only big mine, but other properties have encountered good ore in smaller quantity. Copper showings found over a large area.

Sugar is king in Cuba, but copper may be said to be queen, for nearly every sugar man now has an interest in copper. The opening of the rich Matahambre copper mine in Pinar del Rio caused a mining furor in Cuba, comparable to that created in the Jerome district in our own country by the development of the United Verde Extension mine. It may therefore be of interest to record some impressions of a hasty trip through the copper region of Pinar del Rio, which is the most westerly province of Cuba, forming the southwestern extremity of that crescent-shaped island. I shall not attempt to give a complete review of the copper-mining activities, but merely present from memory some impression of the region and mention briefly a few of the most important operations. It is worthy of note at the beginning that for many years Cuba's only important copper mine—El Cobre—was in the eastern end of the island, while today its greatest copper mine is at the western end.

The Developing Copper Properties

As soon as the facts became known about the Matahambre development, much of this region was plastered with denouncements for a distance of about 50 km. along both sides of the Sierra de los Organos. Today the principal developing properties, aside from the Matahambre mine, are, beginning at the north on the western side of the Sierra: Constancia, Mercedita, Malas Aguas, Mono, (Matahambre), Nieves, Otilia, Francisco, La Mejor, San Ramon and Candida. On the eastern side of the Sierra at the south are the Asiento Viejo and Mercedes; at the north, near Viñales, is the Isabel Rosa, also known as the Willetts mine. Besides these properties, more or less closely grouped along the Sierra, active work is in progress at points as far apart as 90 km.—as at the old property near Bahia Honda in the northern part of the province, and at Pueblo Nuevo near Dimas, a port on the western coast. Some of these developing properties have produced sufficient ore to make shipments, while others have only small bunches of ore and are merely prospecting.

The most active copper operations in the province of Pinal del Rio are at a considerable distance from the railroad on the western side of the Sierra de los Organos in a grassy drift-covered country having almost no outcrops. Therefore, though copper was known to exist in this region for many years, it is not to be wondered at that few mines were opened or that little work was done in this end of the island up to the time of the opening of the Matahambre mine. While the Matahambre may be said to be the only "real" mine in this part of Cuba, yet the showings of copper are so persistent along both sides of the Sierra that work is now certain to be done for some time to come in the endeavor to find another Matahambre. Several other orebodies have indeed been opened, but none has yet proved to be of the size of Matahambre. It should be noted, however, that the orebodies have been of good grade in nearly every instance.

The Sierra de los Organos, along which most of the copper mines are grouped, runs in a northeast-southwest direction, approximating the center line of the province of Pinar del Rio. The most striking feature of the Sierra is the limestone ridges or hills, which are more or less bare and precipitous. These limestone hills are sometimes sheer on one or even two sides; hills of this type, when separated, bear the name locally of *magotes*. They have apparently been thrust upward at lines of faulting, though the geology has not been fully studied. The foothills of the Sierra de los Organos are in places approximately as high as the limestone ridges and are frequently separated from them by an area of serpentine, the igneous basement rock of Cuba. In a bulletin[1] issued under the direction of Pablo Ortega, head of the recently-created Dirección de Montes y Minas, the occurrence of basalt, diabase and other igneous rocks is mentioned, but they did not happen to come under my observation. The foothills are drift-covered and show few outcrops. They are grassed over, and there are practically no trees except in gulches or protected hillsides, owing to a "twister" that passed over this section about five years ago. Only a few live palms and the trunks of many dead trees were left. These rolling hills have more the appearance of a typical grazing country than of a mining region.

Ore Usually Found in Slate or Shale

Most of the orebodies so far disclosed have been found in the shattered slates or shales in the foothills to the west of the Sierra, though in the case of the Constancia mine the ore was reported to have been found in lenses in the serpentine and at the contact of serpentine and limestone (?). In no instance that I observed had any mines been opened at the contact of the surpentine with the *magotes* or the main limestone ridge, and no prospecting of consequence was in progress at this contact. Whether this was because of no visible copper minerals, or because such areas had been investigated and found barren, I do not know.

Matahambre Discovered by a Hunter

The Matahambre mine, which caused the present copper-mining activity in Pinar del Rio, is situated in the foothills on the western side of the Sierra at an altitude of less than 500 ft. and only about 8 km. from the port of Santa Lucia. I shall not attempt to describe the Matahambre mine, but merely touch upon a few interesting facts about this property. Matahambre Hill is typically grass-covered, and the discovery of the mine was purely fortuitous. A hunter caught in a rainstorm is said to have sought shelter under the overhanging ledge of a small gulch. While waiting for the rain to cease, he noticed some peculiar-looking rock—the only copper outcrop on the Matahambre property of 710 hectares. The peculiar color induced him to take some of the rock, which eventually was shown to Dr. Alfredo Porta in the town of Pinar del Rio. Dr. Porta interested Manuel Luciano Diaz, a well-known civil engineer of Havana, who in 1913 began the development of the property. Rich ore was opened by an exploratory adit, and before the end of a year enough ore had been shipped to put the mine "on velvet." Developments continued most favorable for a time, but presently the original orebody came to an end in a gouge against the slate wall. However, the shaft then being sunk at a considerable distance laterally, was in ore at a point lower down the hill and D. Ford McCormick, who was placed in charge of the mining work at this time, decided after some study of the local conditions to drive through the slip. After going over 100 ft. in barren slate, the miners broke into a good-sized lens of nearly solid chalcopyrite ore. This gave the key to the development of the "greater Matahambre mine," now opened to the eighth level, with the shaft being sunk to the ninth and already about 50 ft. below sea level. Native copper and almost every copper mineral from oxide to sulphide have been found in the Matahambre mine, but chalcopyrite is the predominant mineral. The country is slate, much shattered, and with frequent lateral faults. The orebodies generally are at an angle of about 45°. Sufficient ore has now been developed to warrant the erection of an 8-km. aërial tramway to the port of Santa Lucia, the building of port works, a 1,350-hp. crude-oil engine power plant at Santa Lucia, an electric transmission line to the mine and a 200-ton mill on Matahambre Hill to treat second-class ore. Shipments during the rainy season at the time of my visit were amounting to 5,000 or 6,000 tons per month of 14% ore. Additional teaming arrangements were being made to bring this tonnage up to 7,000 or 9,000 tons, pending the completion of the tramway in February or March. Martin Young is general superintendent, while D. Ford McCormick directs the technical work, with the title of "engineer in charge." The Matahambre and most of the other properties near the northern end of the Sierra are usually reached by leaving the Western R.R. of Havana at Pinar del Rio, whence a *guagua*, or stage line, can be taken to Viñales, and La Playa de Esperanza. To reach Matahambre from Esperanza, one proceeds by launch to Santa Lucia, thence on horseback to the mine.

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[1] "Boletin de Minas," Num. I, July, 1916; dirección de Montes y Minas, Secretaria de Agricultura, Comercio y Trabajo, Habana, Cuba.

DEVELOPING PROPERTIES ON WESTERN SLOPE

Of the other mines at the northern end of the Sierra, I visited the Constancia and Nieves. The Constancia, north of Viñales, is an old property, formerly worked by the McLoughlins, of New York, who took out considerable ore. This property is now being developed by M. Paetzold, Austrian consul at Havana. The work is in charge of Marco Laiz, *administrador*, though lately C. Leslie Bruns, an American engineer in charge of Mina Mercedita, has been called in to advise regarding developments. The main feature of interest here is that the orebodies are reported to be found in the serpentine or at the contact of the serpentine and limestone (?), while at most of the other properties on the western side of the Sierra, the ore occurs in the fractured slates and shales. Another feature of interest at the Constancia is the copper mineral, cubanite, a copper-iron sulphide lower in copper (about 25%) than chalcopyrite but occurring fairly pure. Several hundred tons of this cubanite ore on the Constancia dumps are locally estimated to have a copper tenor of approximately 18%. One who is unfamiliar with this ore is astonished at its high copper content, as it appears at first glance to be a low-grade chalcopyrite ore.

I did not visit Mercedita, Malas Aguas (Cosmopolita) or Mono. All are reported to have encountered some bunches of ore, but no orebodies of commercial size. At Malas Aguas, though a number of shafts had been sunk, development lately has been by drilling, which I was told was difficult and expensive owing to the fractured condition of the country. This is probably the reason why prospecting by this method is not generally done.

Going south from Matahambre the first development encountered is that of the Cia. Minera Nieves, which is installing a new surface equipment, consisting of Chicago Pneumatic air compressor, Bolinders oil engine, Jackhamer drills, etc., for the prospecting of a strong pyrite or pyrrhotite vein carrying a small percentage of copper. This vein is developed by shaft. The company also has work in progress in two adits in other parts of the property. Continuing southward, no active properties are encountered until near Gramales, where the Otilia is being developed by a syndicate of Cienfuegos men.

PROMISING AREA NEAR SOUTHERN END OF THE SIERRA

Still farther south, a group of properties under active exploitation are the Francisco, La Mejor, San Ramon and Candida. The developments here are mainly by adits and shallow shafts—the latter as yet less than 200 ft. deep. These mines are all in promising ground and have found some ore in the fractured shale. At the moment the Francisco has the most ore, though Candida has shipped about 3,000 tons from a high-grade pocket. Candida, Francisco and La Mejor are now in the hands of American engineers, and their development is receiving intelligent attention. Whether another Matahambre will be developed remains to be seen. A feature of these southern properties, especially at Francisco and at La Mejor, is the strong "gossan" outcrops—Francisco was in fact originally denounced as an iron property; however, adits run in to cut these outcrops have found nothing at the points expected, though the country is so broken that no conclusions may be drawn from this work as yet. At the Candida, Carl A. Lewis, formerly at Mapimi, Mexico, has lately been put in charge of the technical work; Chester A. Fulton is directing the work of La Mejor Mining Co., and William E. Fenwick is engineer for the Francisco Mining Co. The San Ramon, which I did not visit, is in charge of a Mexican engineer, Ignacio Quintanilla, for a Cienfuegos syndicate. Much of the energy of these four companies to date has necessarily been devoted to road building. They are reached from Guane, the rail end of the Western R.R.; thence by *guagua* (Ford stage line) to Los Acostas, which is the mail point for the mines. From Los Acostas one usually proceeds on horseback to the mines, but the roads will soon permit of driving. Candida, the mine of Gen. José Miguel Gomez, uses the port of Dimas for shipping its ores, though the Francisco will ship to Guane.

Near Los Acostas, but on the eastern side of the range, is the property of the Cia. Minera Asiento [illegible] I did not have time to visit this property, but was told that several hundred tons of ore has been shipped therefrom; I was informed that the ore generally is not so high in grade as at some of the other Pinar del Rio properties. This stock is listed on the Bolsa in Havana. Recently, it was reported that the property was to be purchased by a "French syndicate" for $3,000,000. On the strength of this report, the stock was heavily traded in, skyrocketed to a high figure and then slumped when the sale to the "French syndicate" did not materialize. This left a rather bad taste in the mouth of the public as regards mining speculation. Asiento Viejo, however, has just made another shipment of 100 tons to the United States and has improved the road for hauling further shipments to Dimas. A concentrator is under consideration. The Mercedes mine, also situated near the southern end of the range on the eastern side, was for some time under development by the Cia. Minera Buena Vista, but I understand that the option has now been relinquished. This company also operates the prospect at Malas Aguas.

At the north on the eastern side of the Sierra, near Kilometer 12 on the *carretera* from Pinar del Rio to Viñales, Robert Willetts has been developing the Isabel Rosa mine, which has lately been taken over by interests for whom Chester A. Fulton is engineer. About 150 tons of cubanite ore, occurring in slate, has been taken out in development here; the shaft is now being sunk to a depth of 100 ft.

A deterrent to the entrance of American capital in this region is the high royalty asked. It is currently reported that Dr. Porta, who controls the Matahambre area, has a 40% interest in the profits. This may or may not be correct; only a mine like Matahambre could stand such a tax. Few mining operators in the United States would pay 25% or even 15% to prospect a drift-covered area that only has a chance of containing a Matahambre. As is inevitable in the rapid development of a new region, some of the work has been injudiciously done, but gradually the wisdom of securing technical advice is being appreciated. A number of companies are now employing competent American engineers, and if the latter be given a free hand, these properties will be assured a thorough and intelligent development. Unfortunately, in some instances, the Latin system of dual management prevails—an *administrador* and a technical manager—with its attendant expense and occasional conflicts of authority. Many of these properties have not yet been developed to a stage warranting such an expensive form of management, but Cuban opinion considers it more safe and apparently does not realize that technical men of integrity can be secured and that thousands of mines are successfully run in the States under single management.

Just what the future holds out for Pinar del Rio as a copper region is uncertain. Another year's development should give considerable light on this question. There is a remarkable persistence of copper occurrence for 50 km. more or less on both sides of the Sierra de los Organos, and it would certainly be a curious thing if Matahambre were the only concentration of great extent. The surface indications are not more favorable at Matahambre than at numerous other places. Good orebodies of modest dimensions have already been found, but as to another Matahambre—it took a long time to find another United Verde.

Engineers' Library Endowment

Dr. James Douglas, of New York, has presented $100,000 to the United Engineering Society, the income to be used for the benefit of the library. The trustees of the society have perfected plans for the development and extension of the usefulness of this great engineering library and are endeavoring to secure endowments aggregating $1,000,000, the income to be used for the library.

The plans of the trustees, having been submitted to and carefully examined by Dr. Douglas, have been approved by him and he has signified this approval by his gift of $100,000, which has just been made. Now that the library of the American Society of Civil Engineers has been united with the libraries of the institutes of mining, mechanical and electrical engineers in the building of the United Engineering Society, in West 39th St., New York, the combined library forms the greatest engineering collection in the world. It is the purpose of the trustees to extend greatly its usefulness, and it is hoped that the splendid indorsement which Dr. Douglas has given will stimulate other similar endowments until the necessary million dollars has been obtained.

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American Mining Congress

Special Correspondence

By a unanimous vote the American Mining Congress, which closed its sessions at Chicago, Ill., on Friday, Nov. 17, adopted a resolution putting the congress unqualifiedly on record as favoring "a competent nonpolitical commission" to investigate the defects of the Federal mining laws. The commission desired by the congress would recommend to the Federal lawmakers the remedial legislation thought necessary and would sit in Washington as an advisory body during the consideration of the legislation. The lack of a single voice in opposition to the resolution, as well as the outspoken opinion of many, indicated that operators of coal and of metal mines resent the lack of consideration given the mining industry by the House Committee on Mines and Mining. Since the committee declined to approve of an investigating committee, it was pointed out that most operators had given serious consideration to the proposal that the mining laws be revised without the preliminary investigation. It was declared at meetings of the mining congress that no operator believes the law can be revised intelligently without this investigation. The need for a more suitable code is so great, however, that many favor an attempt to draft a law without the commission, if continued opposition to the commission plan should develop at the coming session of Congress.

Carl Scholz, who has been president of the mining congress for three years, thwarted all efforts to secure his renomination, and the presidency went to Walter Douglas, of Phelps, Dodge & Co. No other nominations were made, and Mr. Douglas was elected by acclamation. George H. Crosby, of Duluth, Minn., and Irving T. Snyder, of Denver, Colo., were elected to fill vacancies on the board of directors; W. R. Richards, of Pottsville, Penn., and M. N. Kemmerer, of New York City, were reëlected to places on the board of directors.

While fifteen cities submitted invitations for the convention next year, it is believed that Birmingham, Ala., found most favor with the members present at Chicago.

No one of the nineteen conventions held by the congress ever has gone to the south. Another argument is that Birmingham combines the coal- and metal-producing districts, in each of which there is much popular interest.

Steps taken by the uniform-legislation section of the convention toward the drafting of a coal-mining code are confined entirely to coal mining. It was explained that it is not the intention of the Uniform Mining Laws' Association (organized at the convention as a separate entity), to consider the application of their proposals to metal mining.

The only resolution adopted at the convention which seriously divided the Resolutions Committee was the one introduced by L. W. Trumbull, state geologist of Wyoming, in which it was urged that the Department of the Interior construe the public-land laws more liberally. The resolution, which passed the general assembly of the congress with few dissenting votes, put the congress on record as being unalterably opposed to any system of Federal leasing of mineral and other land or the enactment by Congress of any laws relating to public lands, the effect of which is to restrict the development of the West.

The attendance of members from the metalliferous sections of the country was unusually light. This was explained by those who did attend, as being the result of the prosperous condition of the industry. In the effort to keep production at the highest possible point, comparatively few operators of metal mines feel that they can spare any time away from their properties. Even the coal men from the fields adjacent to Chicago did not stay through the entire convention. Many of these operators selected the days on which the topics in which they would be most interested were to be discussed and limited their stay to just that time. In this way the attendance was evenly distributed throughout the convention and a minimum amount of time was lost by the operators from their desks. Distance made this procedure impossible for metal-mine operators. Unfortunately for the maximum success of the metalliferous section, a number of those having promised to read papers were prevented from being present.

THE OIL FLOTATION SESSION

The most successful session was that of Wednesday afternoon, when an extended discussion of flotation problems took place. It was at this session that the paper on "Oil Flotation," by Dorsey A. Lyon, of the Bureau of Mines, was presented. Mr. Lyon is in charge of the bureau's Salt Lake City station. He summarizes the work done in the extended study which has been made of the low-grade and complex ores of Utah, as follows: "The development of a brine-leaching process for extracting lead from low-grade and complex ores; the development of a process for the recovery of lead and zinc from lead-zinc sulphides; the application of the flotation process to the recovery of lead in carbonate ores; the development of a process for the recovery of zinc from low-grade and complex ores of that metal, and the development of a process for the production of zinc dust from solutions of zinc."

The social features of the convention were very successful. At the smoker Tuesday night, more than 600 members and their guests gathered in the ballroom of Hotel La Salle and joined in singing old-time songs. Well-selected refreshments in substantial quantities were served. Singers, who adopted the cabaret style, added much to the merriment of the evening.

The banquet Thursday night brought forth notable toasts from Col. George Pope, of Hartford, Conn., and from Judge Frank H. Short, of Fresno, Calif. Col. George T. Buckingham, of Chicago, was toastmaster. The banquet was made the occasion for the presentation to Carl Scholz, the retiring president of the congress, of a $300 gold watch. The presentation was done cleverly. Immediately on the assembling of the guests, Mr. Scholz, in turning the direction of the affair over to the toastmaster, announced the election of Walter Douglas as president of the congress. He had launched into his own farewell address, when he was interrupted by E. W. Parker, of the Anthracite Bureau of Information. Mr. Parker began a discussion as to "time." He talked about springtime and its relation to wintertime. He discussed the advantages of Eastern time and Central time. He compared the general conception of a good time with the time of adversity. As Mr. Parker's rambling talk continued, the perturbation of Mr. Scholz increased, as he knew nothing of the plan. Finally he turned to Toastmaster Buckingham and asked if, by any chance, Mr. Parker had broken the rule of a lifetime and indulged in intoxicants. His perplexity was short-lived, as Mr. Parker cut short his dissertation on "time" by dangling the watch before the astonished eyes of the retiring president, saying that the time kept by the watch he held was declared to be as exact as human ingenuity could devise. The watch was a token of the esteem in which the members hold Mr. Scholz, thrice elected to the highest office of the congress.

JUDGE SHORT'S PARABLE

Judge Short based his talk on a parable, which in substance is as follows: "The Sam family was one of wealth. The father, Uncle Sam, divided the property equally between his sons, North, East, South and West. The portions which fell to the three older sons were awarded them and placed at their disposal at once. The youngest son, West, assigned his portion of the estate so early in life, was unable to take advantage of it as had his brothers. After having had full benefit of their part of the estate and seeing the great value of their brother's estate, North, East and South came to the conclusion that West's estate should be handled so that the profit accruing from it would be divided equally among them all." Judge Short, from this parable, developed a convincing argument in favor of the Western idea of conservation.

Colonel Pope, in his toast, dwelt on the kinship between mining and manufacturing. He pointed out that the mine operator often loses sight of the fact that the manufacturer is more than a consumer of the raw material he produces. He emphasized the fact that the manufacturer also bears a very important relationship to the mining industry in that he perfects and makes machinery without which the operation of mines on any but the primitive scale would be impossible.

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Tungsten in New Brunswick is the latest development. The "Canadian Engineer" reports that tungsten deposits are now being worked experimentally near the [illegible] of the Miramichi River, in New Brunswick. Three veins [illegible] reported, one being 16 in. thick. A concentrating mill [illegible] tons daily capacity [illegible]

Editorials

The Situation in Copper

The present situation in copper is unprecedented. The causes leading up to it are clear. With a shortage of refining capacity and difficulty of increasing it, a large part of the expected production during the first half of 1917 was taken out of the market by one huge purchase by the allied governments. Domestic users of copper subsequently became panic-stricken and rushed to buy the remainder of the probable output up to the middle of 1917.

Therefore we find ourselves in the situation where nearly all of the expected production for seven months ahead has been sold. Conversely, it is probable that the expected requirements have been covered. The brutal, reckless buying of the last fortnight must mark the culmination, or the close approach to it, of the satisfying of the large needs.

Cessation of buying there must be some day. Then we shall face the position where all the copper to be produced for six or seven months ahead has been sold and all the copper to be needed has been bought. Buying may then extend into the second half of 1917, as it has already upon a relatively small scale, but sooner or later there must be a halt in the recklessness of people committing themselves so far ahead.

Assuming that presently there will develop such a halt, we may expect a prolonged period of dullness in the market, for producers will have no more copper to sell and users will need to buy no more. There will, however, be a copper market on small transactions, for there will be some users who have held aloof, with the nerve to take their chances later on, while on the other hand there will be some who will find themselves overbought and will be desirous of reselling. Moreover, producers will come into possession of small supplies held in reserve for safety in conducting their business, which will be gradually released as time wears on. And there will be other ameliorative factors.

As between production and consumption, we are probably approaching a state of equilibrium. During the recent excitement there has been undoubtedly a tendency to overestimate the consumption and underestimate the production. The purchases by the allied governments for delivery in the first half of 1917 call for about 480,000,000 lb., or about 80,000,000 lb. per month. This is not an addition to the normal exports figured on the basis of 1916. Rather is it simply a replacement of them. We are prone to shut our eyes to the fact that the allied governments have not been buying all this copper for military purposes alone, but rather for the entire consumption of their countries, the industries of which they have mobilized and taken in hand.

There has been some outside buying from both Great Britain and France, which is permitted under certain circumstances, and from other countries. Let us estimate this at 120,000,000 lb., calling for the export of about 20,000,000 lb. per month. We shall then have a total contemplated export of 100,000,000 lb. per month to go out, not 160,000,000 lb. per month, which is assumed by adding 100,000,000 to 60,000,000—the latter being the average rate of 1916. The domestic use of copper will be probably about 125,000,000 lb. Thus the total requirement will be around 225,000,000 lb. per month. The outlook is that the production will be at approximately the same figure, probably more rather than less. This is about the way things look now.

However, there are numerous factors that may enter into the situation as time passes, and will have a general tendency toward amelioration of the stringency. During the first nine months of 1916 the exportation of copper in bars, plates, ingots and rods averaged 61,500,000 lb. per month.[1] If Europe is going to take 100,000,000 lb. per month in 1917 instead of about 60,000,000 as in 1916, there is ground for the suspicion that she has contracted for more than she really needs, in order to be on the safe side. However, it is to be remarked that Great Britain and France are probably going to manufacture wares that they have previously got from this country. On the other hand, the refiners have probably been conservative in contracting to deliver what they expect to produce, and as time rolls on will most likely find their actual output greater than reckoned. Of course, everybody knows now that the stringency in copper is due to shortage of electrolytic refining capacity. The high prices will undoubtedly stimulate further the production of lake copper, which requires only a furnace refining, and moreover, we shall see an increased use of blister copper low in silver—such as the Arizona, Braden, Detroit, Tennessee, and Miami—which can be refined in furnaces up to 99.75% Cu and can be marketed as "best selected."

Everybody will say that this is no time to consider statistics. The market has gone up because consumers have insisted on buying. If a producer did not sell to one, he could to another, for many were begging him to let them have copper. But without any doubt the extraordinary situation of the last few weeks has resulted from the failure of consumers to appreciate the statistical position, and becoming panic-stricken, they insisted upon buying all their next six months' supply at once. Exactly the same thing happened in spelter in 1915. If the allied governments had deferred their large purchases and taken 80,000,000 lb. per month, or if domestic consumers had not become scared, the copper market would probably have moved along in an orderly way, with the possibility, perhaps, that the allied governments might have paid more and the domestic consumers less.

The producers have now sold about all of their first-half 1917 copper at prices ranging from 24 to 32c. per lb., the bulk of it under the arithmetical mean of 28c. When the present storm abates and calm ensues, we may expect a prolonged period of dullness, during which the market will be established on relatively small sales, for it is not to be expected that consumers will buy furiously all the time for long distances ahead.

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[1] Last year the Government altered the form of its copper statistics and is now including the exports of rods with the statement of bars and ingots, thus embracing a manufactured product with what is properly the refiners' product. Formerly rods were grouped with wire, which is more correct.

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Revision of the Mining Laws

We have referred several times to the discussions by the several mining societies of the United States respecting revision of the mining laws and the expression of opinion upon a series of questions that were proposed. The vote upon those questions, which is reported in the last bulletin of the Mining and Metallurgical Society of America, is highly illuminating. It will be recollected that the M. M. S. A. invited all the other national societies and also the several state societies to vote upon the same questionnaire. The Northwest Mining Association, the California Metal Producers' Association, the Nevada Mine Operators' Association and the Colorado Scientific Society did so.

Let us consider first the vote of the M. M. S. A. This is a national society. Its membership is small, but is representative and influential. Of its members 123 voted, a rather large vote by percentage. Foreign members did not vote, nor did many members who are metallurgists rather than miners. Moreover, many members engaged in mining in Eastern districts excused themselves from voting on questions pertaining especially to the public lands of the West, as to which they professed ignorance.

The vote of the M. M. S. A. showed that while with regard to questions of detail, such as the size of claims and the orientation of lines, there was difference of opinion—sometimes to the extent of a nearly equally divided vote—upon all fundamental questions there was all but unanimity.

On the proposition that in a revision of the mining laws it should be aimed to preserve to the maximum extent the phraseology of the present laws and their principles of administration, the vote was 110 in the affirmative and 4 in the negative. It was voted 116 to 1 that a new mining law should be made to cover all classes of valuable mineral deposits other than coal and that this intention be so clearly defined that there will be no misunderstanding of it. On the proposition that the new law shall authorize mineral locations *without* discovery in any part of the public lands officially classed as mineral and *upon* discovery in any part of the public lands whether officially classed as mineral or nonmineral, the vote was "yes," 83, "no," 15. That there be further a provision permitting bona fide prospecting on land classified as nonmineral and protecting the prospector in the meanwhile was voted 110 to 3. By almost equally sweeping vote it was the consensus of opinion, however, that patents should not be granted until discoveries had been made.

The question as to whether the number of claims locatable by one person or association be limited or unlimited developed a closer division of opinion, 42 voting "limited" and 60 "unlimited." However, the propositions that existing regulations respecting the marking, notice and recording of location be continued, that the recording must be done within 90 days, that there be emphatic provisions to insure the honest performance of annual assessment work and that proceedings for patent remain as now were carried sweepingly by votes of 91 to 3, 94 to 9, 110 to 2 and 73 to 16 respectively.

Most interesting of all, of course, was the vote respecting abolition of extralateral rights, for it was dissatisfaction with the law of the apex that started the agitation for revision of the mining laws. This question was put in the form of a memorandum that had previously been adopted by the New York section of the society, as follows:

> Subject to the existing extralateral rights of mining claimants or patentees, the holder or patentee of a mining claim located hereafter to have the exclusive right of possession and enjoyment of the surface held by him and of the minerals under it, bounded by vertical planes passing through surface boundaries of said land, but not the right to follow any mineral deposit beyond said planes. And the holders or patentees of claims heretofore located to have similar exclusive possession of all the mineral in said claims that is not covered by any existing extralateral rights.
>
> The above article abolishes extralateral rights in so far as any claims hereafter to be located are concerned. The extralateral rights of existing claims may not be taken away, however, wherefore any new location and grant of patent may be made only with the reservation of such rights. The rights of existing claims having been thus expressly preserved, the last sentence of this article confers upon previously located claims the rights to everything comprised within the vertical projection downward of their side lines that is not legally claimed by anybody else, this being thus an addition to the original extralateral rights.

Members were asked to vote approval or disapproval of the above. The vote was 120 "yes," 1 "no."

It was voted 106 to 8 that there ought to be provision for appeals from decisions of the United States Land Office to a court of competent jurisdiction.

So much for the Mining and Metallurgical Society. The other national societies made no returns. Four state societies did so, but their machinery did not in all cases permit of definite expression of opinion. The Northwest Mining Association and the Nevada Mine Operators' Association voted officially as bodies. The California Metal Producers' Association issued ballots and filed those that were returned. The Colorado Scientific Society referred the questionnaire to a committee and returned the report of that committee.

With a few exceptions these organizations voted in the same way as the Mining and Metallurgical Society upon the main questions that have been summarized in this article. The California Metal Producers' Association by a vote of 5 to 1 declared in favor of limiting the number of locations. The Colorado Scientific Society is unwilling to see the requirement of discovery abolished, but desires that actual possession of a delimited claim be legalized pending bona fide effort to make discovery. Otherwise the differences among the several organizations relate mainly to details. In this connection it is interesting to call attention to the matter of size of claims, wherein are reflected differences of opinion arising from environment and experience. The Northwestern mining men are strongly in favor of a claim not less than 1,320 ft. square (10 acres). They have come most in contact with British Columbia practice, where the claim unit is 1,500x1,500 ft. The Colorado men are divided between large claims (40-acre maximum) and small ones (2½-acre minimum). The Southwest men generally favor a small claim. They have had experience with the small *pertenencias* of Mexico.

It is singularly gratifying that the general expression of opinion as to revision of the mining laws of the United States thus obtained through the medium of the Mining and Metallurgical Society has been so harmonious upon all main points. It ought not, with this information, to be difficult to proceed to draft for introduction in Congress a bill that will be what mining men want. The matter now stands in much the same way that it would if a commission had toured the United States and obtained oral expressions of opinions in several mining centers and tabulated them. The present expression of opinion is probably more representative, for it summarizes votes not merely from a few places but from many, scattered all over the United States, and moreover it follows a prolonged discussion—extending through several years—in the course of which all kinds of views have been advanced and considered.

It will now naturally devolve upon some committee to consider the wishes of the mining industry and weld them into a properly phrased measure to be offered in Congress. Without any doubt the Mining and Metallurgical Society will proceed to take this next step with the same broad view that it has had in taking the previous ones; that is, assuming only the leadership in getting something done and inviting the coöperation of everybody interested. The purpose is manifestly to produce a "mining men's bill," embodying what mining men want. It is to be expected that whatever committee undertakes this will have adequate legal assistance, and moreover that it will publish its proceedings as it goes along. This will not be altogether an untried experiment in framing legislation. The model bill drafted by the Committee on the Prevention of Accidents in Metal Mines (published in U. S. Bureau of Mines Bulletin No. 75), which has been enacted with trifling modifications by several mining states, is evidence of what a committee of engineers can do in such things.

Spanish-American Scholarships

Peace advocates are not all theorists. According to the *Evening Post* the peace committee of the Philadelphia yearly meeting of the Society of Friends (Quakers) is urging the foundation of university scholarships for the benefit of properly prepared Mexican students. They feel that friendly relations will be stimulated by facilitating the acquisition of an education on American soil with American surroundings. Haverford College has already responded by offering two such scholarships.

This is constructive peace work that may well be imitated by our mining schools with relation to all the Spanish-American republics. The more residents of those lands who have acquired their education in this country, the more who have learned to know us as we really are, the less will be the feeling of distrust now so prevalent in some Spanish-American states.

Not only will this be good work from the point of view of peace for peace sake, but it will be good business from a broader point of view. Many of our mining schools are not overcrowded at the present time, their facilities are not being used to capacity; they could easily afford several scholarships at $200 to $500 without materially increasing their budgets, and the good that would result would be vastly in excess of the cost.

The popular slogan at the present time is, "Increase of of foreign commerce." We miners know that it has been the seeker of minerals and metals who has been the pioneer ever since the Western Hemisphere was discovered. He has gone into the wilderness where the railways, the farmers and bankers have followed him, and we know that if our people expand their mining interests in the southern republics, other commercial enterprises are bound to follow; and as these develop and are properly nurtured, the inducements to maintain peace and amicable relations must grow. We believe that engineering education acquired by foreigners in this country will be a means of stimulating friendly and business relations to a very marked degree.

The Boom in Copper Stocks

Last week saw the development of a real boom in copper stocks. During the six days ending with Nov. 19 Utah advanced 12 points to 130, Kennecott 8½ to 63½, Inspiration 7 to 74½, Chino 8 to 74, Granby 24 to 120, Ray 4 to 36½, Miami 7 to 48 and Chile 16 to 39. All these prices were the highest ever recorded. Anaconda was conspicuous by its moderation, its advance for the week being only about 6 points, its closing being about 105, a figure far below what its predecessor—Amalgamated—had realized in former years.

The violent advance in these stocks was based primarily upon general appreciation of the phenomenal position to which the copper companies had arrived. Starting from this, the public came into the market and bought recklessly, crazily. Intrinsic value was no consideration. People bought stocks simply because they thought they were going up. The motive for the mad advance on Nov. 18 was a rumor that there was to be a consolidation of Utah, Kennecott, Cerro de Pasco, Chile, Nevada and Inspiration. Why Chino and Ray should have been omitted and why Inspiration was included nobody stopped to think, nor was there any heed of what Washington might say of such a project. Consolidation rumors are the old baits, and never-failing ones, to appeal to speculative imagination. The market was in the hands of people intoxicated by the ecstacy of profits.

Many of the copper-producing companies have long been selling at less than their intrinsic value. Some of them are not yet selling for more than they are really worth. But a good many are now selling for far more than they are worth, giving them full credit for all that is to accrue to them from their sales of copper extending to the middle of 1917. However, nothing of this sort has received consideration. The keynote has been simply to buy anything. The denouement is, of course, inevitable. Some day the buying power will exhaust itself, the pools will have distributed their holdings, the public will have the stocks, and when the last buyers become tired and try to realize, the break will come. But in the meanwhile the gold inflation provides great buying power.

A curious thing about the recent rise in copper stocks has been the relative sluggishness of Anaconda, which up to about six weeks ago was historically the leader of the market. A broad swing without Anaconda heading the list was hardly conceivable. The present rise started with Anaconda and Utah both at about 90. Utah rose to 130, while Anaconda went only to 105. Comparing with the low points of 1914, Utah more than tripled in price, while Anaconda but little more than doubled.

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Some judges express the opinion that the rises both in copper metal and in copper stocks are approaching culmination. As to the metal, when producers have sold all they expect to turn out during the first half of 1917 and conversely consumers have bought all they expect to use, there must be a halt unless buying and selling extends generally into the second half of 1917; but there must be some time when ordinary prudence will check future commitments. As to the copper stocks, the rise was based on an appreciation of the great profits accruing to the producers. The sharp advances in copper added fillips to the imagination, but no longer do they amount to anything. If the producers have sold at 24@32c. all the copper they expect to produce up to the middle of 1917, it will not add anything to their income if speculators sell a few million pounds at 35c., or 45c., or 55c. It was therefore necessary to have some stronger medicine to keep the stock market going, wherefore on Nov. 18 there were circulated rumors of a big consolidation of copper companies. This looked much like administering strychnine to a tiring horse. Of course ideas of such a consolidation were all moonshine, but the rumors served their purpose.

BY THE WAY

"But Wall Street must have news. It feels that it must have some excuse, outside of general conditions, for putting prices up. If it cannot get news, it will take rumors." The witty writer of Wall St. Paragraphs in the *Evening Post* thus begins his comment on the copper consolidation rumor of last week, and continues: "There are the the copper stocks. Wall street long wondered why the copper stocks did not move. Their earnings were phenomenal. They were constantly increasing their dividend distributions. And when the coppers began to advance, the advance was at first attributed to the discounting of past and present earnings and dividends. But as the advance went further the old explanation was found unsatisfactory, unsuitable; and so rumors were spread around of future dividend increases and future orders. And these dividend increases and future orders came; there was placed with the copper companies of this country the largest single order they had ever received in their history; it was so great that it was equal to about one-quarter of their annual capacity; it was greater than even the most optimistic forecasts had believed it would be. The copper stocks took an upward leap. But the leap was not great; it was short-lived, and people began looking about for a further stimulus. They talked of higher prices for the metal. Even these came: the metal went to the highest price since electrolytic copper was invented. The copper stocks again began to soar. This time their gains were greater and more sudden than ever before. Some parts of Wall Street could not see how the record price for the metal could be causing this. And so merger rumors were started. The beauty of a merger rumor is the element of mystery. If you hear that the earnings of the So-and-So copper corporation have increased so much, you know just about what that will mean to the price. But you really do not know exactly what a given merger will mean to the value of a security. Hence there is a glamour about it. You hear of a merger of copper companies with mines spread all over the country. You cannot see how that will effect any economies in production. You cannot see how that will lead to any increase in efficiency. You can see that if the merger is large enough it may be able to exercise greater control over the output, and hence the price of the metal; but you would naturally imagine that if the merger were big enough to do that, it would be big enough for the Department of Justice to call a halt."

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Quantitative Microscopy

In copper refineries it has for some time been a custom to determine the copper oxide in refined copper by making photomicrographs, weighing the same, cutting out the portions showing oxide, and weighing again. This gives the relative areas of the oxide and nonoxide portions. Quantitative photomicrography is a new art of the analyst that promises much usefulness.

In the *Journal* of the American Chemical Society, 1916, XXXVIII, 1647-58, F. E. Wright states that it is possible with the aid of the petrographic microscope to measure readily and with sufficient accuracy the optical constants of crystal grains measuring only 0.01 mm. in diameter. He discusses briefly the application of the instrument to chemical problems. It is possible, for example, to identify any one of the pentose- and hexose-osazones by means of their optical constants, even though only a few miligrams of substance is available. In the identification of alkaloids also, where chemical methods are unsatisfactory or difficult to apply, the petrographic microscope should prove of value. Other applications mentioned include the examination of baking and cleaning powders, abrasives, paints, fertilizers, cements, drugs, sugars, salt and photographic developers.

At a recent meeting of the Society of Public Analysts, in London, T. E. Wallis said that quantitative results based on microscopical work have hitherto failed to obtain recognition such as is accorded to similar results based upon chemical processes. By adopting the procedure outlined below, a high degree of precision can be given to quantitative work with the microscope, which has a unique value in those instances where chemical methods are inapplicable. Equal weights of the material under investigation and of a standard mixture for comparison are mixed separately with similar weighed quantities of lycopodium spores. The mixed powders are suspended in a suitable fluid, and two slides are prepared from each suspension. Ten fields, selected according to a prearranged plan, are counted on each slide, and the average ratio of the number of particles of substance to be determined, to the number of lycopodium spores present, is found, and reduced in each case to the number corresponding to 100 lycopodium spores. The figures so obtained are proportional to the quantities of material present in the substance and in the standard mixture respectively. A simple calculation gives the quantity sought. The accuracy and utility of the method were shown by experiments with typical mixtures, including wheat flour, potato starch and mustard, each mixed with corn flour; wheat flour containing potato starch; white pepper adulterated with ginger and with rice starch; and gentian root with added cocoanut shell.

This suggests the applicability of a similar method to the examination of milling and metallurgical [illegible]

Personals

Herbert I. Ellis is at Kellogg, Idaho.

G. R. De Beque is at Frawley, Colo.

Walter Neal has changed his address from Hall, Mont., to 1553 Haward Ave., Salt Lake City.

J. R. Finlay has gone to Arizona on professional business, expecting to be absent about three weeks.

H. C. Bellinger has been appointed general manager at Chuquicamata for the Chile Exploration Co.

S. B. Williamson will have charge of construction for the Chile Exploration Co. at Chuquicamata, Chile.

F. R. Weekes has returned to New York from a trip to British Columbia and California on examination work.

I. L. Merrill, of Los Angeles, Calif., president of the Hedley Gold Mining Co., has been visiting the Nickel Plate mine at Hedley.

W. H. Wright, of the Malm-Wolf Co., Denver, examined mining property near Silver Plume, Colo., last week.

W. A. Williams, superintendent of Granby smeltery at Grand Forks, spent a few days in the Nicola Valley looking at mining properties.

Frank G. Berton, gold recorder of the Yukon Territory, has resigned his position to enlist for service overseas with the Canadian Engineer corps.

George N. Short has been placed in charge of the new office of the Grasselli Chemical Co., recently opened at 1108 Newhouse Bldg., Salt Lake City.

George L. Holmes, consulting engineer, of San Francisco, is making a map of the Angels Camp district, California, for the Angels Camp Deep Mining Co.

Henry Hay, assistant general manager for the Chile Exploration Co., at Chuquicamata, was so badly injured while in an ore bin that one leg had to be amputated.

Col. Thomas Cantley, president of the Nova Scotia Steel and Coal Co., has gone to England in connection with important new developments in the plans of the company.

Frank G. Stevens, a graduate of the Kingston School of Mines, who has had a lengthy experience in Mexico and British Columbia, has been appointed managing engineer of the Davidson mine, Porcupine.

Charles E. Mills, general manager of the Inspiration Copper Co., has been made president of the Cananea Consolidated Copper Co. to succeed Dr. L. D. Ricketts, who will maintain his office in New York in the future.

Reginald W. Petre, mining engineer of Baltimore, has just completed an examination of the Newray mine on behalf of American capitalists and is investigating the mining conditions and methods of treatment of the ores of the Porcupine camp.

W. Earl Greenough, for 5 years manager of the Marsh Mining Co., Cœur d'Alene district, Idaho, resigned his position with that company on Oct. 1 to engage in independent practice, and has opened offices in the Old National Bank Building, Spokane, Wash. He will be assisted by S. B. Davis, formerly of Wallace, Idaho.

Dr. John Sharshall Grasty, formerly associate professor of geology at the University of Virginia, has resigned to take charge of the new department of mining geology recently established at Washington and Lee University. Dr. Albert William Giles has been appointed adjunct professor of geology in the University of Virginia.

R. P. Burgan, of Duluth, president of the Cananea Mining Co., the Carnegie Lead and Zinc corporations holding company in Mexico; C. J. Zachnane, treasurer, and directors D. F Helm, A. W. Schruber, J. E. Cooley, V. Pridert, J. L. Crawford, S. W. Semman and W. J. Burgan visited and inspected the property at Cananea, Sonora, this week.

Obituary

Hon. David MacKeen, lieutenant governor of Nova Scotia, died at his summer residence, Maplewood, N. S., on the 13th inst. as the result of a paralytic stroke at the age of seventy-seven. He took a prominent part in the development of the coal and steel industries of Nova Scotia. He was born at Mabou, N. S., and was the son of Hon. William MacKeen, a member of the Provincial Legislative Council. Entering the service of the Caledonia Coal and Railway Co. early in life he acquired a thorough knowledge of the coal-mining industry and became agent and treasurer of the company and ultimately its principal owner. The company was absorbed by the Dominion Coal Co. in 1893 and Mr. MacKeen was appointed general manager, resigning that position in 1896. He was also largely interested in the Dominion Iron and Steel Co., which he assisted in establishing. He was a director of the Dominion Steel Corporation and of several financial companies. In 1887 Mr. MacKeen was elected to the Canadian House of Commons in the Conservative interest as member for Cape Breton County and in 1896 was appointed a senator. He became lieutenant governor of Nova Scotia in October, 1915. A widow and four children survive him.

Societies

Society of Chemical Industry—The next meeting of the New York section will be held at Runford Hall, 50 East 41st St., New York, on Friday evening, Nov. 24. The program will include an address on "The Importance of Impurities," by Jerome Alexander, the chairman, and one on "Some Present-Day Technochemical Problems," by R. F. Bacon, of the Mellon Institute.

American Institute of Mining Engineers—New York section will hold its first meeting of the fall season on Nov. 27, at the Machinery Club. At this meeting Edgar Rickard, who was one of the honorary secretaries of the Commission for Relief in Belgium at the headquarters in London for two years and who is now assistant director in America, will tell us about the work of American engineers in Belgium. Ladies are invited to attend this meeting.

American Institute of Mining Engineers, Utah Section—The postponed annual meeting of the Utah Section of the American Institute of Mining Engineers has been arranged to take place in Salt Lake City on Saturday, Dec. 16, 1916. At a later date a notice will be mailed to all members giving further particulars of the December meeting, including a list of papers to be read. C. W. Stimpson has been appointed to arrange for entertainment, and arrangements for the use of the inclosed roof garden at the Hotel Utah for the evening have also been made. C. W. Whitley, chairman, is arranging for two papers to be read that will be on live issues, and of vital interest. Ernest Gayford is secretary of the Utah local section.

Trade Catalogs

"Clipper" Rock Drills. The Denver Rock Drill Manufacturing Co., Denver, Colo. Pp. 16. 6x9 in. Illustrated.

"Spraco" Paint Gun. Spray Engineering Co., 93 Federal St., Boston, Mass. Booklet. Pp. 13. 3½x6 in. Illustrated.

"Churn-Drill Prospecting at Morenci, Ariz." Armstrong Manufacturing Co., Waterloo, Iowa. Bulletin No. C. D. 2. Pp. 16. 6x9 in. Illustrated. This is a reprint of an article by Wm. R. Grunow, which appeared in the June 3d issue of the "Journal."

New Patents

United States patent specifications listed below may be obtained from "The Engineering and Mining Journal" at 25c. each. British patents are supplied at 40c. each.

Agitating Machine. Willett H. Barton, Sam Diego, Calif. (U. S. No. 1,204,733; Nov. 14, 1916.)

Alloy—Metal Alloy Containing Metals of Nickel Group. Theodore B. Brix, Newark, N. J., assignor, by mesne assignments, to American Alloys Co., Newark, N. J. (U. S. Nos. 1,203,180 and 1,203,555; Oct. 31, 1916.)

Alloy of Lead, Antimony and Phosphorus. John T. Dwyer St. Louis, Mo. (U. S. No. 1,203,991; Nov. 7, 1916.)

Crushing—Tube Mill. Johan S. Fasting, Fredericksberg, near Copenhagen, Denmark, assignor to F. L. Smidth & Co., New York, N. Y. (U. S. No. 1,204,554; Nov. 14, 1916.)

Dehydrater. Cyrus Robinson, Mount Vernon, N. Y., assignor to Metallurgical Engineering and Process Corporation. (U. S. No. 1,204,070; Nov. 7, 1916.)

Drill—Rock Drill. William A. Smith, Denver, Colo., assignor to the Denver Rock Drill Manufacturing Co., Denver, Colo. (U. S. No. 1,204,708; Nov. 14, 1916.)

Electric-Arc Furnace. Carl Olaf Andersen Dovle, Notodden, Norway, assignor to Norsk Hydro-Elektrisk Kvaelstofaktieselskab, Christiania, Norway. (U. S. No. 1,204,349; Nov. 7, 1916.)

Electric Furnace. Ernest Kilburn Scott, Belvedere, England, assignor to Atmospheric Nitrates (Kilburn Scott Patents), Ltd., Manchester, England. (U. S. No. 1,203,276; Oct. 31, 1916.)

Electrolysis—Apparatus for the Electrolytic Manufacture of Light Metals and Reaction Products Thereof. Edgar Arthur Ashcroft, London, England. (U. S. No. 1,204,234; Nov. 7, 1916.)

Flotation—Concentration of Ores. Fleury James Lyster, Broken Hill, N. S. W., assignor, by mesne assignments to Minerals Separation American Syndicate (1913), Ltd., London, England. (U. S. Nos. 1,203,373, 1,203,374 and 1,203,375; Oct. 31, 1916.)

Fuel—Pulverized-Coal-Feeding Apparatus. La Rue B. Chevalier, Iola, Kan. (U. S. 1,203,703; Nov. 7, 1916.)

Gases—Means for Producing Discharge of Electricity Into Gases. Walter August Schmidt, Los Angeles, Calif., assignor to International Precipitation Co., Los Angeles, Calif. (U. S. No. 1,204,907; Nov. 14, 1916.)

Gases—Method and Means for Recovering Certain Constituents from Gaseous Bodies. Walter August Schmidt, Los Angeles, Calif., and Linn Bradley, East Orange, N. J., assignors to Research Corporation, New York, N. Y. (U. S. No. 1,204,906; Nov. 14, 1916.)

Ingot Mold. Charles W. Greene, Pittsburgh, Penn.; Helen Greene, administratrix of said Charles W. Greene, deceased. (U. S. No. 1,204,270; Nov. 7, 1916.)

Leaching—Chemical Concentration of Ore Values. Charles S. Bradley, New York, N. Y. (U. S. No. 1,204,932; Nov. 14, 1916.)

Loading and Conveying Apparatus for Use in Mines. Robert P. Greenleaf, Cleveland, Ohio, assignor to Frank Billings, Cleveland, Ohio. (U. S. No. 1,204,760; Nov. 14, 1916.)

Locomotive—Electric Locomotive. John H. Flory, Columbus, Ohio, assignor to Jeffrey Manufacturing Co., Columbus, Ohio. (U. S. No. 1,203,999; Nov. 7, 1916.)

Mine-Car Body. Edwin E. Slick, Westmont Borough, Penn. (U. S. No. 1,203,801; Nov. 7, 1916.)

Mine-Car Wheel. Edwin E. Slick, Westmont Borough, Penn. (U. S. No. 1,203,800; Nov. 7, 1916.)

Percussive Tools—Water-Head for Fluid-Operated Percussive Tools. Lewis C. Bayles and Albert H. Taylor, Easton, Penn., assignors to Ingersoll-Rand Co., Jersey City, N. J. (U. S. No. 1,201,676; Oct. 17, 1916.)

Phosphate Rock—Treatment of Phosphate Rock. Earl S. Bishop, Pittsburgh, Penn., assignor to Armour Fertilizer Works, Chicago, Ill. (U. S. No. 1,204,238; Nov. 7, 1916.)

Refining—Process for Treating Copper. Frank L. Antisell, Perth Amboy, N. J. (U. S. Nos. 1,204,926 and 1,204,927; Nov. 14, 1916.)

Refractory—Silicon-Carbid Refractory Article. Frank J. Tone, Niagara Falls, N. Y., assignor to the Carborundum Co., Niagara Falls, N. Y. (U. S. No. 1,204,211; Nov. 7, 1916.)

Refractory Materials, Process for Making. Charles B. Stowe, Lakewood, Ohio. (U. S. No. 1,205,056; Nov. 14, 1916.)

Tin—Detinning Tin Scrap. Walter J. Phelps, Baltimore, Md., assignor to Phelps Can Co., Weirton, W. Va. (U. S. No. 1,202,886; Oct 31, 1916.)

Titanic Oxide—Method of Obtaining Titanic Oxide. Louis E. Barton, Niagara Falls, N. Y., assignor to the Titanium Alloy Manufacturing Co., New York, N. Y. (U. S. No. 1,201,541; Oct. 17, 1916.)

Wire Rope—Nonrotating Wire Rope. Noble C. Harrison, Trenton, N. J., assignor to John A. Roebling's Sons Co. (U. S. No. 1,201,290; Oct. 17, 1916.)

Assessments

Company	Delinq.	Sale	Amt.
Buffalo, Ida	Nov. 15	Dec. 12	$0.005
Challenge, Nev	Nov. 29	Dec. 20	0.05
Christmas, Utah	Nov. 20	Dec. 16	0.005
Confidence Silver, Nev	Nov. 8	Nov. 29	0.10
Con. Virginia, Nev	Dec. 8	Dec 29	0.05
Cottonwood King, Utah	Nov. 14	Dec. 1	0.005
Cunapah, Utah	Nov. 8	Nov. 25	0.01
Emerald, Utah	Nov. 15	Dec. 9	0.00½
Exchequer, Nev	Dec. 5	Dec. 27	0.03
Federal Ely, Nev	Dec. 2	Dec. 20	0.005
Four Timbers, Ida	Dec. 2	Jan. 2	0.002
Friend, Ida	Oct. 21	Nov. 24	0.002
Hale and Norcross, Nev	Nov. 8	Nov. 29	0.03
Idaho & L. A., Ida	Oct. 16	Nov. 17	0.005
Idaho Mont, Ida	Oct. 30	Nov. 18	0.002
Idaho-Nevada, Idaho	Nov. 15	Dec. 16	0.002
Idora, Ida	Nov. 24	Dec. 23	0.005
Lehi Tintic, Utah	Nov. 8	Dec. 2	0.0025
LeRoy, Ida	Oct. 28	Nov. 28	0.005
Lion Gold, Utah	Nov. 13	Dec. 5	0.0025
Mary Ellen, Utah	Nov. 11	Nov. 28	0.001
Mexican G. & S., Nev	Nov. 25	Dec. 18	0.10
Military, Ida	Oct. 25	Nov. 25	0.00025
Mines Dev., Utah	Nov. 17	Dec. 7	0.30
Monarch-Pgh., Nev	Oct. 23	Nov. 27	0.01
Naildriver, Utah	Nov. 4	Dec. 4	0.01
National Lead, Ida	Nov. 25	Dec. 26	0.001
Nevada-Stewart, Ida	Nov. 14	Dec. 2	0.002
New Hope, Ida	Oct. 11	Dec. 11	0.002
Nonpareil, Ida	Oct. 23	Nov. 23	0.001
North Franklin, Ida	June 19	Nov. 23	0.005
North Star, Ida	Oct. 10	Dec. 5	0.001
Paloma, Utah	......	......	0.015
Pittsburgh Cons., Utah	Nov. 17	Dec. 8	0.0175
Rico-Argentine, Colo	Nov. 18	Dec. 5	0.01
Seg. Belcher & Midas, Nev.	Oct. 30	Nov. 24	0.02
Selma, Utah	Nov. 4	Nov. 23	0.005
Silver Moon, Ida	Nov. 25	Dec. 23	0.005
Silver Mt., Ida	Oct. 21	Nov. 24	0.002
Sonora, Ida	Nov. 15	Dec. 6	0.004
Tobar, Nev	Nov. 2	Nov. 23	0.002
United Tintic, Utah	Nov. 11	Nov. 28	0.005
Utah Arizona, Ariz	Oct. 31	Nov. 25	0.005
Utah United, Utah	Nov. 15	Dec. 4	0.01
Wallace M., M & R., Ida	Dec. 8	Jan. 8	0.0025
Zuma, Utah	Oct. 30	Nov. 30	0.005

The publication of this table will be discontinued after Dec. 30, 1916.

Editorial Correspondence

SAN FRANCISCO—Nov. 15

Miners in Amador County Are Returning to work, following the ending of the labor strike. Many left the county as soon as the strike was declared, as they were not engaged in the demand for increased pay. Some of the foreigners who voted for and conducted the strike, but declined to favor the return to work, have now left the county. It is believed all the mines will be working full handed within another month.

The Blue Sky Law in California has been in operation since Jan. 1, 1915, and the commissioner of corporations has filed what he calls his first biennial report, covering 20 months to Sept. 1, 1916. The commissioner offers the assurance that "the operation of the Investment Companies Act has clearly demonstrated the expediency of its passage and necessity of its continuance." Evidently the purpose of filing this report on Oct. 28, 2 months prior to the close of the biennial period, was to acquaint the voters of the state with the performances of the commissioner and to encourage supporters of the administration at the polls. Nobody questions that the department of corporations has accomplished a great deal of good; neither is there any question that a good deal of hardship has been worked upon a number of small operators, especially in the mining field. Other departments created or reorganized by the Johnson administration have likewise accomplished some benefit to the people, but some of them have become so expensive that they may be classed as luxuries. An utterly useless department or bureau could not survive, so it is necessary to accomplish some good in order to be maintained. The department of corporations supplies the press of the state with regular reports of the doings of the department. Some of these items regarding the mining industry are of value for publication, but many of them are incomplete and wholly useless. In the 20 months covered by the report, the commissioner has authorized the issue by 1,970 corporations of an aggregate of 82,781,439 shares of stock at an authorized aggregate selling price of $246,353,759, and the sale by 93 companies of bonds of a total face value of $59,699,400. Approximately 120 companies, having an aggregate authorized capital stock of $53,000,000, and proposing to sell $23,000,000 of their securities, were either denied authority or they abandoned their application, because of failing to furnish necessary information or to comply with required conditions. There were 304 permits issued that were subsequently revoked. Some of these revocations were due to the completion of the financing of the corporation and withdrawal of the securities from the market; others because the business was being conducted in a manner perilous to the interests of investors. No appeals from the rulings of the commissioner have been taken to the courts. It is pointed out that 312 mining and oil companies have been permitted to offer more than $78,000,000 of their securities for sale. The expense of maintaining the department was $57,755 for the 20 months.

DENVER—Nov. 16

Modoc Mine at Victor, in the Cripple Creek district, has passed to new ownership. Since 1892 this mine has been owned and operated by a close corporation, consisting of members of the Frankenburg family, of Pueblo. It was recently purchased by a group of Denver men, incorporated as the Modoc Consolidated Mines Co. with James Grafton Rogers, an attorney, as president. This mine's production has always been kept secret. It was famous 20 years or more ago for its rich shipments, one carload lot shipped to Pueblo being reported as worth $40,000. Sinking the main shaft a further depth of 500 ft. from the 1,000 level is proposed.

Coal Miners' Wages Advanced in the northern Colorado coal field, particularly in Boulder County, on Nov. 16. All company men, paid by the day, will receive 5% more than heretofore, while miners working on contract will receive an additional 3c. per ton. Under this new schedule, outside men with the exception of hoisting engineers will receive $2.94 per 8 hr., while these engineers will be paid $3.46½ per shift. Contractors will receive 66c. per ton for coal broken and loaded into cars. These prices and wages are slightly higher than those prevailing in the bituminous fields of the southern part of the state. Throughout Colorado, advances have been made in the prices for coal to dealers and consumers, varying from 50c. per ton for lignite to $1 per ton for anthracite.

Colorado Power Co.'s Tunnel and power plant at Shoshone, a few miles above Glenwood Springs, were seriously damaged during the night of Nov. 7 by an incipient earthquake or fault. This wrecked part of the tunnel paralleling the Grand River and conveying water from the dam to the power house 2 mi. downstream. The tunnel was driven through solid rock the entire distance and finished with a thick concrete lining. The company supplies power to many mining companies throughout central Colorado and to the Denver public utilities. Some inconvenience is being experienced because of this seemingly improbable phenomenon but power is being supplied at maximum capacities from the company's hydro-electric plant at Magnolia, in Boulder County, and its steam plant at Leadville, as well as from the Denver Gas and Electric Co.'s steam plant in Denver. A big force of men is employed making such repairs at Shoshone as are expected to enable the plant to resume within the next two weeks. By way of preparedness, the Denver company has ordered a 12,500-kw. steam turbine to be installed in its West Side station.

Empire Zinc Co. is carrying on extensive work at Leadville, principally in the nature of unwatering, reopening and repairing old mines on Carbonate Hill. At the Robert Emmet mine, Superintendent Bargler is repairing the main shaft and enlarging the main drifts therefrom, this mine having been completely drained by the pumping operations in the neighboring Wolftone and Greenback mines which, though not owned or controlled by the Empire company, have been coöperating in the recent drainage project. The Emmet workings could now be carried several hundred feet deeper, it is claimed, without encountering water. New drifts are being pushed in the McCormick to intercept known orebodies and old drifts are being enlarged ond retimbered. Although no effort has thus far been made to ship any specially heavy tonnage, shipments are being maintained and every arrangement is being provided to assure a large production in the near future. A new railroad spur is being laid to the McCormick shaft-house.

LEADVILLE, COLO.—Nov. 16

Leadville's Ore Production continues to grow steadily, due to the entrance of the Penrose, Tip Top, Cloud City and other properties into the shipping list. During October, 80,600 tons of ore of various grades and widely differing content were sent to the smelters. The 100,000-ton mark is expected to be reached when the Empire Zinc Co., the Mikado and the Greenback begin shipments.

Copper-Ore Shipments from Leadville are forming part of the regular output of the Little Jonny and other mines on Breece Hill, controlled by the Ibex Mining Co. Several hundred tons of copper ore, carrying from 6 to 14% copper, are being shipped monthly. Some large specimens of native copper have been extracted. Indications point to more copper shipments, owing to the high copper market.

BUTTE—Nov. 16

More Water Power for Montana Mines will soon be available. Just now attention is being directed to the Montana Power Co.'s latest project, known as the Wolf Creek plant, situated on the Missouri River, 60 mi. above Great Falls. Its cost is estimated at $3,500,000, and when completed it will furnish approximately 66,000 hp. Power is expected to be available by next July. The new plant will materially help in the development of Montana's mineral resources and other industries awaiting the advent of cheap power.

Anaconda Operations Were Closed for a day or two by the sudden advent of winter at the beginning of the week, with temperatures ranging between —10° and —20°. Operations at Butte, Anaconda and Great Falls were unprepared to cope with the effects of such a violent temperature drop. As a result the Anaconda Copper Mining Co. and other concerns were forced to close most of the Butte mines for periods of from 24 to 36 hr., the ore in the bins freezing too hard to be successfully handled. Altogether, more than 10,000 men were affected by the weather conditions, losing from two to three shifts a man, while the loss to the companies will amount to many thousands of dollars. Not for 13 years was Butte and vicinity visited by so early zero weather, which accounts for the fact that the thawing rooms were not in readiness, nor extra supply of ores on hand for such an emergency. Stoppage of operations will curtail monthly output about 1,500,000 lb. Work was resumed on Wednesday at most of the mines and works.

SALT LAKE CITY—Nov. 16

A Six Weeks' Course in Mining for prospectors, miners and business men is proposed by the University of Utah for the coming winter. The course will offer instruction in the fundamentals of mining, as well as some of the theory underlying mining practice.

Net Proceeds of Utah Mines for 1916—as figured by the state board of equalization—will amount to $21,825,609. In 1915 net proceeds were $8,119,195 and in 1914 these were $9,663,186. Figures by the board show the output of the year as coming from 12 counties, with Salt Lake County in the lead, Summit County second, Carbon County third and Juab County fourth.

Tintic Shipments in nine months ended Sept. 30 amounted to approximately 365,150 tons of ore. Few districts in the country have as many producers and dividend payers. From present outlook Tintic output for 1916 will be heaviest in history. Principal shippers are: Chief Consolidated, Dragon Consolidated, Iron Blossom, Centennial-Eureka, Eagle & Blue Bell, Mammoth, Gemini, and Grand Central. Altogether 50 mines made shipments.

Utah Power and Light Co., which furnishes electricity to mining and smelting interests in this section, is increasing its capitalization from $15,000,000 to $60,000,000, according to a notice filed Nov. 6 with the secretary of state. Extensive development already accomplished and plans for future expansion are responsible for the increase. Extensions will be made to furnish power for railroads. The company has in view electrification of the road to Saltair and of the Bingham & Garfield Ry. Further use of electricity at the Utah Copper mine is being considered.

Daly-Judge Co., of Park City, has now completely given way to the Judge Mining and Smelting Co. Shares of the new company were listed on the Salt Lake Stock and Mining Exchange, Nov. 11, in place of the former Daly-Judge. The official statement filed at the time of listing shows that there are 500,000 shares of $1 par value. There are 20,000 shares in the treasury and $825,000 cash. The only debts are current expenses. The company owns 150 patented claims amounting to about 2,000 acres, about 1½ mi. from a railroad and situated in the Snake Creek district, Uinta County and Big Cottonwood. Development consists of 1,650 ft. of shaft and 30 mi. of underground workings. The property is equipped with modern electric hoist, a 450-ton concentrator, and has an electrolytic-zinc plant nearing completion. The capacity of this plant will be 15 tons of spelter per day. Shipments average about 500 tons a week, of ore carrying silver, lead, zinc, gold and copper. There are 350 men employed. H. Otto Hanke is president, and G. W. Lambourne, secretary-treasurer.

SPOKANE—Nov. 14

The Day Holdings in Hercules Mine have lately been increased through the purchase by Mrs. Eleanor Day Boyce, of Portland, Ore., of the sixteenth interest in the property formerly held by the estate of the late Damian Cardoner, of Barcelona, Spain. With the exception of August Paulsen, of Spokane, Mrs. Boyce becomes the largest individual owner in the Hercules mine, her interest now being slightly less than one-quarter, while the Paulsen interest is a fraction over one-quarter. The aggregate interests of the Days in the Hercules mine now amount to $^{33}/_{64}$, or slightly more than a half interest. The consideration named in the recent deed, which bears date of Oct. 28, is $1, but it is believed that the price actually paid for this controlling fraction was $500,000. The $^{1}/_{16}$ interest conveyed by deed is the interest left in the estate of Cardoner and was appraised in probate court at $250,000. This interest was distributed to Mathilde Cardoner, widow, and the deed is made by her to Mrs. Boyce. Other Day holdings are reported to be $^{3}/_{32}$ each for Harry L., Jerome J. and Eugene R. Day, while Blanche Day Ellis, a sister, holds $^{1}/_{64}$ interest.

PHŒNIX, ARIZ.—Nov. 15

Jerome Verde Contact Copper Co. is ordered by State Corporation Commission to refund all money collected for pre-organization stock; also to report all stock sales and copies of letters soliciting same. In one week 20 mining companies filed articles of incorporation and 10 investment companies were given permits to sell stock.

MORENCI, ARIZ.—Nov. 16

Work Resumed at Arizona Copper Co.'s properties on Nov. 15 by striking employees. After losing 11 days' work, pulling switches, letting the company's concentrator and smeltery close, beating up a couple of men, and running them out of town, the strikers decided it was not a good business policy to forfeit five or six thousand dollars a day in an effort to collect $15, which latter is the sum Juan, or Jose, was demanding for the time he was laid off. Just how the agreement was brought about has not been learned. Mr. Myers, of the department of labor, has been in Clifton the last few days, and it is possible he had something to do with the [illegible]. On the night of Nov. 12 the [illegible] concentrator had a narrow escape from [illegible] by fire of an incendiary origin.

MOGOLLON, N. M.—Nov. 14

A Drainage and Transportation Tunnel, on Mineral Creek, which will eventually tap the leading vein systems of the camp at various depths up to 1,800 ft., is about to be started by the Oaks Co. The road to the tunnel site has been overhauled to facilitate traffic to that point. The road through Mogollon is also being macadamized and put in shape for winter traffic, though this has no connection with the drainage-tunnel project.

Pacific Mine's Aërial Tramway to the Socorro mill, 1 mi. distant, has just been completed, tested and found to operate perfectly. The adoption and placing in commission of this system of transporting the Pacific product marks the end of an era of operation during which 11,162 tons of ore carrying a gross value of $171,585 were mined in a crude way and shipped to local custom mills by burro train. While the general average of ore mined in the Mogollon district for the period has been around $12 per ton, that from the Pacific had an average of $15.37, and with the more adequate mining facilities now employed, in connection with modern tramway delivery to mill, the property may be expected to soon eclipse its past record and take rank with the best producers in the camp. Operations at the Pacific mine are being conducted by Socorro Mining and Milling Co., under agreement with the Oaks Co.

JOPLIN—Nov. 18

Settlement of Henryetta Labor Troubles is reported. The trouble at the Oklahoma smelteries was caused when announcement of a cut in wages was made. Workers decided to strike rather than accept cut, and did so. Then price of spelter went up and smelters decided they could afford to pay the bonus and offered to do so and employees went back to work. During the past week gas-fired smelteries suffered from weak-gas pressure, and a slightly decreased demand from them for zinc ore was recorded as result. Work is being pushed on construction operations of C. T. Orr smeltery, to be known as the Athletic, at Fort Smith, Ark. City is laying temporary pipe line to site to furnish water for building purposes, permanent main to be laid later.

Continued Curtailed Output during the past week must be reported from this district, due to insufficient electric current and to weak gas pressure. The later was caused by the unseasonably severe cold wave the first of the week, creating an unexpected demand for gas for heating purposes. At a number of properties where gas is depended upon entirely for fuel, it was necessary to shut down for a day, and at some places for two days. The electric company is still unable to meet the demands for current, as recent rains have not been sufficient to raise the water in Spring River, nor at the Lake Taneycomo dam, so full service from water-operated turbines can be received. Most of the electrically operated mills are permitted to run only at night, and as most of them would, with present prices, be operating night and day, it means a considerable curtailment in the ore output.

HOUGHTON, MICH.—Nov. 15

Labor Situation in the Lake Superior district has cleared itself in a remarkable manner. The number of men employed increases steadily now that winter is ahead and the men are doing more work. That applies particularly to contract mining and tramming, where the pay is remarkably high. Ten years ago there was a plan on foot to do away entirely with contract mining—the old Cornish mining system that came to the Lake Superior district with the first copper miners. Some of the mines applied nothing but the plain day-wage system to all miners. But in recent years more and more of the mines have changed back to the contract system. When the Calumet & Hecla took over the Fay mines and the Bigelow mines it instituted the contract system, always popular in the Calumet & Hecla. And it has resulted in greater efficiency. At the present time the men are making extremely high wages. Miners that are able to get better than $200 a month are not so exceptional as formerly. This is not the average, of course, but there is hardly a contract miner in the district who is not averaging better than $5 a shift at present. Of course the contract men are the best men. And they work all the time and know their business. They are the pick of the miners. Contract tramming, at first laughed at as a joke, is becoming more and more in vogue. And it is resulting in a much larger haulage than was ever considered possible. Not only that, but the men are making a great deal more money than was possible on the flat scale. One gang of trammers averaged $4.85 per shift per man last month. Combining the greater efficiency of the men, the application of brains as well as strong backs to tramming, with the steadily increasing number of underground employees, the mines are likely to surpass their best records for rock and copper outputs in November and December.

WASHINGTON, D. C.—Nov. 20

Reduction in Mexican Taxes on mines is reported unofficially in an interview with Luis Cabrera, acting in his capacity as secretary of the treasury for the Carranza government. He is quoted as saying that "tax on mined gold and silver ore will be reduced from 10% to 7% and on bullion from 8% to 5%." A schedule of taxes acceptable to the foreign mining companies has been prepared and submitted to Señor Cabrera, who is anxious to provide conditions that will restore the mining industry to its former activity.

TORONTO—Nov. 18

Sudbury Nickel on "Deutschland" is the claim of the Providence "Journal." Members of both the Federal and Provincial governments are disposed to be extremely reticent as to that paper's statement that the nickel which forms a portion of the return cargo of the "Deutschland" is the product of the Sudbury mines. Beyond a repetition of the assertion that the precautions taken with the approval of the British government render it impossible for Canadian nickel to fall into German hands, they have nothing to say on the matter. The Ottawa government has ordered an investigation. It is stated that no official statement on the matter can be made without the sanction of the British government..

Returns of Metalliferous Mines and Works of the Province of Ontario for the nine months ended Sept. 30 are interesting for the comparison with the preceding year's value. The nine months of 1916 showed an output of a total value of $46,396,263 as compared with $26,751,288 for the corresponding period of the previous year. This increase is more apparent than real as it is partly made up by putting a value of 25c. a lb. on nickel in matte instead of 11c. as formerly. Had the same price been applied to 1915, the total for that period would have been $34,228,752. The real increase is however gratifying, and the returns for the full year should be proportionately greater, as many of the mines have been increasing their capacity. Cobalt and nickel, both oxides and metallic, show considerable increases but do not represent any large proportion of the total values. Copper shows an increase of about $4,000,000 in value and gold shows an increase of about $2,000,000. Nickel due partly to a natural increase in production and partly to the new basis of valuation shows an increase from $5,370,000 to $15,500,000. While the production of silver shows a decrease of about 1,000,000 oz., the value due to higher prices shows an increase of $1,750,000.

The Mining News

ALASKA

ALASKA MEXICAN (Treadwell)—In September, mill ran 17 days; crushed 10,780 tons, yielding $16,380, or $1.53 per ton; operating expenses, $12,260; operating profit, $4,119; construction, $3,109; net profit, $1,009; estimated net value, $26,034.

ALASKA UNITED (Treadwell)—In September, both mills ran practically full time, Ready Bullion mill crushed 23,394 tons, 700-Ft. Claim mill 24,675, average yield, $1.70 and $1.90 per ton respectively; net realization, $39,346 and $46,334; operating expenses, $35,975 and $63,336. Ready Bullion operating profit, $3,370; construction expense, $15,710; net loss, $12,339. Operating expense, 700-Ft. Claim mill, $63,336; loss, $17,002; construction, $5,919; net loss, $22,921.

ALASKA-JUNEAU (Juneau)—Good progress is being made with the new mill. There is neither a screen nor an elevator in it. There will be a minimum capacity of 8,000 tons, a probable capacity of 10,000 tons and a maximum capacity of 12,000 tons per day, all depending upon the output of the "ball mills." The management expects that the operating costs will be astonishingly low, consisting principally of tramming and milling, as the caving system laid out is already so successfully working that the mine is about ready to supply the mill to its maximum capacity. The mill building proper is now all under cover and about half of the interior machinery has been delivered. It is expected that the first unit of the mill will be ready by next March.

ALASKA-TREADWELL (Treadwell)—The proposed consolidation is now up to the stockholders, who are scattered in large numbers all over Europe. It is going to require considerable time to work the matter out, for the consent of 51% of the Treadwell stockholders has to be obtained to begin with; in the meanwhile, the management is going right ahead doing everything that should be done for the common good on the consolidation ratio of 54, 34 and 12%, as recommended by the consolidation committee. In September, 150 stamps were operated, crushing 24,794 tons, averaging $2.19 per ton—$13,154 in free gold and $41,095 in concentrates; net realization, $53,706; operating expenses, $31,139; construction, $11,780; net operating profit, $10,786; estimated net value copper plates, $42,289; other income, $11,281.

ARIZONA

Gila County

MEMBERS BRADEN MILL STAFF, including Supt. Horace Graham and Messrs. Rutherford, Rain and Moran have been in Miami studying milling operations of Inspiration and Miami companies.

Greenlee County

SHANNON (Clifton)—October copper production about 757,000 lb.

ARIZONA COPPER (Clifton)—October production, 2,450 short tons of copper.

Mohave County

IVANHOE (Oatman) — Unwatering; will resume operations on 500-ft. level soon.

OATMAN UNITED (Oatman)—Working shaft 150 ft. deep. New compressor now in use.

UNITED NORTHERN (Oatman)—Wide vein, carrying fair gold content, cut on 400-ft. level.

OATMAN CRESCENT (Oatman)—Main adit now in about 500 ft. Manager George Pierce expects to cut vein in few days.

CARTER (Oatman)—Chicago men will take block of 350,000 shares for $68,687. Fund to be applied to development of property and small mill may be erected.

BIG JIM (Oatman)—Complete sampling shows higher average value than previously conceded. Sampled at every 5 ft. on 515 ft. of drifts; said to average $22.80 per ton.

Pinal County

MAGMA (Superior)—Report for third quarter states: Produced 2,153,364 lb. copper at cost of 9.95c.; average selling price, 24.55c.; average monthly profit, $104,808. Production in preceding quarter, 2,232,936 lb.; monthly profit, $101,675.

Yuma County

ARIZONA EMPIRE MINES (Parker)—Considering plans for flotation plant; 1,000-ft. shaft will be started soon; contract let for hauling 2 cars ore daily to Parker.

YUMA WARRIOR (Salome)—Shipping gold bullion from oxidized ore mined in upper levels of old Harqua Hala Bonanza mine; plan to develop sulphide ore in lower levels.

CALIFORNIA

Calaveras County

ESTELLE GOLD MINING CO. (Angels Camp)—New incorporation, capital $150,000; property situated on West Belt of Mother Lode. Installing Straub 10-stamp circular mill. Dr. Estelle Sibald, of Denver, interested.

ANGELS MOHAWK MINING CO. (Angels Camp)—New five-stamp mill installed to treat ores from the Sultana, Maltman and Great Western; additonal five stamps contemplated. Doctor Galleri and associates interested.

PURE QUILL (Angels Camp)—Fred Bender has bonded, unwatered shaft, installed new headframe and hoist. Will drive a crosscut at 100 level and sink. Good ore exposed in crosscut at 50-ft. level. Small mill contemplated.

ANGELS CAMP DEEP MINING CO. (Angels Camp)—New air compressor installed. Concrete foundatons placed under hoist and mill. Sinking resumed with air drills. Shaft, now down 125 ft. on Pioneer claim, to be deepened to strike footwall at about 600 ft. total depth. Crosscut at 90-ft. level disclosed 12-ft. vein.

Eldorado County

TEDDY BEAR (Placerville)—John W. Cover, and associates, of Seattle, exploring this property.

HOLLY QUARTZ MINING CO. (Placerville)—Incorporated for $50,000 to acquire the Lemon mine, situated on the edge of town. Louis Scholler, C. A. Doyle and George Corey are incorporators; principal office at Fresno.

BOSTON COPPER (Placerville)—Property, idle since Civil War, recently examined by John C. Skuse, mining engineer of the Champion copper mine at Luning, Nev., with view of determining if it will warrant development. Ore mined in early days was treated at property in small smeltery situated on the property.

Inyo County

CERRO GORDO (Keeler)—The zinc-carbonate and silver-lead orebody disclosed last June on the 200 level and developed in October on the 300 level has been found to persist to the 550-ft point, maintaining a width of 6 to 10 ft. The carbonate average is 45% zinc and the silver-lead ore carries 35 oz. silver to the ton. Company has recently acquired additional claims north of the present working with the expectation of prosecuting development in that territory. Besides the ore being shipped, 50 tons per day of slag from the old smelting furnaces is also going out.

DARWIN LEAD AND SILVER MINES (Darwin)—Second unit of mill using Murex process for lead-carbonate ores will be completed early in 1917. Annual capacity of plant will then be 20,000 tons.

Sierra County

MARIPOSA (Alleghany)—Stamp mill being installed. S. A. Hendricks in charge.

HOMESTAKE (Downieville)—Large vein carrying free gold uncovered. Under examination by San Francisco engineer. Cole Burke, owner.

OPHIR (Alleghany)—Rich ore struck in upper workings. Lower tunnel being driven to tap two oreshoots. S. A. Hendricks, superintendent.

SLATE CREEK (Port Wine)—Débris dam completed. Bedrock cuts being run, and repairs made to flumes and ditches, preparatory to hydraulicking. C. A. Brunnell in charge for Los Angeles company.

Siskiyou County

WILLIAMS COPPER (Happy Camp)—Property at the head of Buzzard Creek reported bonded by J. B. Woods and associates, of San Francisco.

G. E. BRADLEY CO. (Happy Camp)—Road being constructed from Klamath to mine on Independence Creek, 12 mi., will be rushed to get supplies in before heavy snows come. Cyanide plant for testing ores will be installed in spring.

Tuolumne County

BASIN (Columbia)—Deep gravel property being unwatered with electrically driven pumps.

CONFIDENCE (Sonora)—Headframe, blacksmith shop, cottages and other surface improvements installed preparatory to unwatering north shaft.

HARVARD (Jamestown)—Reported that mine will be reopened for development, and that H. W. Gould has resigned as manager to give all his attention to management of New Idria quicksilver mine in San Benito County.

COLORADO

Boulder County

WIND STORM in Caribou-Lakewood-Nederland district Nov. 10 caused much damage. Chief loss at Nederland where National Building and Widman Hotel were blown off foundations and many small buildings destroyed.

PYRAMID MINING, MILLING AND EXPLORATION CO. (Gold Hill)—Gold-silver oreshoot assaying over $200 per ton opened in tunnel at point 315 ft. from portal, and 700-ft. vertical depth.

DEGGE-CLARK (Boulder)—Storage facilities for crude ore and concentrates being increased at this custom tungsten mill in Boulder Cañon, permitting the holding indefinitely of tungsten ores pending changes in market price.

U. S. GOLD CORPORATION (Sugar Loaf)—New oreshoot opened on Douglas vein in Livingston mine. Considerable milling ore having average value of $20 a ton disclosed; rich streaks assay as high as 4 oz. gold a ton. Sinking pump being installed in fifth level; contract let to Allen McCarver to sink shaft to 600-ft. level.

Clear Creek County

GOLD ANCHOR (Alice)—Payable ore being developed and mill is in operation.

CLARA (Alice)—Development will be resumed in near future by owner, Henry J. Walder.

JEAN (Empire)—Ore being shipped from this mine in Daly district to mill at Empire station.

OTTAWA (Alice)—A 20-in. streak of 2-oz. gold ore opened by John Kaminky. Another opening will be driven to develop vein at a lower level. Two products produced from development; first-class ore shipped to smelters and milling ore treated in the Argo mill at Idaho Springs.

CONSOLIDATED MINES DEVELOPMENT (Alice)—This company is developing the Yukon property. Three drifts on 130-ft. level are being advanced on ore. A three-compartment raise is being driven for development and ventilation. New change room and shop constructed at portal of tunnel, which has been advanced 575 ft. and will be continued to Silver Moon vein and thence to Gold Quartz vein, a total distance of about 500 ft. Installation of air compressor and machine drills under consideration. The Evening Star, at Argentine, acquired recently by company, is being explored.

Gunnison County

VULCAN MINES CO. (Vulcan)—Has closed its mines and smelting plant indefinitely.

COLORADO-YULE MARBLE CO. (Marble)—At petition of Receiver J. F. Manning, court has ordered quarries and finishing plant closed after completion of present contracts and placed in hands of caretakers until final disposition made.

Lake County

IRON-SILVER MINING (Leadville)—Mikado mine, on Carbonate Hill, is being equipped with a 300-hp. Wellman-Seaver-Morgan electric hoist—largest of its type in state.

Ouray County

VERNON MINING CO (Ironton)—Has encountered high-grade silver-copper ore in South Dakota vein, and is shipping copper ore from Vernon vein to Durango. Incline shaft on South Dakota vein, now 150 ft. deep, is being sunk to 500 ft. to tap intersection of Vernon and South Dakota veins; sinking 5 ft. per day with Jackhamer drills. Compressor, sawmill and winter supplies taken in. A. G. de Golyer, manager.

Saguache County

MICHIGAN-PARAGON (Bonanza)—These two properties under lease to Warren F. Page and associates, of Leadville. Some good-grade copper ore shipped from Michigan. Paragon tunnel, lower working on two properties, being reopened so that both can be worked through it.

RAWLEY (Bonanza)—Driving three-compartment raise from main adit, or 1,200-ft. level, to 600-ft. level under way. Regular shipments 50 tons daily of heavy sulphide ore being made to Ohio & Colorado Smelting Co., Salida. Railroad shipping point, Villa Grove; ore hauled by teams and one truck. Surveys of tramway from adit portal to Denver & Rio Grande R.R. at Shirley station, tram terminal and ore bins completed. Excavating for power house and installation of electric power line under way. Stated options secured on several properties adjoining, among them Superior-Huron, Sastilla, Peyton and other groups. Work held back by scarcity of miners.

San Miguel County

SHIPMENTS of concentrates from Telluride during October were as follows: Tomboy, 61 cars; Smuggler-Union, 51; Liberty Bell, 15; Black Bear, 1; total, 128 cars.

Summit County

SHIPMENTS from Kokomo-Robinson district increasing. Among mines now shipping are Robinson Tunnel, Wilfley, Felicia Grace, Silver Bowl, Colonel Sellers, Raven-Eagle and Michigan.

TUCKER MOUNTAIN MINING (Kokomo)—Has leased Bed Cloud and Black Cloud groups on Tucker Mountain. Will develop shoot of copper ore.

Teller County

SHOO FLY (Cripple Creek)—Being developed by Hickman & Co., who have made a shipment.

BLUE FLAG GOLD MINING (Victor)—Bids being received for sinking Raven Hill shaft 300 ft. below present level of 1,100 ft.

AJAX (Victor)—Entire property on Battle Mountain, excepting the Colburn mill, have been purchased by Judge E. A. Colburn for $180,100.

GOLDEN CYCLE (Colorado Springs)—Recent sale of plant and property of United States Reduction and Refining Co., at Colorado City, to this company, confirmed by Federal court. Consideration $383,000, less certain credits. Final payment of $50,000 made to receiver Arthur Connell. Plant will be dismantled. Later: Entire plant purchased by Morse Bros. Machinery and Supply Co., of Denver.

ALBERT-BEACON (Cripple Creek)—Shipments of one car per day being made from Prince Albert shaft, on Beacon Hill. Electric hoist will be installed at old Beacon shaft and mine reopened. Shaft will be sunk from present depth of 360 ft. to cut Gold Dollar flat vein 300 ft. deeper. Subleases will probably be let on this mine. Some production being made from Iland tunnel.

IDAHO

Shoshone County

BUNKER HILL & SULLIVAN (Kellogg)—Satisfactory progress is being made with the smelting plant and it should be in operation by next May. The only difficulty so far has been the delivery of cement in sufficient quantities.

REX CONSOLIDATED (Wallace)—Purchased six claims adjoining Rex group in Nine Mile Cañon; reported price, $47,600 cash and 187,000 shares of Rex. Mill has been given trial run; capacity now about 200 tons. Reported that company has optioned Hypotheek ground near Kingston; equipped with 200-ton mill about 6 mi. from Cataldo station.

CONSOLIDATED INTERSTATE-CALLAHAN (Wallace)—Regarding increased rail facilities, report says: "Construction of the Oregon-Washington Railroad and Navigation Co.'s new branch line up Beaver creek will enable us to ship our ore all the way by rail to Enaville, Idaho, where the proposed new mill is to be erected. It also will make possible opening the property on the Beaver Creek side giving a depth of 3,000 ft., or 1,500 ft. lower than the No. 7 level."

MICHIGAN

Copper

LAKE (Lake Mine)—Sending 200 tons daily to the Baltic mill, same yielding about 26 lb. to the ton.

ISLE ROYALE (Houghton)—Has completed enlargement of No. 7 Shaft to full size, and begun sinking.

AHMEEK (Ahmeek)—Development of Kearsarge conglomerate discontinued in order to use men to get out ore; will be resumed later.

VICTORIA (Victoria)—The second 5-ton skip put in commission to the 21th level, bottom of shaft; replaces 2½-ton skips formerly used. Sinking started again below the 26th level.

WINONA (Winona)—Working two shafts, No. 1 and No. 4, both shifts, but not able to secure enough men for second shift at No. 3 shaft. Rich rock coming from No. 1 shaft.

OSCEOLA CONSOLIDATED (Osceola)—Old Osceola branch continues to show improved quality of rock, but total shipments from all branches were not up to normal during October.

NEW ARCADIAN (Houghton)—Has begun crosscut on 1,500-ft. level to the New Arcadian lode. Delay in getting new crusher prevents completion of new shaft house or use of new hoisting engine.

ADVENTURE (Greenland)—Shaft repaired, new piping run, compressor working and ground being opened. Rock showing good. Stamping has not yet started but more men are going underground. Mine was shut down 14 years ago, when in fair rock.

CALUMET & HECLA (Calumet)—Production for October was 6,633,199 lb., and from subsidiaries, as follows: Ahmeek, 1,976,977 lb., Allouez, 981,136; Centennial, 190,600; Isle Royale, 1,035,580; La Salle, 121,132; Osceola, 1,555,021; Superior, 221,162; Tamarack, 582,225; White Pine, 374,166 lb.

MISSOURI

Joplin District

STARK CITY (Stark City)—Opened up rich shallow ground on Kilgore land, near town.

PELICAN ZINC (Joplin)—New company organized to take over Cock Robin property, at Chitwood.

MONT B (Webb City)—Operating again after two months' shutdown. Is one of largest sheet-ground mines.

ACME MINING AND MILLING (Joplin)—Has made good strikes north of Carl Junction and is starting shafts.

YELLOW PUP (Zincite)—Opening up new run of ore to northwest of old workings and expect to operate mill full shift again soon.

REBEKAH (Commerce, Okla.)—To erect new mill on 250-acre tract four miles north of Commerce. W. A. Wood, general manager.

C. C. McCORMICK (Aurora)—In searching for zinc, opened 12-ft. face of "Venetian Red" paint, on farm south of Aurora. Expects to develop.

CARMEAN & SQUIRES (Webb City)—Have taken over Old Virginia mine south of Carterville. It is their sixth sheet-ground property.

KING JACK (Commerce, Okla.)—Another cave-in, in which a rougher jig and set of rolls were lost, has caused final abandonment.

SPENCER & CO (Joplin)—One sludge plant going and will construct another to work sands from A. W. C. properties. J. S. Spencer, Webb City, manager.

H. D. SKELTON (Miami, Okla.)—Expects to erect two new mills on tracts he and associates are developing northeast of Picher, Okla., near Baxter Springs. Drilling continues but two shafts have been started.

RED BIRD (Webb City)—New mill recently completed now in operation and good returns being made. Owned by Curtis, Cosden & Aitken interests of Tulsa, Okla. W. B. Shackelford, of Webb City, manager.

MONTANA

Beaverhead County

NATIONAL OIL CO (Dillon)—Reported that oil has been struck in Sheep Creek basin near Dell. Well 750 ft. deep.

ORIGINAL BANNACK MINING (Bannack)—At depth of 150 ft. a 50-ft. vein carrying about 1½% copper and $2 in gold was opened. Development to be continued through winter and if satisfactory, mill will be erected in spring. John F. Cowan, Salt Lake City, Utah, consulting engineer.

Fergus County

BARNES KING (Kendall)—Third quarterly report shows profit $23,606 on Shannon property in Marysville district, Lewis and Clark County. Losses on Piegan Gloster, in same district, on Woodrow Wilson in Kimini district and on North Moccasin and Kendall in Fergus County and miscellaneous expenses amounted to $17,148, leaving net profit for quarter of $6,458. During period another $30,000 was paid in Kendall property, completing purchase. With this item out of the way and with many improvements made at Shannon and Piegan-Gloster properties, it is expected that both output and earnings will increase.

Jefferson County

CRYSTAL COPPER (Basin)—On Cataract Creek, 8 mi. north of Basin, No. 2 crosscut tunnel now being driven; expected to intercept vein in [illegible] days.

Mineral County

RICHMOND MINING, MILLING AND REDUCTION (Saltese)—Shipping carload a day. Contract for hauling ore 6 mi. to railroad let. About 1,000 tons of ore broken in stopes ready for removal.

Silver Bow County

BUTTE & SUPERIOR MINING CO. (Butte)—Present indications are that present [illegible] quarter will exceed preceding quarter, which was poorest made by company [illegible]. Many improvements now nearly c[illegible] ore. Development on 1,700 and 1,800 levels shows continuation of orebodies found on upper levels. This with orebodies developed in upper levels gave an additional of 186,000 tons to ore reserve. Most promising feature is continued extension of orebodies to the east of former workings.

ANACONDA (Butte)—Preparing to sink 1,000-ft. shaft on Bonanza claim, ½ mi. southwest of Emma mine. Bonanza was recently acquired and prospected by company and decision to sink shaft indicates that exploration proved satisfactory. Work at Emma mine progressing rapidly; reported large bodies of zinc ore blocked out down to the 800 level. Crosscut now being driven from company's Gagnon mine will intercept these orebodies 800 ft. below this and may double the reserves now in sight. It is intention to bring mine up to a producing basis of 400 tons of zinc ore a day, with ability to increase output whenever demand requires.

NEVADA

Churchill County

NEVADA WONDER (Wonder)—During year ended Sept. 30, milled 57,281 tons of ore, average value $14.86 per ton; recovery, 92.72%. Mining expenses, $295,958; milling, $187,046; marketing, $14,661; metal losses at milling, $61,950; sinking subshaft, $10,374; general expenses, $1,840; net operating profit, $279,264; dividends paid, $211,251. Orebody opened on 1,300-ft. level; milling grade ore being developed on 1,600 level, reached by subshaft; some sulphide ore also found on this level. September mill recovery, 94.22%.

Esmeralda County

GRANDMA CONSOLIDATED (Goldfield)—Has acquired control of Gold Sunrise property, adjoining on east. Proposes to absorb latter company by exchange of stock.

REORGANIZED CRACKERJACK (Goldfield)—Recent report covering June 1 to Nov. 1 states 1,355 ft. development work done, exposing above the 120-ft. level considerable low-grade ore.

FLORENCE (Goldfield)—Following recent visit of President A. D. Parker, operations at mine and mill were suspended. Present stopes and faces were not yielding ore of a profitable grade. Deep development may be undertaken.

Lyon County

NEVADA-DOUGLAS COPPER (Ludwig)—Main leaching plant started Nov. 5. About 30 cars of high-grade ore shipped in October.

Nye County

TONOPAH ORE PRODUCTION for week ended Nov. 11 was 9,757 tons, valued at $191,566, compared wtih 10,176 tons for week previous. Producers were: Tonopah Belmont, 2,810 tons; Tonopah Extension, 2,380; Tonopah Mining, 2,050; Jim Butler, 1,150; West End, 794; Halifax, 215; Rescue-Eula, 189; McNamara, 54; leases, 115 tons

MONARCH-PITTSBURGH (Tonopah) — Raise from 1,000-ft. level continues to show ore of fair grade. Trial shipment of 90 tons made to the West End mill.

TONOPAH BELMONT (Tonopah)—Now have two diamond drills and one churn drill at work prospecting area included in various groups recently acquired in eastern section of district.

MONARCH-PITTSBURGH (Tonopah)—Oreshoot encountered in raise from 1,000-ft. level at height of about 100 ft. Stated to average $30 across 3 ft. Raise will be continued to 850-ft. level for air connection.

ORIZABA (Millers)—Control of this mine held by Diamondfield Black Butte company, of Goldfield. Ore of shipping grade now exposed in both east and west drifts on 100-ft. level and shipments are being sent by auto truck to railroad.

TONOPAH EXTENSION (Tonopah)—Three lines of development of major importance being conducted from 1,540-ft. level of Victor shaft; the long crosscut to the Afterall company's ground, the northerly crosscut towards the Sully group and the deepening of the Victor shaft to the 1,850-ft. level.

Storey County

ANDES (Virginia)—Saved 56 cars of ore from 350-ft. level.

OPHIR (Virginia)—North drift 2,700 level advanced to 421-ft. point.

CON. VIRGINIA (Virginia)—Joint west crosscut extended to 338-ft. point. Repairs made in man shaft.

MEXICAN (Virginia)—Repairs made in shaft and west crosscut on 2,500 level advanced to 472 ft.; face in quartz and porphyry.

JACKET (Gold Hill)—Cyanide plant, 16 mills and 3 tables operated; 603 tons dump rock put in mill bins; bar of bullion shipped.

UNION CON. (Virginia)—Extracted from 2,500 level 118 cars of ore, $10.60 per ton; 38 cars, $21.30 per ton. Rapid advancement in development and sampling on 2,300, 2,400, 2,500, 2,700 levels.

SIERRA NEVADA (Virginia)—Jointly with Union east crosscut from 2,600 station advanced to 244-ft. point. Old north drift 2,500 level advanced to 124 ft. Connection made with 2,400-2,500 raise.

NEW MEXICO

Grant County

CHINO (Hurley)—Seven trains of 28 cars each, averaging 55 tons to the car, hauled daily from mines at Santa Rita to mills at Hurley.

EL PASO MINING CO. (Pinos Altos)—New organization of El Paso and Pinos Altos men to consolidate some old gold properties, and erect mill.

CLIFTON (Mogollon)—Oaks Co. driving south drift from adit level and raising on No. 1 orebody. Last shipment to custom mill assayed $14 per ton.

EUREKA (Mogollon)—D. E. Bearup, owner and operator, made rich strike recently; scouring camp for burros to pack accumulation of mill ore to local custom works; richer ore being sacked for shipment to smelters.

SANTA RITA DEVELOPMENT (Santa Rita)—Larger hoist and compressor for No. 1 shaft purchased; contract let for driving prospect drift in extreme south end of property; two Cyclone churn drills arrived; new office building ready and assay outfit ordered. Ruddle shaft unwatered; two cars ore ready for shipment.

LITTLE FANNIE (Mogollon)—Socorro Mining and Milling Co., operator, has installed automatic scale at mill terminal of aërial tramway from Pacific mine for weighing all ore received from latter property. Belt conveyor being placed to handle this ore between receiving bins and crusher. Bullion output for October was 4,100 lb.; ore treated 7,000 tons.

LAST CHANCE (Mogollon)—Timbering of new 960-ft. shaft below 500-ft. level progressing rapidly, work being conducted from two different points. Development will be pushed from both 800- and 900-ft. levels as soon as timbering will permit. Mogollon Mines Co., operating property, shipped during October 2,800 lb. gold-silver bullion from treatment of 4,100 tons.

TENNESSEE

TENNESSEE COPPER (Copperhill)—Suit was filed in the Supreme Court in New York, on Nov. 17, by 15 fire-insurance companies to prevent collection of $750,000 damage resulting from destruction by fire, on Mar. 20, of the company's trinitrotoluol plant near Fox Hill, Tenn. Insurance companies claim to have been unaware of the nature of the product and that their inspector was not shown this plant while in the Fox Hill district.

UTAH

Beaver County

KING DAVID (Frisco)—Diamond drilling being done on the 800 level; hole down 100 ft. Some lead and zinc ore being opened in western part of ground.

INDIAN QUEEN (Frisco)—Contract for 100 ft. of drifting from old Indian Queen tunnel given to J. Nielson. Lessees working in one part of property. Three cars of ore shipped recently.

Box Elder County

LAKEVIEW (Saline)—Car of ore running well in lead and silver settled for. November shipments expected to be nine cars of silver-lead and four cars of high-grade zinc. Eight sets of lessees working.

Juab County

MONTANA MINING (Eureka)—Company owning property not far from Tintic Standard to be reorganized. Adjoins Iron King. Has two-compartment working shaft and modern equipment. Expected to resume work.

CHIEF CONSOLIDATED (Eureka) — Drifting being done from shaft on 52-ft. level, north and south, on this company's Homansville property. Work during month has not increased water flow; small pump still adequate.

YANKEE (Eureka)—High-grade ore cut in shaft in Humbug ground. Ore along north-south break near Jesse Knight-Humbug stope, from which large amount of ore produced. New ore runs high in silver, and carries gold and lead, some of it to be sacked for shipment.

TINTIC MILLING (Silver City)—Mill treating approximately 200 tons of ore a day. Six of new roasters installed. New leaching plant will be completed in two weeks; rated capacity, 300 tons. At present ores, largely from Knight properties, being treated; more custom ores will be treated when 300-ton capacity is reached.

EAGLE & BLUE BELL (Eureka)—Shaft down 2,000 ft., and being continued to 2,050 ft., below which water is looked for. Station to be cut and drifting done just above water level. Drifting—under contract to Walter Fitch, Jr.—to be started on 1,200 of Victoria, going through Victoria and Eagle & Blue Bell into Plutus ground (latter controlled by Chief). Companies to share jointly in expense.

Piute County

PITTSBURGH-UTAH POTASH CO. (Marysvale)—Incorporated under laws of Delaware to operate alunite property comprising 17 claims near Sevier River; Charles J. Petgen, of Pittsburgh, is president and manager. James Long, Jr., is in charge of the property in Utah. A 20-ton plant contemplated.

DE WITT (Marysvale)—On these claims in Bullion Cañon, near Bully Boy & Webster, opened ore on main vein at three points—total distance of 150 ft.; gold-silver-copper-lead ore 3 or 4 ft. in thickness followed down 35 ft.

POTASH CO. OF UTAH (Marysvale)—Articles of incorporation soon to be filed. Capitalization to be 1,500,000 shares. Object to develop alunite claims adjoining Mineral Products corporation at Marysvale. B. H. Payne, of San Francisco, F. B. McCarthy, of Philadelphia, Boies Penrose, W. W. Byrne, H. W. Clark and others are interested.

Salt Lake County

ORE CONGESTION at Tanner's Flat below Alta. continues, owing to team shortage. Three cars daily are being sent out; heaviest shippers are South Hecla and Michigan-Utah.

SELLS (Alta)—Car of lead-silver ore shipped, and another broken in mine. Ore coming from No. 1 raise and being taken out in development. A. C. Jacobson, manager.

EAST HECLA (Alta)—Improved conditions in new tunnel between 100- and 150-ft. point. Expected to reach vein—showing good ore further up hill—within 25 ft. Property lies between South Hecla and Mineral Flat, ½ mi. southeast from Alta townsite. D. J. Cook, superintendent.

Summit County

PARK CITY SHIPMENTS in October amounted to 8,201 tons. Shippers were: Silver King Coalition, Ontario, Federal Leasing, Daly, Utah Ore Sampling, Iowa Copper, Silver King Consolidated, Daly West, Big Four Exploration, New Quincy, Jones and Mines Development.

NEW QUINCY (Park City)—Ore being mined in three places. New ore in west workings promising and has been followed 60 ft. Two cars shipped.

JUDGE MINING AND SMELTING (Park City)—Machinery and tanks for new electrolytic-zinc plant arriving and being placed in position. Expected to be operating early in year. M. H. Kuryla in charge.

SILVER KING CONSOLIDATED (Park City)—Carbonate stope, between 1,550 and 1,625-ft. levels, north from incline, promising. New tramway, eliminating wagon-haul, operating smoothly; 500 tons of second-class sent down to mill. Thaynes cañon tunnel in 960 ft

BIG FOUR EXPLORATION (Park City)—Mill handling 700 tons of tailings daily and making zinc concentrates of good grade. Recent experiments indicate savings can be raised to 55% zinc and approximately $4 in gold, silver and lead by comparatively inexpensive changes.

Tooele County

LION HILL (Ophir)—Shipments of high-grade silver ore to be resumed. George St. Clair, superintendent.

CANADA

British Columbia

GRANBY CONSOLIDATED (Anyox)—Treated in October about 82,000 tons.

PIONEER (Lilloot)—A. F. Noel, in charge of this property, brought out gold bullion recently valued at $5,800.

SILVER KING (Nelson)—Consolidated Mining and Smelting Co., of Trail, has let contract for 1,000 ft. of drifting on Toad Mountain.

LUCKY JIM (Slocan)—A. G. Larson, receiver, has contracted with Consolidated Mining and Smelting Co for treatment of 600 tons of zinc concentrates monthly for one year. This is first contract entered into for customs ores since erection of the Trail electrolytic zinc plant, which has been treating ores of its Sullivan mine exclusively.

Ontario

McINTYRE (Schumacher) — October earnings were over $60,000.

KERR LAKE (Cobalt)—Produced in October 210,073 oz. of silver.

TEMISKAMING (Cobalt)—Shipping car of high-grade ore that is expected to return $200,000.

DAVIDSON (Porcupine)—Cut main vein at 300-ft level where it shows some free gold.

MINAKER (Kirkland Lake) — This property south of the Lake Shore, purchased by Rochester men.

WRIGHT-HARGRAVES (Kirkland Lake)—Has opened extension of main vein showing 9 ft. of $40 ore.

DOME LAKE (South Porcupine)—Mill started again after shutdown of several months; treating about 70 tons a day.

NIPISSING (Cobalt)—In October produced ore of estimated net value of $233,646; bullion from Nipissing and customs ore, $410,233.

McKANE (Kirkland Lake)—Orebody on 400-ft. level shows 40 ft. of ore. Beaver Consolidated of Cobalt will exercise its option.

TRETHEWEY (Cobalt)—Now making a profit of about $8,000 a month.

McKINLEY-DARRAGH (Cobalt)—Decided to close Savage mine, which has been substantial producer for some years.

JUPITER (Schumacher)—Receiving about $5,000 a month from ore treated in McIntyre mill. It is stated that amalgamation of McIntyre, Jupiter and McIntyre Extension will not be consummated

The Market Report

Metal Markets

NEW YORK—Nov. 22, 1916

Again there was a week of great activity in all of the metal markets, accompanied by advancing prices, but toward the close there seemed to be an abatement of the tempest in copper.

Copper, Tin, Lead and Zinc

Copper—Copper continued to advance furiously on insistent demand of the same kind that was reported last week. The major market was distinctly for delivery in the second quarter of 1917. There began to be some sales for June-July on the part of producers who had sold out everything up to June. The market seemed to culminate on Saturday, Nov. 18. At that time business in second-quarter copper was done in large volume at 32¼c., net cash, New York. Prompt copper was quoted at 34@35c. These quotations remained unchanged during the rest of the week.

The aggregate of business done last week was very much less than in the previous week, and the major part of it was done during the first three days. Following them transactions became rather light and, indeed, the market might be called dull, some producers reporting no sales for three days running. Present views of the market are rather conflicting, some producers reporting consumers being desirous of buying if they could get what they want; while, on the other hand, there are reports of consumers admitting that they are uncovered for the second quarter of 1917 and expressing intention of waiting. Following the crazy and tempestuous buying of the first half of November, it is but natural that calm should ensue.

Price of London electrolytic copper for Nov. 15, was 153½, instead of 153 as published last week.

Copper Sheets—Base price for copper sheets is 41c. for hot rolled and 42c. for cold rolled. Copper wire is now at 39@40c. for prompt and 38¾c. for December.

Tin—An active business was done, especially on Nov. 20, when transactions were large. At the beginning of the week; spot was 45¼c.; futures, 43¼c. At the close spot was 45⅝c.; futures, 43¾c.

Exports of Bolivian tin ore, concentrates and bars for the nine months ended Sept. 30, were equivalent to 14,790 tons fine tin. Exports to the United States, included in the total, were 4,911 metric tons concentrates, equivalent to 2,900 tons fine tin.

Receipts of tin ore and concentrates from Bolivia at Liverpool in September were equivalent to 1,093 tons metallic tin; from Nigeria, 333 tons.

Shipments of tin from the Straits in September were 3,345 gross tons.

Lead—This market was very strong on large buying from many quarters; while, moreover, sympathy with the advance in copper no doubt played a part. Canada continued to be a buyer, while there were further inquiries from Russia, Japan and China, and some sales to them. On Nov. 20 independent producers began to realize premiums over the price of the A. S. and R. Co.

Spelter—A large business was done, both in common and brass special, at advancing prices. Transactions were divided between November-December and first-quarter delivery. Some large transactions for January-June delivery were made. The strength in the spelter market is variously explained. Production is undoubtedly very large. At present buying also is good. One theory is that sellers are holding stiffly in anticipation of a diminished production with the advent of cold weather. The other theory is that the advance in spelter is chiefly in sympathy with the rise in copper.

Zinc Sheets—The base price of zinc sheets has advanced twice during the week. On Nov. 17 it was placed at 18 per 100 lb., and on Nov. 20, at $19 per 100 lb., f.o.b. Peru, Ill., less 8% discount.

Other Metals

NEW YORK—Nov. 22

Antimony—Market rose sharply, business being done at 14½c. on Nov. 21. Stocks have been about cleaned out and producers are expecting higher prices, which will probably result if any considerable buying develops. At the close we quote 14½@14¾c.

Quicksilver—Market firm at $80. Demand fair. San Francisco reports, by telegraph, $76, market steady.

Aluminum—The price of No. 1 ingots remains nominal at 64@66c. per lb. New York.

Nickel—Shot and ingot nickel remains at 45@50c. per lb.; electrolytic commanding a premium of 5c.

Gold, Silver and Platinum

NEW YORK—Nov. 22

Gold—The holding by the Bank of England against its note issues shows an increase of £248,695, as compared with last week's return, according to Samuel Montagu & Co., London, Nov. 2, 1916.

Silver—The market has been very broad with an advancing tendency. Recent information is to the effect that considerable shipments of silver have been made from San Francisco to the East—so that the depression caused by China being a selling factor has changed to a healthier tone by purchases for Eastern account by China in way of replacement.

The tendency of prices has been upward, according to Samuel Montagu & Co., London, Nov. 2. On Oct. 28 32¼d. was recorded and on Oct. 31, 32½d. The price remained at this figure until today when offerings being somewhat freer a reaction of 1/16 took place. The upward movement was encouraged by buying on account of the Indian Bazaars, and also by some inquiry by China. The importance of this latter, as an indication of market tendency, does not depend so much upon its size as upon the fact of its occurrence, and the possibility of its recurrence on a more substantial scale.

The stock in London on Oct. 27 consisted of about 7¾ million standard oz.—an increase since last month of about ¾ million standard oz.

The stock in Shanghai on Oct. 28 consisted of about 23,000,000 oz. in sycee and $16,400,000, as compared with about 24,000,000 oz. in sycee and $16,500,000 dollars on Oct. 14, 1916. The stock in Bombay consists of 4,000 bars the same as last week.

Platinum—Price has risen to $105 per oz.

Palladium—Unchanged at $75 per oz.

Zinc and Lead Ore Markets

Platteville, Wis., Nov. 18, 1916—Quotations for the district are according to the following prices: Base price per 2,000-lb. ton for material assaying 60% zinc was $93 for premium ore down to $85 for medium grades. For material assaying 80% lead the base price per 2,000-lb. ton was $84. Shipments for the week were: 2,883 tons of zinc ore, 107 tons of lead ore, and 698 tons of sulphur ore. For the year to date the figures are: 115,799 tons of zinc ore, 3,901 tons of lead ore, and 28,395 tons of sulphur ore. Shipped during the week to separating plants, 2,577 tons of zinc ore.

Joplin, Mo., Nov. 18—Price quotations per 2,000 lb.: Blende, high $96.90; 60% zinc, premium ore, $95, medium grades, $93@85; low, $80. Calamine, per ton 40% zinc, $55@45. Average selling price, all grades of zinc, $78.26 per ton.

Lead, high price, $88.75; base, $88@84. Average selling price, all grades of lead, $85.75 per ton.

Shipments of the week: Blende, 6,227 tons; calamine, 686 tons; lead, 1,060 tons. Value, all ores the week, $631,950; 46 weeks, $32,768,980.

Offerings of $80 base for 54% zinc on Thursday gave the market an impetus upward, and on that day Granby holders of high-grade calamine refused $55 base.

Outputting conditions continue unsatisfactory, caused by scarcity of water for wet concentration, and the low stage of stream water has reduced the hydro-electric power 5,000 hp. A severe cold snap early in the week lowered the natural gas pressure to the detriment of both mining and smelting interests.

Other Ores

Tungsten Ore—Large sales at $17@17.50 per unit. Market closes firm at the latter figure.

Molybdenum Ore—Good demand. Supplies still small. Sellers ask $1.85 per unit.

Manganese Ore—Manganese ore imported to the United States in August this year were reported at 76,721 gross tons, against 81,912 tons in July. August receipts are next to the largest this year, those of May being third at 74,825 tons. The total of imports for the eight months to Sept. 1 was 395,686 tons, compared with 147,003 tons to Sept. 1, 1915, and 183,029 tons to Sept. 1, 1914. The average monthly rate thus far this year is 49,160 tons against 28,757 tons in 1913, the previous record, and 22,170 tons as the average for the five-year period from 1910 to 1915. Manganese-ore imports to the United States are now in excess of those to Great Britain, which, for the first nine months of this year, were [illegible] tons.

Imports at Baltimore included 11,690 tons of manganese ore from Brazil and 1,000 tons from Capetown.

Iron Trade Review

NEW YORK—Nov. 22

It is considered that there is some doubt about the kind of deliveries the mills will make on rails ordered for the first half of 1917. The British inquiry for nearly 1,000 mi. of 75-lb. rails carries an attractive profit, but it seems doubtful, even with 1917 deliveries permissible, if the 145,000

SILVER AND STERLING EXCHANGE

Nov	Sterling Exchange	Silver New York, Cents	Silver London, Pence	Nov	Sterling Exchange	Silver New York, Cents	Silver London, Pence
16	4 7569	71¾	34	20	4 7569	72¾	34⅜
17	4 7569	71¾	34	21	4 7569	72¾	34 7/16
18	4 7569	71¾	34⅛	22	4 7569	72¾	34 11/16

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine.

DAILY PRICES OF METALS IN NEW YORK

Nov	Copper Electrolytic	Tin Spot.	Lead N. Y	Lead St. L.	Zinc St. L.
16	30¾ @31¼	45¼	7 00	6 85 @6 92½	11 @11¼
17	31 @32	45¼	7 00	6 85 @6 92½	11¼ @12
18	32 @32½	45¼	7 00	6 85 @7 00	11½ @12
20	32 @32½	45⅜	7 00 @7 125	6 90 @7 00	11¾ @12¼
21	32 @32½	45½	7 00 @7 15	6 90 @7 15	12 @12¼
22	32 @32½	45⅝	7 00 @7 25	6 90 @7 15	12 @12¼

The quotations herein are our appraisal of the average markets for copper, lead, spelter and tin based on wholesale contracts for the ordinary deliveries of the trade as made by producers and agencies, and represent, to the best of our judgment, the prevailing values of the metals, reduced to basis of New York, cash, except where St. Louis is basing point.

The quotations for electrolytic copper are for cakes, ingots and wirebars. Electrolytic copper is commonly sold at prices including delivery to the consumers and is subject to discounts, etc. The price quoted for copper on "regular terms" (r.t.) is the gross price including freight to the buyer's works and is subject to a discount for cash. The difference between the price delivered and the New York cash equivalent is at present about 0.25c. on domestic business. The price of electrolytic cathodes is 0.05 to 0.10c. below that of electrolytic. Quotations for lead represent wholesale transactions in the open market for good ordinary brands. Quotations for spelter are for ordinary Prime Western brands. Only St. Louis price is given, St. Louis being basing market. We quote New York price at 17c. per 100 lb. above St. Louis.

Some current freight rates on metals per 100 lb. are: St. Louis-New York 17c.; St. Louis-Chicago, 6.3c.; St. Louis-Pittsburgh, 13.1 cents.

LONDON

Nov	Copper Standard Spot	Copper Standard 3 Mos	Copper Electrolytic	Tin Spot	Tin 3 Mos	Lead Spot	Zinc Spot
16	135	130½	154	189	190½	30	[illegible]
17	139	135	158	188½	190½	30½	[illegible]
18			158				
20	141	136	160	188	190½	30	[illegible]
21	144	139	163	188½	190	[illegible]	[illegible]
22	144	139½	164	191	193	[illegible]	[illegible]

The above table gives the [illegible] London Metal Exchange. All prices are in pounds sterling per ton of 2,240 lb. Copper quotations [illegible] electrolytic are subject to 3% discount. For convenience in comparison of London prices, in pounds sterling per 2,240 lb., with American prices in cents per pound the following approximate [illegible] reckoning exchange at 4.80. £15 = [illegible]; 4.29 . £30 = 6.43c.; £40 = 8.57 [illegible] 12.8 [illegible] Variations, £1 = 0.21⅜ cents.

tons involved can be placed in this country. The fact is that the demand is strong for steel products carrying 50 to 200% larger profits than rails, this factor seriously influencing the manufacture and delivery of rails. The shortage of cars in railroad service is serious, but probably is matched by the shortage of motive power.

PITTSBURGH—Nov. 21

Yesterday afternoon the Carnegie Steel Co. advanced bars $4 a ton to 2.90c., shapes $4 a ton to 3c. and plates $5 a ton to 3.50c. Other producers took similar action the moment they heard of the advances. The National Tube Co. yesterday advanced base sizes of steel boiler tubes six points or about $12 a ton and one other size five points. Black sheets are up $7 a ton and galvanized sheets $10 a ton, to 4c. and 5.50c. respectively, while tinplates are up $15 a ton to $7 per base box.

Steel prices are advancing more rapidly than ever in this remarkable movement. The advance since December, 1914, is now three times the amount it required to bring prices up to the level of 1907, the highest level in the market from 1902 to the beginning of this year.

Earlier in this movement the mills suggested that they were advancing prices to check buying as they did not wish their order books to become overloaded. Now they seem to be advancing prices because enough buyers are indifferent to prices to keep their order books replenished as the present heavy shipments are made. Export sales are not particularly heavy but it appears that if domestic buyers should drop out of the market foreign buyers would take all the tonnage thus relinquished.

Car shortages continue in evidence, but as a rule shipments of steel products have been made with somewhat more facility in the past week than formerly. Box cars are not as scarce as flats and gondolas. The weather has been exceptionally favorable for the season, and a real cold snap, especially if accompanied by snow, would probably tie up the railroads and cause a congestion of material at mills that would operate to curtail production.

Pig Iron—Sales for the second half of 1917 are more common, and quite a considerable tonnage of basic is now under cover for the period, the first sales having been at $24, valley. There is no price distinction as to deliveries. In all grades prices show a sharp advancing tendency. Bessemer is up $1 and foundry $2. We quote: Bessemer, $31; basic, $26@27; foundry and malleable, $27@28; forge, $26.50@27.50, f.o.b. valley furnaces, 95c. higher delivered Pittsburgh.

Iron Ore—It is probable that sales of Lake Superior iron ore for the season of 1917 will start tomorrow or next day, at about $1.30 advance from 1916 prices, which were 65 to 70c. above those for 1915 and 1914. The new prices would then be: Old range bessemer, $5.75; nonbessemer, $5; Mesabi bessemer, $5.50; nonbessemer, $4.85, on Lake Erie docks. Late last week large chartering of vessels for 1917 fixed the rate at $• net to the vessels, against 50c. for 1916, paving the way for a fixing of ore prices.

Steel—The market, as far as quotable at all, is about $5 a ton higher, at about $55 for billets or sheet bars, but transactions are light, there being scarcely any steel available. Rods are higher, it being possible to obtain from $65 to $70. Forging billets are $70@75.

Coke

Connellsville—The recent large buyers of spot furnace coke remain out of the market, pursuing their intention of not paying fancy prices. Scattered inquiry resulted today in sales of small lots at $6.50 and at $7. Contract furnace coke is nominal, last contracts being at about $4. Spot foundry is bringing $9.50@10 and contract $5.50@6.50. Cars continue scarce.

Ferroalloys

Ferromanganese—The market has turned strong and the shading appears to be over. We quote imported on contract at $164 and domestic on contract at $165, with prompt at $165.

Chemicals

NEW YORK—Nov. 22

The general market continues firm. A steady demand continues for soda ash and caustic soda. The explosive acids including sulphuric and nitric are firm notwithstanding increased production.

Arsenic—White quoted 6@6¼c. per lb., red arsenic, 55@60c. per lb., 6c. in kegs of 200 lb.

Bleaching Powder—Quoted $4.75@5 in 100-lb. drums.

Sulphur—Crude quoted $28.50@29 per ton; roll, $1.95@2.25 per 100 lb.

Potassium Carbonate—Quoted at $1.30@1.35 per lb.

Soda Ash—Quoted 3@3⅝c. per lb. for 48%.

Nitric Acid—Quoted $7.50@8 for spot.

STOCK QUOTATIONS

N. Y. EXCH.†	Nov. 21
Alaska Gold M.	12½
Alaska Juneau	8¼
Am.Sm.&Ref.,com	122⅜
Am. Sm. & Ref., pf.	116⅞
Am. Sm. Sec., pf. A	101
Am. Sm. Sec., pf. B	97
Am. Zinc	61¾
Am. Zinc, pf	82
Anaconda	102⅛
Batopilas Min	2
Bethlehem Steel	680
Bethlehem Steel, pf	160
Butte & Superior	71
Chile Cop.	33
Chino	69¼
Colo.Fuel & Iron	58½
Crucible Steel	88⅝
Dome Mines	23¼
Federal M. & S.	16
Federal M. & S., pf.	49
Great Nor., ore ctf	48¼
Greene Cananea	54
Homestake	130
Inspiration Con	71½
International Nickel	47¼
Kennecott	59⅞
Lackawanna Steel	103⅜
Miami Copper	47⅞
Nat'l Lead, com.	69
National Lead, pf	115
Nev. Consol.	30⅞
Ontario Min	6
Quicksilver	2¼
Quicksilver, pf.	2¼
Ray Con.	33¾
RepublicI.&S.,com.,	90
Republic I. & S. pf.	115
Sloss-Sheffield	87¾
Tennessee Copper	24⅞
U. S. Steel, com	122
U. S. Steel, pf.	125
Utah Copper	125
Va. Iron C. & C.	66

N. Y. CURB†	Nov. 21
Buffalo Mines	1.15
Butte & N. Y.	2⅞
Butte C. & Z.	15¼
Caledonia	.55
Can. Cop. Corpn	2¼
Cashboy	06
Cerro de Pasco	44½
Con. Ariz. Sm.	2 13/16
Con. Coppermines	3⅞
Con. Nev.-Utah.	3/16
Crystal Cop.	1
First Nat. Cop.	5⅝
Florence	70
Goldfield Con	52
Goldfield Merger	06
Granite	.43
Hecla Min.	8⅜
Howe Sound	8¼
Jerome Verde	1 11/16
Joplin Ore & Spel	.50
Kerr Lake	5
Magma	60
Majestic	15/16
McKinley-Dar-Sa	58
Mother Lode	.38½
Nevada Hills	21
N. Y. & Hond	16¼
Nipissing Mines	9¼
Oro	‡ 03½
Ray Hercules	6
Rochester Mines	77
St. Joseph Lead	21¾
Standard S. L.	1⅞
Stewart	.28½
Success	.49
Tonopah	6
Tonopah Ex	5¼
Trihullion	⅜
United Zinc	5½
White Knob, pf.	2¼
White Oaks	4
Yukon Gold	2⅞

SAN FRAN.*	Nov. 21
Alta	04
Andes	09
Best & Belcher.	05
Bullion	02
Caledonia	25
Challenge Con	.05
Confidence	.20
Cons. Imperial	‡ 01
Con Virginia	07
Gould & Curry	03
Hale & Norcross	07
Jacket-Cr. Pt	.03
Mexican	07
Occidental	.65
Ophir	.16
Overman	.03
Savage	07
Seg Belcher	02
Sierra Nevada	.25
Union Con.	.52
Utah Con	.02
Belmont	4.60
Jim Butler	92
MacNamara	07
Midway	.22
Mont.-Tonopah.	.22
North Star	.16
Rescue Eula	.28
West End Con	70
Atlanta	.07
Booth	07
C.O.D. Con	02
Comb. Frac	04
D'field B.B.	05
D'field Daisy	‡ 05
Jumbo Extension	22
Round Mountain	35
Sandstorm Kendall	‡ 03
Silver Pick	22
Central Eureka	‡ .05
Argo	06
Ariz. Central	.05
Big Jim	1.43¾
Lazy Boy	06
Nellie	.25
Tom Reed	2.05
United Eastern	4.50
United Western	05

BOSTON EXCH.*	Nov. 21
Adventure	5⅜
Ahmeek	122
Algomah	1½
Allouez	82
Ariz. Com., ctfs	17¼
Bonanza	.25
Butte-Ballaklava	2⅝
Calumet & Ariz.	97¾
Calumet & Hecla	630
Centennial	26
Copper Range	86¾
Daly West	3
East Butte	18¾
Franklin	12¼
Granby	108
Hancock	21
Helvetia	85
Indiana	6¼
Island Cr'k, com	62
Island Cr'k, pfd	91⅞
Isle Royale	39¾
Keweenaw	6½
Lake	16½
La Salle	5¾
Mason Valley	7¼
Mass	18½
Mayflower	4⅞
Michigan	4½
Mohawk	105
New Arcadian	8
New Idria	16¼
North Butte	29½
North Lake	2½
Ojibway	2¼
Old Colony	3
Old Dominion	80½
Osceola	102
Quincy	106½
St. Mary's M. L	‡91½
Santa Fe	2⅝
Shannon	10¾
Shattuck-Ariz.	34½
So. Lake	7¼
So. Utah	.30
Superior	20½
Superior & Bost	7¼
Tamarack	45½
Trinity	8
Tuolumne	65
U. S. Smelting	80
U. S. Smelt'g, pf	51¼
Utah Apex	3⅜
Utah Con.	26¾
Utah Metal	7⅞
Victoria	7⅞
Winona	7¼
Wolverine	55
Wyandot	2⅞

BOSTON CURB*	Nov. 21
Alaska Mines Corp.	86
Bingham Mines	11¾
Boston Ely	85
Boston & Mont	80
Butte & Lon'n Dev	60
Calaveras	5
Calumet-Corbin	.02
Chief Con	2⅝
Cortez	25
Crown Reserve	42
Davis-Daly	4⅞
Eagle & Blue Bell	1 13/16
Houghton Copper	2¼
Iron Cap Cop., pf	10½
Mexican Metals	.47
Mines of America	2¼
Mojave Tungsten	2½
Nat. Zinc & Lead	.61
Nevada-Douglas	1 15/16
New Baltic	3¼
New Cornelia	19¼
Ohio Copper	40
Oneco	1¼
Rex Cons	.65
Rilla	.08
United Verde Ext.	41¼

SALT LAKE*	Nov. 21
Big Four	1.17½
Black Jack	06
Cardiff	7.25
Colorado Mining	22
Crown Point	05
Daly-Judge	8.00
Emma Cop	2.37½
Empire Copper	1.45
Gold Chain	18
Grand Central	.50
Iron Blossom	1.62½
Lower Mammoth	03½
May Day	10½
Opohongo	‡ 01
Prince Con	1.35
Seven Troughs	‡ 04
Silver-King Coal'n	3.20
Silver King Con	4.35
Sioux Con	15
So. Hecla	1.72½
Uncle Sam	06
Wilbert	08
Yankee	22

TORONTO*	Nov. 21
Bailey	07½
Beaver Con	.45
Chambers Ferland	16
Coniagas	4.85
La Rose	53
Peterson Lake	.18
Right of Way	.03
Seneca Superior	‡ .09
T. & Hudson Bay	73.00
Temiskaming	.64
Wettlaufer-Lor	.07
Dome Exten	.29
Dome Lake	.58
Foley O'Brien	.70
Hollinger	6.90
Jupiter	.29
McIntyre	1.80
Newray	1.10
Porcu. Crown	.70
Vipond	.37
West Dome	34

STOCK QUOTATIONS—Continued

COLO. SPRINGS	Nov. 21
Cresson Con	8.60
Doctor Jack Pot	.08¼
Elkton Con	.12
El Paso	.40
Findlay	.03¾
Gold Sovereign	.04
Golden Cycle	2.58
Granite	.65½
Isabella	.23
Mary McKinney	.28
Portland	1.90
Vindicator	1.75

LONDON	Nov. 9		
Alaska Mexican	£0	12s	6d
Alaska Tre'dwell	2	17	6
Burma Corp.	4	0	0
Cam & Motor	0	11	9
Camp Bird	0	7	0
El Oro	0	8	3
Esperanza	0	10	0
Mexico Mines	3	15	0
Nechi, pfd	0	13	9
Oroville	0	16	6
Santa Gert'dis	0	10	9
Tomboy	1	1	3

* Bid prices. † Closing prices. ‡ Last Quotations.

MONTHLY AVERAGE PRICES OF METALS

Silver	New York			London		
	1914	1915	1916	1914	1915	1916
January	56.572	48.855	56.775	26.553	22.731	26.960
February	57.506	48.477	56.755	26.573	22.753	26.975
March	58.067	50.241	57.935	26.788	23.708	27.597
April	58.519	50.250	64.415	26.958	23.709	30.662
May	58.175	49.915	74.269	26.704	23.570	35.477
June	56.471	49.034	65.024	25.948	23.267	31.060
July	54.678	47.519	62.940	25.219	22.597	30.000
August	54.344	47.163	66.083	25.979	22.780	31.498
September	53.290	48.680	68.515	24.260	23.591	32.584
October	50.654	49.385	67.855	23.199	23.925	32.361
November	49.082	51.714	.	22.703	25.094	....
Dec.	49.375	54.971	...	22.900	26.373	......
Year	54.811	49.684	.....	25.314	23.675	......

New York quotations cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

Copper	New York		London			
	Electrolytic		Standard		Electrolytic	
	1915	1916	1915	1916	1915	1916
Jan.	13.641	24.008	60.756	88.083	65.719	116.167
Feb	14.394	26.440	63.494	102.667	*	133.167
Mar.	14.787	26.310	66.152	107.714	*	136.000
April	16.811	27.895	75.096	124.319	*	137.389
May	18.506	28.625	77.600	135.457	*	152.522
June	19.477	26.601	82.574	112.432	95.333	137.455
July	18.796	23.865	76.011	95.119	91.409	125.500
Aug.	16.941	26.120	68.673	110.283	82.333	126.304
Sept	17.502	26.855	68.915	113.905	85.250	134.071
Oct	17.686	27.193	72.601	122.750	88.000	142.523
Nov.	18.627	......	77.744	..	93.273	
Dec.	20.133	......	80.773	..	100.430	....
Year	17.275	......	72.532	...	...	....

Tin	New York		London	
	1915	1916	1915	1916
January	34.260	41.825	156.550	175.548
February	37.415	42.717	176.925	181.107
March	48.426	50.741	180.141	193.609
April	47.884	51.230	166.225	199.736
May	38.790	49.125	162.675	196.511
June	40.288	42.231	167.636	179.466
July	37.423	38.510	167.080	168.357
August	34.389	38.565	151.440	169.870
September	33.125	38.830	152.625	171.345
October	33.080	41.241	151.554	179.307
November	39.224	...	167.670	..
December	38.779	....	167.000	....
Av. year	38.590	......	163.960	......

Lead	New York		St. Louis		London	
	1915	1916	1915	1916	1915	1916
January	3.729	5.921	3.548	5.826	18.606	31.167
February	3.827	6.246	3.718	6.164	19.122	31.988
March	4.053	7.136	3.997	7.375	21.883	34.440
April	4.221	7.630	4.142	7.655	21.094	34.368
May	4.274	7.463	4.182	7.332	20.347	32.967
June	5.932	6.936	5.836	6.749	25.170	31.011
July	5.659	6.352	5.531	6.185	24.611	28.137
August	4.656	6.244	4.520	6.088	21.946	29.734
September	4.610	6.810	4.490	6.699	23.151	30.786
October	4.600	7.000	4.499	6.898	23.994	30.716
November	5.155	...	5.078	.	26.278	....
December	5.355	...	5.266	...	28.807	......
Year	4.673	......	4.567	...	22.917	......

Spelter	New York		St. Louis		London	
	1915	1916	1915	1916	1915	1916
Jan.	6.386	16.915	6.211	16.745	30.844	89.810
Feb	8.436	18.420	8.255	18.260	39.819	97.762
Mar	8.541	16.846	8.360	16.676	44.141	95.048
April	10.012	16.695	9.837	16.525	49.888	99.056
May	14.781	14.276	14.610	14.106	68.100	94.217
June	21.208	11.752	21.038	11.582	100.614	68.591
July	19.026	8.925	18.856	8.755	97.250	50.750
Aug	12.781	8.730	12.611	8.560	67.786	51.587
Sept	13.440	8.990	13.270	8.820	67.841	52.095
Oct.	12.800	9.829	12.596	9.659	66.536	54.159
Nov.	15.962	.....	15.792	......	88.409	....
Dec	15.391	.....	15.221	......	89.400	..
Year	13.230	......	13.054	.	67.553	..

New York and St. Louis quotations, cents per pound, London, pounds sterling per long ton. * Not reported.

Pig Iron, Pitts.	Bessemer‡		Basic‡		No. 2 Foundry	
	1915	1916	1915	1916	1915	1916
January	$14.59	$21.60	$13.45	$18.78	$13.90	$19.70
February	14.55	21.16	13.45	18.93	13.90	19.51
March	14.55	21.81	13.45	19.20	13.95	19.45
April	14.55	21.65	13.45	18.95	13.95	19.45
May	14.61	21.78	13.60	19.11	13.83	19.58
June	14.70	21.95	13.67	18.95	13.77	19.34
July	14.94	21.95	13.91	18.95	13.68	19.20
August	16.01	21.95	15.31	18.95	14.75	19.25
September	16.86	22.88	15.95	19.58	15.70	19.53
October	16.95	24.61	15.96	21.26	15.80	21.51
November	17.57	.....	16.47	...	17.20	.....
December	19.97	.....	18.44	.....	18.95	....
Year	$15.82	......	$14.76	......	$14.95	

‡ As reported by W. P. Snyder & Co.

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A Sedimentary Magnesite Deposit

By Leroy A. Palmer*

SYNOPSIS—Deposit operated by Rex Plaster Co., near Bissell, Calif., is the only one in United States of known sedimentary origin. It is worked by opencut and by underground stoping, principally by undercutting with picks, very little powder being used. In surface work, including stripping, 25 men and 12 teams produce daily 45 tons of shipping product with less than 14% of silica and lime. Product is graded according to impurities and shipped to Los Angeles for calcining.

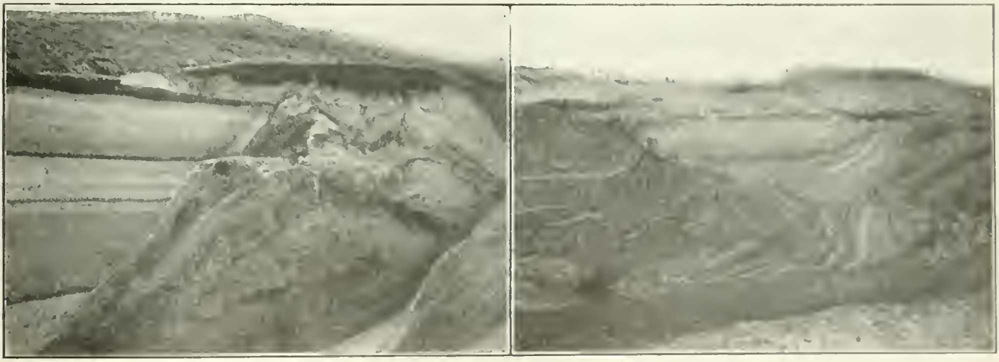
The only commercial magnesite deposit of sedimentary origin, known to exist in the United States, is situated 1 mi. north of Bissell, Calif.,[1] a small station 11 mi. east of Mojave on the main line of the Atchison, Topeka & Santa Fe R.R. It is operated by the Rex Plaster Co., of Los Angeles, Calif. All other deposits of this mineral which have heretofore been exploited to any extent are such as have been formed by the alteration of igneous rocks of high magnesia content, such as the olivines or pyroxenes, by which alteration magnesite, serpentine or some allied rock is usually produced.

The Bissell deposit consists of a series of interstratified beds showing magnesite, clay, sandstone and chert, all more or less magnesian in character and presumably of the same series as certain massive limestones which outcrop near-by. One measured section of 87 in. shows 13 distinct beds, six of which are magnesite varying from 3 to 18 in. in thickness.

The origin of the deposit is not fully understood. In his report on it Hoyt S. Gale[2] advances the theory that this region was once a lake basin containing waters high in sodium carbonate. Springs and streams containing magnesium sulphate in solution drained into the lake, resulting in a reaction by which magnesium carbonate and sodium sulphate were formed and the magnesium carbonate precipitated.

Following the deposition and faulting of the various strata of the magnesite series, the deposit was overlaid unconformably by a more recent deposit of a few feet of sand and gravel, forming the slight "overburden" shown in the illustrations. Subsequent to the formation of the sedimentary beds, they were faulted by a heavy overthrust of almost due east-west strike. This overthrust resulted in highly folding and distorting the beds and was accompanied by many minor reverse faults with throws from a few inches to three or four feet. Along the fault plane the dips are opposed and vary greatly, ranging from 25 to 45°; but from present developments it would appear that they are much flattened at a distance from it. The faulting was also accompanied by lateral flexure.

The faulting brought some of the magnesite strata to the surface, and the deposit has been developed along the fault-plane by an opencut, 1,000 ft. or more in length, with a maximum depth of 30 ft.



Horizontal and distorted beds

Anticline on fault line

VIEWS OF SEDIMENTARY MAGNESITE BEDS NEAR BISSELL, CALIF.

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*Mining engineer, 512 Custom House, San Francisco, Calif.

[1] Located in Kern County, in T. 10 N., R. 11 W., San Bernardino Meridian and Base-Line.

[2] United States Geological Survey, Bulletin 540.

In the 87-in. section referred to, there is a total thickness of 55 in. of magnesite, but this is exceptional. Taking the deposit as a whole and allowing for the overburden, there is a proportion of six or seven parts of waste to one of ore. Most of the ore so far extracted has been from the cut in which the magnesite seams vary in thickness from 2 to 18 in., the average being from 3 to 5 in. The overburden has a maximum thickness of 6 ft. and is loosened by plows and removed by scrapers, leaving the magnesite and associated strata exposed. By these means 14 to 25 cu.yd. of overburden is removed by each team per day, the amount varying according to the length of the haul to the dump.

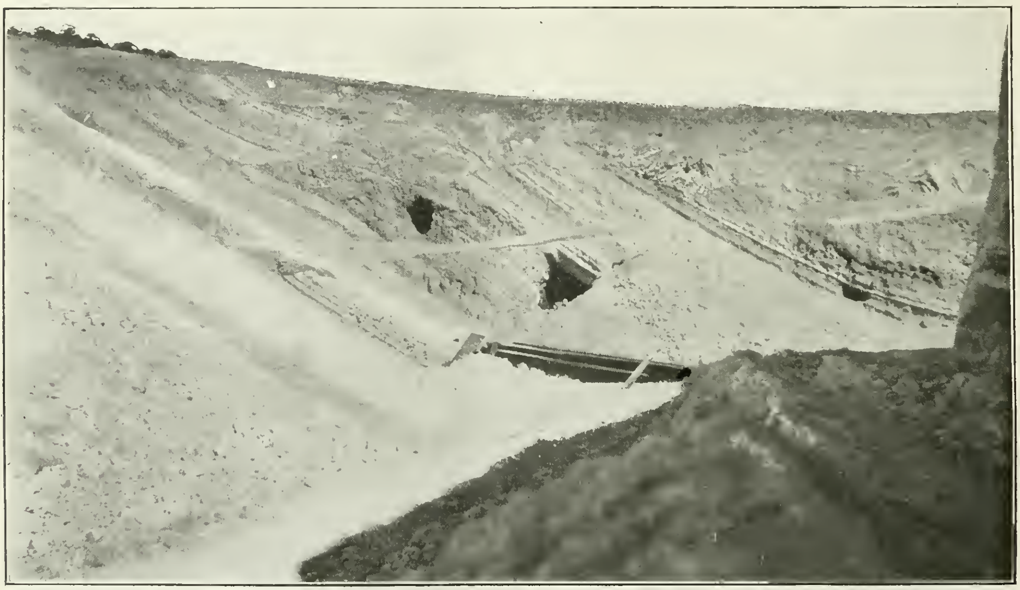
With the overburden stripped, the deposit is opened by benches; working both ways from the fault-plane on the opposed dips. The height of the benches is varied from 10 to 20 ft., as convenient, and they are carried back about 15 ft. horizontally. Powder is used very sparingly, as it is desirable to avoid the mixing of waste and ore as much as possible. The work is carried on by undercutting, somewhat on the order of coal mining, which can be accomplished in the softer strata by the use of a pick alone. The cut is carried under the waste until a seam of good magnesite is reached. The waste above the undercut is then broken by working upward and picking as much as possible, pulled down and wheeled out of the way, leaving the seam of magnesite exposed.

The magnesite is usually found covered by a seam of magnesian clay, thin but such as materially to detract from its quality. This is scraped off by hand, a broad-pointed pick resembling a small adze being used for the purpose. The magnesite seam is then undercut, picked down and the underside cleaned of clay; after which it is ready for shipment.

This would perhaps appear to be a crude and expensive system of mining, but is necessary; as both overburden and waste must be handled with care to insure a clean shipping product. As stated, dips in the cut vary from 25 to 45°., and the amount mined per man will vary with the dip. On the steeper slopes, where the rock slides easily, one man can bring down as much as 25 or 30 tons of ore and waste per day. The proportion of this that can be accounted for as ore will of course vary with the composition of the section being mined. Including stripping, mining and cleaning the magnesite on both sides, 25 men and 12 teams produce 45 tons of shipping product per day; so that, considering the thin seams, the frequent flat dips, the careful breaking and handling necessary, the method is not so expensive as it might seem.

In order to reach those seams lying too deep for opencut work a 4x4-ft. shaft (with a gasoline hoist) has been sunk to a depth of 100 ft., at which point it meets an incline 185 ft. long with an average pitch of 23°. About 550 ft. of drifting and crosscutting has been done from the shaft, and at one point a stope of considerable size was opened, by square-setting, where there were several thick seams close together. It was decided, however, that any method involving the permanent use of timber was too expensive for this deposit, and a modified room-and-pillar system is being installed. The method to be followed is to put up cribbed raises from the main drift and open rooms along the seams, both to the rise and to the dip. All rock, both ore and waste, will be brought down by stripping overhead. The rooms are to be supported by light timbering, consisting of posts and headboards, and will be packed with waste. Surplus waste and ore will be dropped down the raises and hoisted.

The system tentatively adopted is to drive rooms 30 ft. wide with pillars of 8 to 10 ft. The timbers used will be recovered, but it does not appear that any means can be devised for robbing the pillars. If the magnesite seams were thicker, so that the ore could be quickly removed, this



SEDIMENTARY MAGNESITE DEPOSIT OPERATED BY REX PLASTER CO. NEAR BISSELL, KERN COUNTY, CALIF.

might be accomplished and the roof allowed to cave; but with the small proportion of ore that can be recovered and the weak nature of the accompanying strata, it is probable that from the standpoint of safety and economy it will be advisable to lose the pillars.

The product of the mine is shipped to Los Angeles for calcining. It is graded according to the impurities present, of which lime and silica are the most important. The lowest commercial grade acceptable must contain not more than 11% SiO_2 and not more than 3% CaO, after calcination.

SHAFT AND ORE BIN OF REX PLASTER CO. MAGNESITE MINE NEAR BISSELL, CALIF.

Acknowledgment is due P. A. Wickham, superintendent, for assistance in gathering these data.

* * *

Chile Copper Tax

A project has recently been presented to the Chilean Congress by Señores Arturo Prat and Guillermo Subercaseaux for the taxing of copper bars and copper minerals exported from Chile, according to the *West Coast Leader*, Sept. 14, 1916. At present this metal pays no duty.

The projected decree states that copper bars and copper ores will pay an export tax of 1½% ad valorem, when the price of copper in London or New York fluctuates between £60 and £65 per metric ton. When the price flucturates between £65 and £80, it will pay the beforementioned duty plus 10% on the difference between £65 and the total value. When the price fluctuates between £80 and £100, it will pay the taxes mentioned plus 15% on the difference between £80 and the total value. When the value exceeds £100 per metric ton a tax of 20% will be imposed on the amount above the £100. This apparently means that copper, say, at £110 per ton would pay 1½% on the first £65, 10% on the next £15, 15% on the next £20 and 20% on the remaining £10.

Article 2 states that for determining the value of the bars and ores, the president of the republic will fix a tariff in accordance with the scale used in commerce for the sale and purchase of the same products.

Borates, either in a raw state or calcined, are to pay a fiscal tax of one peso gold of 18d. per 100 kg. (220.46 lb.) At the end of two years counting from the promulgation of this law, they are to pay 15 pesos gold of 18d. per metric ton.

Article 4 states that exporters of minerals will be obliged to declare the average grade of their shipments, producing the assay certificates if they are the producers, or the bills of sale if they are the buyers.

In case of doubt as to the grade the customhouse authorities can order a new assay. In case of a false declaration of assay, the exporter will be subject to a fine of 10% of the duty, which corresponds to the duty on the copper in bars.

Testing Refractory Firebrick*

Tests should be made on bricks taken at random and not on specially prepared test pieces. They must be conducted at temperatures bearing some relationship to those in commercial furnaces; for example, the upper part of a blast furnace is about 260° C., while 1,350° C. is above the melting point of cast iron and is in other ways a suitable temperature at which to make tests. The following tests have been developed mainly with reference to bricks to be used in iron and steel plants, but may be modified so as to be applicable to almost any conditions of service:

IMPACT, ABRASION AND SPALLING TESTS

Before making the impact test, the brick is heated to 260° C. in one hour and kept at that temperature for three hours. A steel ball of 2½ in. diameter, weighing 2.31 lb., is dropped on the end of the brick from a height of 2 in., by 1 in., and so on, until the brick shows a fracture radiating one inch or more from the point of contact. The ball falls between two vertical and parallel angle irons, so that it may travel freely with not more than ¼ in. clearance. The ends of the bricks are ground parallel and at right angles to the angle irons. The brick is supported on a steel block 6½x15x12 in.

To make the abrasion test, the brick is heated slowly to 1,350° C., and kept at that temperature for three hours. One end is then pressed under a constant pressure of 10 lb. per sq.in. for exactly five minutes against a vertical carborundum wheel of 18 in. diameter with 2-in. face, grit 16, grade J, revolving at a surface speed of 1,610 ft. per min. The depth of the cut is regarded as a measure of the abrasion. Some bricks give different results when both ends are tested.

To make the spalling test, the brick is dried thoroughly, weighed and placed in the doorway or wall of a furnace so that one end is exposed for one hour to a temperature of 1,350° C., this end being flush with the wall. The brick is then plunged to a depth of 4 in. in two gallons of water for three minutes. After heating and cooling in this way ten times, the bricks are dried at 100° C. for at least five hours, all particles that can be easily broken off with the fingers are removed, and the bricks are reweighed. The percentage loss in the weight of the brick is regarded as a measure of the spalling. This test is applicable only to fireclay bricks.

SLAGGING, COMPRESSION AND GRAVITY TEST

In making the slagging test, the use of kaolin rings to confine the slag was unsatisfactory, and it was found necessary to drill a circular cavity of 2½ in. diameter and ½ in. deep at the sides, in the brick, the cutting edges of the drill inclosing an angle of 150°. The brick is heated to 1,350° C., 35 grams of slag ground to pass a 10-mesh sieve is placed in the cavity, and the heating is continued for two hours. The brick is allowed to cool and is then sawn through the center of the drilled cavity by means of a carborundum wheel ⅛ in. thick, grit 16. The area penetrated by the slag is measured with a planimeter.

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*Excerpts from a paper by C. E. Nesbitt and M. L. Bell presented to the American Society for Testing Materials, June, 1916.

For making the compression test, the brick is heated slowly at 1,350° C., and is then maintained at that temperature for three hours; it is removed from the furnace, and a 2½-in. steel ball forced into it by means of a weighted lever of the second order consisting of a 4-in. I-beam 10 ft. long. The brick is placed 6 in. from the fulcrum, and a spherical depression in the beam marks the location of the ball. The lever alone applies a pressure of 850 lb. on the ball, and sand is run into a bucket at the end of the lever at the rate of 25 lb. per second so as to produce a total load of 1,600 lb. on the ball. After five minutes the pressure is released, the brick removed and allowed to cool. The depth of the impression is measured with a micrometer gage when the brick is cold.

Apparent specific gravity is determined by weighing and measuring the brick, and not by suspension in water. It depends partly on the percentage of moisture in the material used for making the bricks, and on the pressure employed in shaping them. Power-pressing up to 1,500 lb. per sq-in. improves the quality of fireclay bricks.

Expansion, contraction and fusibility are determined by the usual methods.

Tungsten Ore in Peru

A recent consular report from Peru says that the high prices prevailing have caused much interest in the working of properties containing ores of tungsten and other rare metals. Prior to 1910 no tungsten was exported from Peru. In that year 12 tons was shipped. The demand has rapidly grown until at present there are shipments of about 345 tons a year, mostly to the United States and England. During the first three months of 1916 about 70 tons of concentrates, running from 58 to 56% WO_3, was exported from the consular district of Salaverry, and it is not improbable should the demand continue and high prices prevail, that this quantity will be increased.

Tungsten was first discovered associated with gold in a mine in Lircay, Ayacucho, and later on in considerable quantities in the mountain region of Pelagatos, in the province of Santiago de Chuco, where there exist today three or four valuable mines. The mineral found in Lircay is tungstate of iron and manganese, and that found in the north is principally hubnerite (tungstate of manganese). The rapid increase in the utilization of this mineral in the manufacture of war material and tools has given it an enormous value at the present time. The production for 1916, should the war continue, will probably be at least 50% higher than for the preceding year. The French government is at present manifesting interest in these mines. Recently Colonel Dogny, of the French Army, visited the tungsten-producing regions of Peru in the interest of the factories of Creusot, belonging to Schneider & Co., France. In December, 1915, there were rumors to the effect that large deposits of tungsten were discovered in the Puno region, and samples submitted to the engineers at Lima proved it to be wolframite of good quality. Nearly all the tungsten exported at the present time is shipped to the United States.

The three principal mines are owned by Peruvians who have at present a contract for a few months with a German house of Lima, which firm ships this ore largely to a banking firm of New York.

The Mineral Production of Spain for 1915

In *Revista Minera* of Sept. 24, 1916, the *Consejo de Mineria* (Department of Mines) is congratulated for making public at an early date the statistical report on mining and metallurgy of Spain for 1915. With the exception of some of the nonmetallic products of lesser importance, the mineral production for 1915 is tabulated here, the items being rearranged in the order of the value of the total output of each substance, at the mine where produced.

Substance	Metric Tons
Bituminous coal......	4,135,919.000
Lead (ore)......	285,265.796
Iron (ore).	5,617,839.000
Iron pyrite (cupriferous).	1,464,349.716
Iron pyrite.	730,568.000
Zinc (ore).	81,921.851
Anthracite coal......	222,621.000
Mercury (presumably ore)	20,717.000
Lignite	328.213.000
Copper (ore)....	23,067.871
Salt.	305.035.000
Manganese (ore)..	14,328.000
Tungsten (presumably concentrates).	511 300
Argentiferous lead (presumably ore).	2,934.639
Sulphur (presumably crude rock)....	28,937.000
Copper pyrites.. .	2,001.430
Tin (presumably concentrates)....	102.400
Silver (presumably selected ore).	210.398
Barytes..	4,218.000
Asphalt....	4,521.000
Antimony (presumably ore)........	300.000
Bismuth (presumably concentrates)..	16.805
Kaolin...	4.700.000
Wulfenite (presumably concentrates)	26.000
Fluorspar........	370.000
Asbestos.......	39.000
Magnesite....	1,400 000
Graphite.....	30.000

John Fritz Medal Presentation

The John Fritz Medal, awarded to Dr. Elihu Thomson in January, 1916, will be presented at a meeting to be held in Boston, Dec. 8, 1916. The presentation will take place in the Central Lecture Hall of the new buildings of the Massachusetts Institute of Technology. The members of the four national engineering societies and others interested, including ladies, are invited to be present.

The John Fritz Medal is awarded from time to time for notable scientific or industrial achievement and was provided for in a fund subscribed in memory of the great engineering pioneer, John Fritz. The award is made by a permanent board composed of four members from each of the four national engineering societies. Dr. Thomson was awarded the medal "for achievements in electrical inventions, in electrical engineering, in industrial development and in scientific research."

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Diatomaceous Earth, which is made up of remains of minute aquatic plants, is a light earthy material resembling chalk or clay. The hardness, the minute size and the angular shape of its grains make it an excellent metal-polishing agent, and heretofore it has been largely used as an abrasive in the form of polishing powders and scouring soaps. Of late, however, according to the United States Geological Survey, the uses of diatomaceous earth have been considerably extended. It is used by sugar refiners for filtering or clarifying; as an insulating packing material for safes, steam pipes and boilers; and as a fireproof building material. In the United States it is used in the manufacture of records for talking machines. In Europe it has been used in preparing artificial fertilizers and in the manufacture of water glass, cements, artificial stone, paper, sealing wax, fireworks, papier-mâché and other articles. A total of 4,593 tons of diatomaceous earth was produced and sold in the United States in 1915.

The Valuation of Bedded Mineral Land

By F. A. Grignon*

SYNOPSIS—Formulas and examples are given for the valuation of bedded mineral deposits, based on one of four possible conditions: (a) where mineral is being used; (b) mineral not to be used for a year; (c) mineral being used and land has surface value; (d) mineral not being used, land having surface value.

The value of a mineral deposit is usually determined more or less by the law of supply and demand or by the judgment of one or more parties. At times when a company has needed a particular piece of land to keep its business in operation, the seller has demanded a price that was limited only by his judgment of the willingness and ability of the company to pay it. The object of this article is to furnish the operators of any mineral deposit a basis on which to figure the value of the deposit when buying or selling or when figuring the value of their own holdings for accounting purposes.

There are four basic conditions affecting the value of land containing a mineral deposit, each one being represented by an algebraic formula. When the mineral is being used, the following formula is applicable:

$$A = \frac{2BCD}{2 + E + EF} \qquad (1)$$

When the mineral is not being used and its use will not begin this year, use the following formula:

$$G = \frac{2BCD}{(1 + EH)(2 + E + EF)} \qquad (2)$$

When the mineral is being used and the surface land has a value for farming or other purpose, use the following formula for the surface-land value:

$$J = \frac{(BKE)(F + 1)}{2 + E + EF} \qquad (3)$$

When the mineral is not being used and its use will not begin this year, and when the surface land has a value for farming or other purpose, use the following formula for the surface-land value:

$$L = \frac{(BKE)(F + 1)}{(2 + E + EF)(1 + EH)} + \frac{BKEH}{1 + EH} \qquad (4)$$

Evidently when it is desired to find the total value of the land which has a surface value and contains the mineral deposit, we must add together A and G or J and L, as the case may be.

In all these formulas,

A = Present value of the mineral deposit if now being used or if its use will be started in the present year;

B = Number of acres underlaid with the mineral;

C = Average tonnage per acre estimated from the average depth of the deposit;

D = The advantageous price per ton (this is the price per ton that the mineral is worth and must be figured as a decimal of a dollar);

E = Interest due on invested capital (when this is 6% it must be entered as 0.06),

F = Number of years the deposit will last if used at a uniform rate, which is usually estimated.

G = Present value of the deposit if it is not being used and if its use will not be started in the present year;

H = Number of years it is thought the deposit will lie idle or the number of years that will elapse before the continuous operation of mining the mineral will be started (when the term represented by H is concluded, the term represented by F begins);

J = Surface-land value when used for farming or other purpose on a piece of land containing a mineral deposit that is being used or will be used this year (J represents the surface-land value when A represents the value of the mineral deposit);

K = Surface-land value per acre for farming or other purpose if undisturbed by mining operations;

L = Surface-land value when used for farming or other purpose on a piece of land which contains a mineral deposit that is not being mined and that will not be mined this year (L represents the surface-land value when G represents the value of the mineral deposit).

Formulas (1) and (2) are based on the fact that if every year there should be deposited in a sinking fund an amount equal to the value of D in each instance multiplied by the tonnage taken out, the sinking fund at the end of the term represented by F would be large enough to repay the total value represented by the formulas and interest on the value of the mineral remaining unused each year.

Formulas (3) and (4) are based on the same principle except that the amount supposed to be deposited in the sinking fund would be equal to the value of E multiplied by the value of the surface land undisturbed by the mining operations each year. The value per acre of the land undisturbed is to be found by dividing the original value as found by the formulas by the original number of acres.

The Determination of "D"

The surface-land values as found by these formulas are based on the assumption that when the mineral is mined, the surface land will be rendered unfit for any further use. In the very few cases where the surface would not be disturbed or where the land would be of any later use, these values will not govern. These isolated cases can be covered by adding to the present value of the land as determined by ordinary methods, the value of the mineral deposit as determined by formulas (1) and (2).

We must be very careful in figuring the value of D in our formulas. An operator can determine his value of D by answering the question, "How much more per ton can I afford to pay for this piece of land containing a mineral deposit than for another?"

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*Terra Cotta Tile Co., Ottawa, Ill.

All natural but very few artificial conditions have an effect on the value of D. Of course, marketing price, depth of vein, the amount of dead material that must be handled, the depth of stripping, drainage, propping and the height or distance of haulage must all be taken into consideration. In the case of ores the percentage of mineral content will have a bearing on the value of D.

Under only a few conditions should any mining, hoisting, screening, handling or loading machinery or equipment be taken into account. Equipment of this kind saves money for the operator, but this saving is a credit on the value of the equipment and shows good business judgment on the part of the operator. It does not in any way affect the value of the mineral deposit in the ground. Of course if the machinery equipment is owned by the same firm or individual as the deposit itself and the entire land and equipment is leased, the equipment has some effect on the value of the deposit from the standpoint of the lessee.

If a competitor is mining a mineral with poor equipment, it would seem that the value of D ought to be figured at the difference in the cost of operation of the two mines. This is not true. The value of D is really the advantage in the cost of operation which one mine enjoys over another if their equipment is equal or the advantage which it would enjoy if their equipment were equal.

Possibly Jones has a mine with modern equipment and can get his mineral out for five cents per ton less than Smith, who has poor equipment. If Smith were to put in modern equipment, he would be able to get his mineral out for the same amount as Jones. Evidently the value of D for the mine operated by Jones is not five cents. His difference in cost of operation is a credit to his equipment and has no effect on the value of the mineral deposit.

A deposit enjoying good conditions that are hard to duplicate or one producing a large percentage of pure mineral from the ore taken out will have a higher value for D than one not enjoying these good conditions. For any mine that is in operation we would suggest a minimum value for D equal to 1% of the selling price of the mineral. Even though the cost of operation is greater than that of a competitive mine, the assurance and satisfaction of working a vein of ore or mineral so as to show at least some profit is worth that much.

Many land owners will find by these formulas that their supposedly valuable vein of mineral is practically worthless, because the high cost of operation will not justify a value greater than zero for D.

If a firm has an old lease on a royalty of 2½c. a ton and since that lease was signed the price on surrounding land has increased to 5c. per ton, the value of D for the lessee is 2½c. provided other conditions are equal. The owner of a piece of land containing a mineral deposit which he has leased will figure his royalty price as the value of D for his holdings.

Using formula (1), suppose a mine operator owns 50 acres of land and that the mineral averages 6 ft. in thickness. Minerals vary a great deal in weight, but for our purpose we will use 200 lb. per cu.ft. An acre contains 43,560 sq.ft. We have therefore 26,136 tons per acre. We will suppose that this will all be mined. In case some must be left for pillars, the operator would have to deduct an estimated amount from this item. Suppose D equals 5c. per ton. In the case of an ore D would be worth more. Suppose that the capacity of the mine has been 100 tons per day for 300 days in the year. This will make an average yearly output of 30,000 tons. The mineral will then last 43.6 yr. This will be the value of F. We will figure E as 6%. Therefore

$$A = \frac{2 \times 50 \times 26{,}136 \times 0.05}{2 + 0.06 + (0.06 \times 43.6)} = \frac{130{,}680}{4.676} = \$27{,}946.96$$

$$= \$558.94 \textit{ per acre}$$

Suppose that adjoining this tract of 50 acres there is another piece of 25 acres of identical mineral. What can the operator afford to pay for this piece? Assume that the same output will be maintained and the second piece will not be used at all until the first is all mined. We will use formula (2), and H will equal 43.6

$$G = \frac{2 \times 25 \times 26{,}136 \times 0.05}{[1 + (0.06 \times 43.6)][2 + 0.06 + (0.06 \times 21.8)]}$$

$$= \frac{65{,}340}{3.616 \times 3.368} = \frac{65{,}340}{12.178688} = \$5{,}365.11,$$

$$\textit{or } \$214.60 \textit{ per acre}$$

Suppose that the operator buys this second piece for \$5,365.11. Evidently his total mineral value would be \$27,946.96 + \$5,365.11 or \$33,312.07. This equals \$444.16 per acre.

To check our figures suppose we consider the 75 acres as belonging to one piece. We will then use formula (1):

$$A = \frac{2 \times 75 \times 26{,}136 \times 0.05}{2 + 0.06 + (0.06 \times 65.4)} = \frac{196{,}020}{5.984}$$

$$= \$32{,}757.35, \textit{ or } \$436.76 \textit{ per acre}$$

A discrepancy appears due to figuring the interest involved, but as it amounts to only \$7.40 per acre, or a little more than 1.5%, we can be satisfied.

A Deposit Having Surface and Mineral Value

Formulas (1) and (2) can be used just the same for leased land as for land that is owned outright. In the case of leased land the lessor can use the price per ton which he receives as his value of D and the lessee can figure his value of D according to conditions. If the royalty is lower than an adjoining piece, the lessee can figure accordingly. Naturally, the lessor's value of D and the lessee's value of D when added together ought to give the value of D that would be used if the owner of the land were also the operator.

We must still consider the surface-land value. Take the 50 acres that we figured on. There is one new value to determine; namely, K. Suppose it equals \$100. Then formula (3) will be

$$J = \frac{(50 \times 100 \times 0.06)(43.6 + 1)}{2 + 0.06 \times (0.06 \times 43.6)} = \frac{13{,}380}{4.676}$$

$$= \$2{,}861.42, \textit{ or } \$57.26 \textit{ per acre}$$

Take the second piece of 25 acres, from which the mineral will not be mined until all the mineral is taken out of the first 50 acres. We will use formula (4):

$$L = \frac{(25 \times 100 \times 0.06)(21.8 + 1)}{[2 + 0.06 + (0.06 \times 21.8)][1 + (0.06 \times 43.6)]}$$

$$+ \frac{25 \times 100 \times 0.06 \times 43.6}{1 + (0.06 \times 43.6)} = \frac{150 \times 22.8}{3.368 \times 3.616} + \frac{6{,}540}{3.616}$$

$$= \frac{3{,}420}{12.178688} + 1{,}808.63 = \$280.82 + 1{,}808.63$$

$$= \$2{,}089.45, \textit{ or } \$83.58 \textit{ per acre}$$

Adding together the two results, the total value of the surface land of the two pieces is found to be $2,861.42 + $2,089.45 = $4,950.87. This equals $66.01 per acre.

Again, to check our formulas suppose that after the operator has bought the second piece of land, we figure the total combined value on the basis of formula (3).

$$J = \frac{(75 \times 100 \times 0.06)(65.4 + 1)}{2 + 0.06 + (0.06 \times 65.4)} = \frac{29,880}{5.984}$$

$$= \$4,993.32, \text{ or } \$66.58 \text{ per acre}$$

A discrepancy of $0.57 per acre appears the same as when combining formulas (1) and (2). As it amounts to less than 1%, we can disregard it.

To show how our formulas will work out, take the first case, where it was found that A for a certain piece of 50 acres containing a mineral deposit equaled $27,946.96. Each yearly depreciation will be $610.99. The interest on invested capital the first year will be $1,676.82. On account of the depreciation the interest the second year will be $1,638.36 and the third year $1,599.90. The interest for the last 0.6 of the year will be $2.30. If we add together all these interest items, we will find the total to be $37,393.04 plus the total depreciation, $27,946.96, and the sum equal to the income necessary to prove our formula, $65,340.

The tonnage per acre (26,136) multiplied by the number of acres (50) multiplied by the value of D (5c.) gives the total income for the entire period. This is $65,130, which is the same total as the interest and depreciation added together.

This proves the statement previously made, that if the yearly income were placed in a sinking fund, at the end of the term, the sinking fund would be large enough to repay the original investment and interest on the capital remaining invested each year. The other formulas can be proved in the same way by actual figures.

The conditions under which mineral land is owned and operated are too varied to enumerate here. We have, however, shown how to determine the various values separately, and each mine operator or owner can combine the values to suit his conditions.

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Risk Assumed by Miners

By A. L. H. Street*

Applying the general legal principle that an employee assumes all risks of injury inhering in the nature of work carried on, after the employer has taken all reasonable measures to make the occupation safe, the United States Circuit Court of Appeals for the Ninth Circuit holds in the case of Macaulay vs. Alaska Gastineau Mining Co., 234 Federal Reporter, 611, that a miner engaged in assisting in driving an uplift in a mine, the work being prosecuted in a good and workmanlike manner, assumed the risk of being injured through falling of blasted portions of rock in the process of their removal after blasting.

⁂

Aluminum Coins Are to be Used in France for Local Circulation—We have before referred to the replacement of copper coins in Germany by iron pieces. Samuel Montagu & Co. of London say that on the initiative of the Chamber of Commerce of Marseilles, France, aluminum disks bearing the Arms of Marseilles have been authorized recently for local circulation. The issue comprises 75,000 pieces of 10 centimes and 25,000 of 5 centimes.

California Mineral Production

The total value of 49 metallic and nonmetallic minerals produced in 56 counties in California in 1915 amounted to $96,663,369, as shown by statistical bulletin No. 71, issued by Fletcher Hamilton, state mineralogist, and compiled by Walter W. Bradley, mining statistician of the State Mining Bureau. This is an increase of $3,348,596 over the total in 1914, despite a decrease in petroleum of $3,983,272 and decreases in some other minerals. Copper increased $3,111,492; gold, $1,788,800; zinc, $1,597,002; tungsten, $824,892; quicksilver, $599,603. There were increases also in the value of antimony, chrome, lead, manganese, platinum, silver, borax, potash and magnesite. There was a decrease in the total value of both structural and industrial materials, though increases are shown in several of the minerals in these two groups.

Antimony ore amounting to 510 tons valued at $35,666 was produced in 1915, the first production since 1901. In 11 years beginning with 1887 the records show a total yield of 680 tons valued at $79,805. Borax, chrome and magnesite are produced in no other states. The total of saline products, including borax, nitrates, potash, salt and soda, decreased from $2,182,909 in 1914 to $2,135,134 in 1915, but there was an increase in the production of borax from $1,483,500 to $1,663,521 and in potash from $160 to $19,391. The production of potash in 1915 amounted to 1,076 tons, being in part extraction from kelp and part from dust collected in cement mills by the Cottrell process. The plant under construction by the American Trona Corporation, at Searles Lake, was not completed until October, 1916. Experiments were in progress in 1915-16 in the extraction of potash from the bitterns of Owens Lake. The prospects for large production of potash from these two saline bodies in 1916 are encouraging. Chrome and magnesite increased in both amount and value. Chrome was produced principally in Fresno, Shasta and Tuolumne Counties, the total amounting to 3,725 tons valued at $38,044, being more than twice the tonnage and four times the value of the product in 1914. Magnesite increased from 11,438 tons, valued at $111,380 to 30,721 tons valued at $283,401. The product is credited to Tulare, Santa Clara, Sonoma, Napa, Fresno and Kern Counties.

Copper, silver, lead, quicksilver, zinc and tungsten were particularly affected by the European War, showing in each metal except lead a large increase in amount as well as in value. Copper was, as usual, produced chiefly in Shasta County, credited with 30,828,917 lb. Calaveras produced 1,031,149; Plumas, 3,164,496; San Bernardino, 209,140; Inyo, 154,722 lb. Fifteen other counties produced varying amounts under 100,000 lb. The total for the state was 40,968,966 lb., valued at $7,169,567. Silver advanced in price as well as in the number of fine ounces produced, making a total of $851,429, an increase of $37,191 over 1914. Lead production amounted to a total of 4,796,299 lb., valued at $225,426, an increase of only 98,899 lb. in amount, but of $12,288 in value, representing an advance in average price from 3.9c. to 4.7c. Zinc showed the greatest stride in amount and value, the total production being 13,043,411 lb., valued at $1,617,383, an increase over 1914 of 12,643,770 lb. and $1,597,002. Shasta County is credited with 8,378,101 lb.; Inyo County, 4,625,162; San Bernardino County, [illegible] lb. Silver was produced chiefly in Shasta and [illegible] as a byproduct associated with copper, lead, zinc and gold ores; also produced in 28 other counties. Lead production came chiefly from Inyo County, followed by Shasta, San Bernardino and Kern. Tungsten made the most sensational advance in price and the development of new deposits of any of the minerals affected by the war. Prior to 1915 nearly all the production had come from San Bernardino County, produced by one operator. In the last half of the year production extended to Kern and Nevada Counties. The total value of ore and concentrate shipped increased from $180,575 in 1914 to $1,005,467 in 1915.

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*Attorney at law, 829 Security Building, Minneapolis, Minn.

Quicksilver production in California amounts to approximately 80% of the total production in the United States. In 1915 the state produced 14,199 flasks valued at $1,157,449, an increase over 1914 of 2,826 flasks and more than a half million dollars in value. The price ranged from $51.90 in January to $123 in December. The average price for the year, based on actual sales reported to the Mining Bureau, was $81.52; the average quotation price was $85.80. The product came from 12 counties. San Benito produced 6,291 flasks; Santa Clara, 4,386; San Luis Obispo, 1,473; Napa, 507; Lake, 492; Sonoma, 159; Kings, Monterey, Santa Barbara, Solano, Stanislaus and Yolo combined produced 891 flasks.

Manganese has been produced in California continuously since 1887 with the exception of 1905, varying in amounts from 1,500 tons to 1 ton. The production in 1914 was 150 tons, valued at $1,500. In 1915 the amount was increased to 4,013 tons, ranging in price from $12 to $18 for low grades and from $50 to $60 for chemical grades. The total value of the product was $49,098. The greater portion of the ore was low-grade, used chiefly in the manufacture of ferro-manganese by electric-furnace reduction; and was produced in Alameda, Glenn, Mendocino, San Bernardino and San Joaquin Counties.

PRODUCTION OF GOLD AND PLATINUM

Gold was produced in 30 counties in 1915, a total of $22,442,296. California still maintains the lead of the gold-producing states. The principal counties contributing to the yield of gold are: Amador, $3,894,125; Nevada, $3,446,722; Yuba, $2,703.710; Sacramento, $2,131,813; Shasta, $1,120,848; Tuolumne, $1,058,103 Amador advanced to first place, which was held by Nevada County in 1914. Sacramento and Yuba gold is produced almost wholly from dredge placers.

Platinum yield increased from 330 oz. in 1914 to 667 oz. in 1915. This amount has been exceeded only once in the 28 years recorded by the Mining Bureau; in 1908 the yield was 706 oz. The large output in 1915 was chiefly due to improved methods in dredge mining.

Petroleum and other fuels, including natural gas and coal, combined production, amount to approximately 50% of the total mineral production of the state. Coal is not an important product, but natural gas is coming into prominence, increasing in 1915 over 1914 $657,010, and showing a total of $1,706,480, though this figure is largely estimated. The value of petroleum amounted to a total of $43,503,837, and although this is a decrease of nearly $4,000,000, it is not an indication of diminution in the productive capacity of the fields or decline in price, but is due to the closing of the South American markets, suits by the Federal Government and the elimination of gushers. The decrease in total output amounted to 11,735,287 bbl. The production of commercial petroleum in 1915 reported by 363 producers amounted to 88,240,620 bbl., and 2,906,000 bbl. was consumed in the fields, making a total gross output of 91,146,620 bbl. The average price in all fields in 1915 was 47.9c. per bbl. and 46.1c. in 1914. The highest average price, 85.5c., was paid in Ventura field and the lowest average price, 42.3c. in Kern field. The Ventura price was a decrease from 1914 of 19.5c., and the Kern price was an increase of 1.4c. per bbl. Five large refining and marketing companies produced 33% of the commercial oil; several large concerns, such as the railroads, which are large consumers, produced 16%; the remaining 51% is credited to small producers.

The chapter of the bulletin devoted to production by counties includes all but two of the counties of the state. Alpine contains gold and silver, but no production has been recorded since 1913. Sutter is not a mineral county. The principal mineral-producing counties in the order of value of production and including the predominant minerals in each, are: Kern, $22,335,184, petroleum; Shasta, $8,350.153, copper; Fresno, $8,152,300, petroleum; Orange, $6,617,112, petroleum; Los Angeles, $4,168,612, petroleum; Amador, $4,063,762, gold; Santa Barbara, $3,984,966, petroleum; Nevada, $3,492,946, gold; Yuba, $2,862,430, gold; Inyo, $2,771,042 borax and zinc; San Bernardino, $2,674,042, tungsten and gold; Sacramento, $2,562,281, gold; Calaveras, $2,161,893, gold and copper; Tuolumne, $1,171,438, gold; Butte, $1,622,245, gold. The following counties produced over $1,000,000 each; Santa Cruz, Solano, Riverside, Contra Costa, cement predominating.

The bulletin also contains all the mining laws of the state and maps of counties, singly or in groups. Altogether it is an improvement on the statistical bulletins of former years. The gold, silver and platinum production is taken from the report of Charles G. Yale, statistician of the United States Geological Survey.

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Accidents in Cement Plants

The Bureau of Accident Prevention of the Portland Cement Association, Chicago, has issued its report for the year 1915, covering accident and mortality statistics over a period of three years. Substantially the report shows a reduction in loss due to accidents and argues the advantage of accident-statistic work as an aid to accident reduction.

Tabulations show that the commonest causes of accidents and falling objects, flying material and breaking or slipping of machines or parts. Regarded from the standpoint of the process involved, 25% of all the accidents occur in the quarries and the other 75% is distributed throughout the other stages in the process of cement manufacture. In the coal-grinding department the number of accidents is small, but the time lost is high, showing their severity. Recasting of the statistics show that Fridays and Mondays are the worst days for accidents, that 9 to 10 a.m. and 2 to 3 p.m. are the worst hours. Of the injured, 61% spoke good English and only 9% spoke no English.

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Magnesite Production in Greece was 117,430 metric tons in 1914, and 133,858 tons in 1915. Exports in 1915 were 92,661 tons raw and 18,726 tons calcined; 111,387 tons in all. Of these exports 33,641 tons raw and 6,318 tons calcined—39,959 tons in all—went to the United States.

What Can Uniform Mining Laws Hope to Accomplish?*

By Van. H. Manning†

SYNOPSIS—A comprehensive statement showing the present lack of uniformity in the mining laws of the United States and of the individual states. The disadvantages of this condition are indicated, and finally a statement is made of the advantage accruing from uniform mining legislation. The proposed code can best be made by coöperation on the part of the Federal Government, state authorities and mining societies.

To make plain the scope of my remarks, I shall define the term "mining legislation." This term I apply to all legislation relating to the acquisition and transfer of mines and mineral lands, to safety and health conditions and to the prevention of waste and the increase of efficiency in the utilization of ores, metals and mineral substances. In thus applying the term, I may seem to broaden my theme unduly, but my reasons for doing so will be evident when the ultimate aim of such legislation is considered. The mining industry is not only burdened with much confusing legislation, municipal, state and national, but it also suffers from a lack of legislation essential to assuring the wise and efficient use of our mineral resources. As an example I may cite the multiplicity of regulations governing the transportation, storage and sale of kerosene and gasoline and the utter lack in many states of effective legislation for preventing enormous waste of petroleum and natural gas. Also, the uncertainties of our Federal mineral-land law and the lack in many states of adequate laws for protecting the safety and health of metal miners are noticeable.

In discussing what may be accomplished by uniform mining legislation, I shall consider the matter with regard, first, to efficiency and, second, to better health and greater safety. Also, I shall give especial attention to the work of the Bureau of Mines, which has "Safety and Efficiency" as its motto, and to the efforts of the Department of the Interior.

WORK OF THE BUREAU OF MINES

As Director of the Bureau of Mines, Dr. Joseph A. Holmes called attention to the lack of uniformity in the mining laws of the different states and the desirability of uniform legislation. The matter was ever before him in planning the investigations of the bureau, and he constantly sought the coöperation of engineering societies and of other organizations in the endeavor to aid the enactment of better laws. One of the fruits of his efforts was the publication of a proposed code of regulations for metal mines. This code was prepared by a committee of five distinguished mining engineers—John Hays Hammond, W. R. Ingalls, James Douglas, J. Parke Channing and J. R. Finlay—and represented not only the earnest thought of these gentlemen, but the suggestions and criticisms offered by members of the Mining and Metallurgical Society of America, the American Institute of Mining Engineers and other organizations. These rules provide for a thorough system of mine inspection and for safeguarding the miner. Though their chief aim is safety, yet they are intended to contribute to greater efficiency in mining methods.

In efforts to protect miners from the hazard occasioned by oil and gas wells drilled through coal beds, the Bureau of Mines was instrumental in having a conference of coal mine and oil-well operators and state geologists held in Pittsburgh in February, 1913. At this conference desirable changes in well-drilling practice were discussed, as well as a proposed code setting forth the duties of oil and gas inspectors and the precautions that should be observed in drilling and plugging wells.

Engineers of the bureau, in cooperation with members of the American Society of Electrical Engineers and other interested parties, have recently prepared a draft of a proposed law governing the installation of electrical apparatus in coal mines. It embodies the results of investigations dealing with the use of electricity for light and power, and the establishment of effective safeguards against explosions or fires from sparks, flashes or arcs, and against shock from contact with live wires or with equipment accidentally charged. A set of regulations prepared some years ago by the Bureau of Mines in coöperation with other interested parties was bodily incorporated in the mining code of the State of Pennsylvania.

REVISION OF FEDERAL MINING-LAND LAWS

From time to time a demand has been heard for a revision of our Federal mining-land laws that would clarify the vague, conflicting or contradictory provisions of the present code, or for the enactment of a new code that would embody the present needs of the mining industry. This demand has been ably voiced by eminent engineers and members of the bar, who have called attention to the burdens inflicted on innocent persons through the provisions of the law of the apex, and of tunnel-site locations.

The Mining and Metallurgical Society has taken a prominent part in urging the need of a better mining-land code and in enlisting the coöperation of national and state organizations and of Government bureaus. On Dec. 6, 1915, this society called a meeting in Washington, D. C., in which representatives of these organizations, of the National Government and of many operating mines collaborated. The resolutions adopted at that meeting called for a thorough revision of the mining law of the United States so as to coördinate and harmonize its various provisions; recommended the creation by Congress of a Government commission, appointed by the President, to consider and investigate the different questions and issues and to make recommendations in regard to the proposed revision. The Department of the Interior and the Federal Bureau of Mines have favored a revision of the mining-land laws that will eliminate uncertainties, conflicts and contradictions, lessen the chances of litigation over mining titles and thus relieve the industry of unnecessary burdens. The mining code of the Federal Government should exemplify simplicity, clarity and directness

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*Address delivered before the American Mining Congress, Nov. 13, 1916.

†Director, United States Bureau of Mines.

It should serve as a basis for laws governing the acquisition and transfer of mineral lands under state control, and thus should contribute to national efficiency.

The need of wide coöperation in obtaining satisfactory mining laws has been recognized by the Secretary of the Interior, who invited all state mine inspectors and state compensation commissioners to attend a conference in Washington in February, 1916. At this convention one of the principal subjects discussed was the need of uniformity in obtaining and presenting mining statistics. Under present conditions mine operators are asked to report substantially the same information, to four or five different agencies of the state or Federal Government. As a result the compiling of such reports has become a matter that entails considerable work and sometimes the employing of extra assistants. Much of this duplication of reports could be eliminated, thus not only lessening the amount of work involved, but permitting one report to convey all the information desired by the state and Federal officials.

Another important subject discussed was the present lack of a uniform understanding of what constitutes an accident serious enough to come within the requirement of state laws which provide that all serious accidents shall be reported to the mine inspector and shall be included in his annual report. Lack of such a standard definition makes impracticable a fair comparison of the accident risk in one state with that in another, and the need of a uniform method of reporting such accidents was generally recognized.

Classification of mine employees by occupation was another subject that engaged attention. To know the number of men killed or injured in a particular occupation is of little value unless the number of men employed in work of a similar nature is known also. This information is now being reported in some states, and it is hoped that it will extend to all states.

Discussion of present methods of reporting the average number of men employed at mines brought out the fact that there is no uniformity regarding the number of employees in the reports now being submitted by mine operators. Physical difference between one coal field and another make it impracticable to enforce identical regulations in the operation of all mines throughout the country. However, if coal mining can be considered as a whole, we find that even as regards the many features common to all coal mining, there is a lamentable lack of uniformity in state laws.

Probably no one is opposed to mining legislation that shall be as uniform as conditions permit, and the only room for difference of opinion is in regard to conditions that are not alike in different states. The phase of the question should be carefully studied by some representative committee authorized to draft a proposed law covering all phases of the industry that admit of uniform regulation.

A law thus framed would serve as a definite working basis and would be submitted to the mining interests in each state for suggestions. With these suggestions before it, the committee would be in a position to draft a law reasonably satisfactory to all states, and the final draft prepared by the committee might be submitted to the legislature of each state having a mining industry of sufficient magnitude to warrant the enactment of a mining code.

In order to bring about such uniform legislation, the following motion was unanimously adopted: "It is the sense of this meeting that the matter of procuring uniformity of mining laws be referred to the Bureau of Mines, with the request that they do all in their power to bring about that most desirable end." To assist in carrying out the foregoing program and as an aid to a committee that might be appointed to prepare the proposed coal-mine law, a committee was appointed to report on standard forms for reporting mine accidents, mine equipment and other information required by many state mining laws. This committee has had two conferences and is ready to submit its report.

In its efforts to improve health conditions in mining communities, the Bureau of Mines has coöperated with the Public Health Service and the California State Board of Health in general investigations of health conditions and in the study of two diseases, miners' consumption and hookworm. These studies show the prevalence of miners' consumption and pulmonary tuberculosis in certain districts where the mine air contains sharp particles of siliceous dust, and demonstrate that an unsuspectedly large number of men in the Mother Lode gold mines of California are infected with hookworm. They also call attention to the need of adequate preventive measures being adopted not only in the states where the studies were made, but in other states where similar conditions may result in the spread of the two diseases. Other preventable diseases, such as typhoid fever, annually kill or temporarily disable large numbers of persons in the mining industry.

Adoption and enforcement of necessary preventive measures and of strict sanitation may come within the province of officials of mining companies, or of local and state boards of health, but evidently the battle against disease cannot be waged as it should be unless different communities and different states enact laws that will provide for efficient sanitation, the keeping of proper mortality and morbidity records and the quarantine of persons suffering from contagious diseases. The provisions of such legislation and their application should be so uniform that the morbidity figures for certain districts can be compared with those of another, thus permitting the drawing of reliable conclusions as to the relative healthfulness of different methods and practices, the exact determination of what diseases are most likely to affect the mining industry and the special safeguards that may be required.

Ills from Present Lack of Uniform Legislation

In the mines in this country are men from every nation in Europe. Thousands of them had no mining experience before they came to the United States and possessed a merely rudimentary knowledge of English when they began work underground. Moreover, miners in this country are prone to be migratory. For such men the lack of uniform state legislation not only increases the probability of accidents, but also imposes on the mining industry of each state the burden of diminished efficiency resulting from each miner from without that state having to learn the state regulations.

Our coal fields and mineral deposits do not respect state lines, but cross them indiscriminately. Yet one state may have an explicit set of rules governing the operation of mines within its borders, whereas the rules of an adjoining state may be indefinite or insufficient, although operators in both fields supply the same market and must necessarily compete with one another. As a result the operators in the state having the less effective laws are enabled to produce coal at less cost and to undersell operators in the other state.

Furthermore, because of these differences in mining codes, the decisions of a state court construing a law in force is usually of slight value outside of the particular state in which the law was enacted. This practically results in each state building up a mining jurisprudence of its own, whereas if such legislation were uniform throughout the states, the opinion of one court could be given weight in passing judgment on like facts before a court in any state. Such a change would ultimately result in eliminating much costly litigation.

Appraising for Taxation

Another matter of importance is the utter lack of any general system of valuing mining properties for purposes of taxation. Municipalities, states and the Federal Government tax mining concerns. What proportion of the total income shall be charged to working account or to depreciation, what allowance shall be made for ore or minerals left underground in the process of mining, what is the value of unmined minerals or of minerals that cannot be worked at a profit?—these are questions to which widely differing answers are given under the present system, or lack of system, in valuing mining properties. The enactment of uniform laws covering these matters would be an inestimable boon to the mining industry.

To lessen if not eradicate occupational disease in the mining industry, uniform legislation is a prime requisite. If one state enacts laws that inconvenience a miner suffering from an infectious disease and a neighboring state has not such laws, the miner has but to cross into the second state to be unmolested. In this way, though the state law may be of great benefit in improving health conditions within the state, it may be the means of spreading infectious disease through other states and thus, in the lack of uniform laws, prove detrimental to the industry as a whole. Of course this result is not to be considered as showing that any one state should not take the initiative in legislation intended to protect the health of miners; it merely emphasizes the need of uniform legislation in these states in which conditions are favorable to the spread of the same disease.

The lack of a uniform system of hoisting signals in the different states is a condition that plainly demands betterment. Many miners move at frequent intervals so that the lack of a uniform signal code decreases the efficiency of mining operations. Also, as mistakes in giving or noting signals may cause horrible accidents, the present lack of uniformity is a constant menace to mine safety.

Present state laws providing for the inspection of mines, quarries, oil and gas wells, mills and metallurgical works show a great lack of harmony, and some even bring about conflicts of authority with the state itself. Considerations of safety, health and efficiency do not receive the attention they demand. Some states have no direct inspection of quarries or metal mines; in other states coal-mine inspection or the inspection of oil and gas wells still leaves much to be desired. Practices that endanger life, impair health, or waste our mineral resources continue unchecked by state authority. Too many state inspectors are not granted sufficient authority or an adequate inspection force to do properly what the law requires them to do. In some states the methods of selecting inspectors do not insure that inspection will be efficient. Mine inspection is a matter that urgently needs improvement in the direction of more adequate force and the harmonizing of state laws relating to the qualifications, duties, powers and authority of inspectors.

In regard to the requirements of mine inspectors there should be uniform methods of inspecting machinery. The public function that can be performed by national engineering societies in procuring such uniformity is already perceived, as is witnessed by the work of the Boiler Code Committee of the American Society of Mechanical Engineers. This society has standardized these features of boiler construction that are essential to safety, and it will probably be only a short time before each and every state accepts this code. Then we shall have uniform measurements for the inspection of boilers.

For the inspection of mine machinery, and especially hoisting machinery, a uniform code of rules is much needed, which legislatures can adopt, based on the best thought of national societies and of Government bureaus. For this reason uniform requirements for the inspection of machinery await merely the taking of suitable action by influential agencies.

The Value of Statistics

Closely connected with topics of uniformity in mining codes and methods of inspection is that of uniformity in accident statistics. It is well understood that even the most earnest endeavors for the protection of life and limb among miners may fail to accomplish the best results if there are no reliable records on which to base regulations. Accident records and statistics show safety conditions, and without satisfactory records this work must necessarily proceed in the dark. The figures published on mine accidents in the United States are as yet hardly more than crude approximations, especially as regards comparisons of accidents in different states.

Still other matters that should receive notice are the methods for determining the injury done by metallurgical smoke, the abatement of such injury, and the disposal of mine wastes, slag and mill tailings in such manner as to avoid damage to property rights.

Under favorable weather conditions smelter smoke laden with injurious fumes and sulphur gases is carried for miles, so that a smeltery situated in one state may cause great damage to vegetation and even be detrimental to animal life in an adjoining state. The state that suffers may have strict laws for abating such injury, but property holders can reach the offending smelter only through protracted and costly effort and the action of the United States Courts.

Similarly, the refuse of mines, mills or smelteries in one state is dumped into a stream to the damage of property farther down and in another state. Clearly, it is not right that property should be impaired or destroyed by the carelessness or wastefulness of persons over whom the laws of the states in which the sufferers reside have no control. The determination of damages and the method of providing for the abatement of the nuisance creating them should be substantially similar in different states, that justice may be done to all.

Uniform state laws are not a new thing in the United States. Almost every state in the Union has at different times appointed commissioners to meet representatives from other states for the purpose of framing laws covering the more general branches of jurisprudence. The most widely known work accomplished by such commissioners is the "Negotiable Instruments Law." This statute was prepared by commissioners on uniform state laws who were appointed by various states to codify and make uniform throughout the United States the law relating to negotiable instruments. For the most part the statute codified existing laws. It has been adopted without important amendment in the District of Columbia and 45 states and territories.

How Uniformity May Be Procured

The "Uniform Sales Act," drafted by a similar commission in 1916, has likewise been enacted in many states to cover the sale of personal property. Clearly, it should be possible for representatives of those most interested in the adoption of uniform mining legislation to get together and through a codification of existing state laws on mining to draft a uniform law and recommend that the various state legislatures enact it. Such a plan was recently proposed, but not carried out, in Oklahoma, with a view to amending the mining laws of that state. Such a plan as this, with all interested parties behind it, would leave the legislature almost no valid reasons for failing to adopt the law.

The uniform negotiable instrument and the uniform sales acts were adopted after members of bar associations—that is, the persons having the greatest interest in the matter—met and drafted the laws, so why should not a proposed uniform mining law be prepared by the parties most interested?

For instance, if representatives of miners' unions, the American Mining Congress, the American Institute of Mining Engineers, the Mining and Metallurgical Society of America, the Mine Inspectors' Institute of the United States and the United States Bureau of Mines were to confer and then recommend to the public a uniform mining law based on a codification of present laws, this proposed law might receive as favorable a reception as did the negotiable instrument act and the sales act.

I do not mean that these representatives should endeavor to actually frame such a law in joint session, as that would be a tedious if not impossible task. The first code of legal ethics adopted in the United States was drafted by one man, Major Thomas Goode Jones, of Montgomery, Ala. The bar association of Alabama recomended by vote the adoption of such a code, but did not undertake to frame a code in open meeting, instead, it designated Major Jones to draft a code as a foundation for discussion, and after such discussion and amendment this code was adopted. When members of the bar and other interested parties decided that the various states would benefit through a uniform law covering negotiable instruments, they, through the commissioners on uniform state laws previously mentioned, designated John J. Crawford, of the New York bar, to draw such an act for discussion, and then the final draft was submitted to the public. Much the same procedure was followed in drafting the Uniform Sales Act. Therefore, if the mining men, operators, miners, inspectors and engineers desire a uniform mining law in the United States, they should follow the methods that have been successful in bringing about the adoption of uniform statutes now existing and appoint a person versed in the mining laws of the various states to draft an act to codify existing legislation.

Such an act would necessarily be elastic and cover the subject only in a general way, as it would be practically impossible to draft an act that would apply to every condition throughout the United States. However, with such a well-considered general act as a basis, it would be a simple matter for state inspectors to issue suitable regulations to cover local conditions. In fact, it is the general rule for the present state laws to cover the industry only in a general way and leave the necessary rules to the discretion of the inspector.

There are many other benefits that can be hoped for as the result of uniform mining legislation, but those pointed out seem the most important. They indicate how wide is the field of endeavor for those who are seeking to obtain such legislation and how great is the need of all interested persons and organizations coöperating for the common good.

Rapid Surveying with a Bicycle

A method for rapidly marking geological and topographical details on maps is described by Leslie H. Ower, in the *Proceedings* of the Australasian Institute of Mining Engineers, Sept. 30, 1916. For the field work he uses a bicycle equipped with a standard make of cyclometer, designed to register distances in miles and tenths of miles. Instead of using but one striker, eight are employed, so that, for each revolution of the bicycle wheel, eight impulses are given to the vanes of the cyclometer. By ignoring the decimal point, the reading is in chains instead of miles. The author has found, by checking distances on existing maps, that with 1½-in. tires the maximum error is 2%, a low reading being obtained when leading the bicycle with tires pumped hard. When riding, the depressing of the tires reduces the radius, with a corresponding reduction of the error.

For field notes an ordinary level book may be used, with the headings shown in the illustration.

HEADINGS FOR FIELD NOTES

Total Distance	Net Distance	Geology	Time	Aneroid Reading	Reduced Level	Remarks

For noting the time a wrist watch is recommended, and for altitude an aneroid barometer, recording differences of 10 ft., to be carried in the right-hand coat pocket. It is found that after a little practice the average time required to record the cyclometer reading, the direction since the last reading, the class of country, the time, the aneroid height, the locality, and to offset by eye any physical feature, is about 50 sec. Readings are taken whenever there is an appreciable change in direction or at other obvious points, according to the nature of the work in progress.

Aluminum Production in Norway is increasing. The plants already in operation and two others nearly completed have a total capacity of 16,000 tons of metal yearly. All of these plants are operated by water power.

Details of Practical Mining

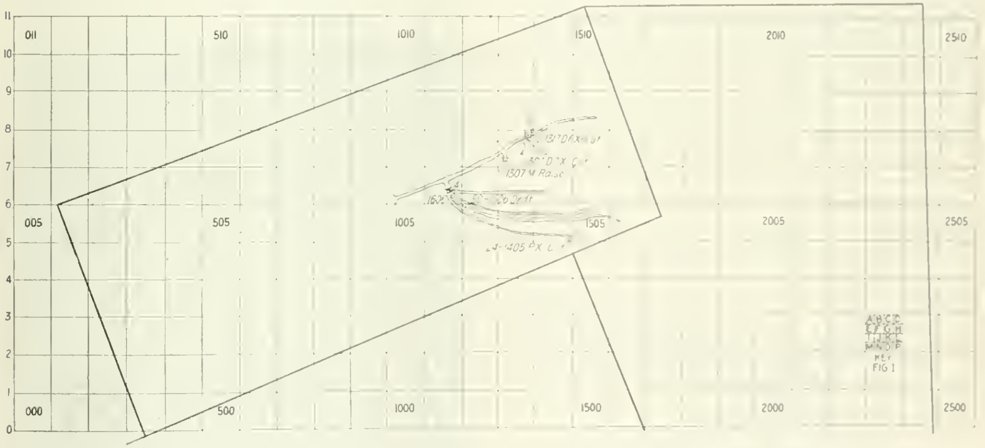
The Scientific Numbering of Mine Workings

By C. Erb Wuensch*

Various methods of naming and numbering mine workings are in use. Some of the systems are logical and serviceable enough for the man at the mine, who is thoroughly familiar with the workings; but for the man in the office or the newcomer at the mine, most numbering schemes fail to suggest the exact, or even approximate, location of a working. A great many appreciate how difficult it is to find a new number on a map or how much more difficult it is to attempt to describe its location.

The system of numbering to be described is based on the three coördinates, X, Y, Z, of solid analytical geometry. The origin of the X and Y coördinates should be so selected that all the property shall lie within the northeast quadrant. The X and Y coördinates will then always be positive. The origin of the Z coördinate should be selected at the uppermost horizon, so that the mine workings will all be below this datum. The Z coördinate values should be considered, below the assumed datum, as being positive. By choosing the origin for the coördinates in this manner we obviate the use of negative coördinates.

The map should be divided into 100-ft. blocks, starting at the origin. Each block will have its X and Y coördinates. Since it is likely in most properties that the workable area will not cover more than 10,000 ft. to the north and the same distance to the east of the origin (one hundred 100-ft. blocks), we will call each block by its X and Y in this manner: 2,108 will be a block 2,100 ft. east and 800 ft. north of the origin, the first two digits representing the X and the last two digits the Y (the Z coördinate will be considered later.) Should it be necessary to further subdivide a block, this can be done by dividing the unit 100-ft. block into 16 squares of 25 ft. on a side. Each 25-ft. block can be given a letter, as A, B, C, etc. (See illustration.) It will not be necessary to put these letters on the map. A small key to the subblocks can be made of a piece of tracing cloth. By superimposing this key over any unit block, we can see at a glance into which sub-block the working we wish to refer to belongs. In rare instances, as in pockety deposits, where several raises or crosscuts may be developed within a 25-ft. block, it may be necessary to further subdivide. This may be done by dividing the 25-ft. block into nine blocks and calling them A-1, A-2, A-3, B-1, B-2, B-3, etc.



PLAN OF A PORTION OF MINE WORKINGS SHOWING THE APPLICATION OF THE SYSTEM OF LOCATION

Thus a raise at one (1) would be 1,307 M, the M being found by the use of the key. Similarly, if two crosscuts should happen to be driven in 1,307 D, one at (2) and the other at (3), the former will be 1,307 D-6 crosscut and the latter 1,307 D-7 crosscut. The workings are numbered according to the place in which they are begun. Thus far the description has dealt only with workings in one plane. In order to refer to a working on another level, we place the Z coördinate before the X and Y. Thus a drift begun at (4) on a level 500 ft. below the assumed datum would be 50-1,605. An intermediate crosscut 60 ft. above the 300 ft. level as at (5) would be 24-1,405 P crosscut. It looks as though it would be very awkward to refer to workings in such a manner. It is true that 20-2,515 crosscut is more awkward to say than 17 crosscut, or whatever number it may be by some other system, but the number 20-2,515 crosscut suggests to the mind the Z, 200-ft. level; X and Y, 2,500 ft. east and 1,500 ft. north of the origin; or a certain distance east and north of some known working. This enables one to picture in his mind just where he is, which undoubtedly makes it easier to remember the name of the working; since it is axiomatic that things that follow a logical sequence are easier to remember than things devoid of logic. By posting signs underground at all the workings, the workman will learn these apparently more complex numbers just as easily as he would the shorter numbers of some other system. The posted numbers also serve another purpose. They enable the engineer or mine foreman to know, while underground, without the use of maps, approximately his position—a distinct advantage toward efficient development, especially in wet or hot mines where it is difficult to use a map underground. Other favorable features of this method of numbering are its infinite flexibility, its adaptability to the coördinate system of working up survey notes and the manner in which it facilitates the writing and interpreting of mine reports.

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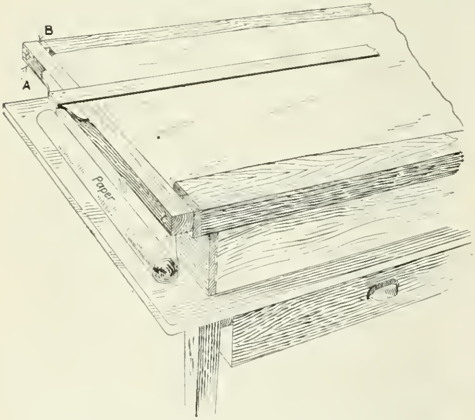
*Mining geologist, Butters Salvador Mines, Ltd., Mineral San Sebastian, Salvador, Central America.

It may not be advisable to change a numbering system that has been in use at a mine for some time, but it would undoubtedly be worth while to adopt this method in order to facilitate the writing of weekly and monthly reports.

⁂

Arrangement of Drawing Board for Handling Large Drawings

In the making of layouts an occasion often arises where it is desirable to use a sheet of paper which is longer than the board, says a writer in *American Machinist*. This would prove rather an awkward task were the board handled in the usual manner, but by arranging the board as shown in the illustration a sheet of flat paper of any length may be used.



ARRANGEMENT OF DEVICE ON DRAWING BOARD

The arrangement consists of a strip of wood, or steel, *A* screwed in the edge of the board. The blocks *B* are placed between the strip and the edge so as to leave a space through which the paper may be passed.

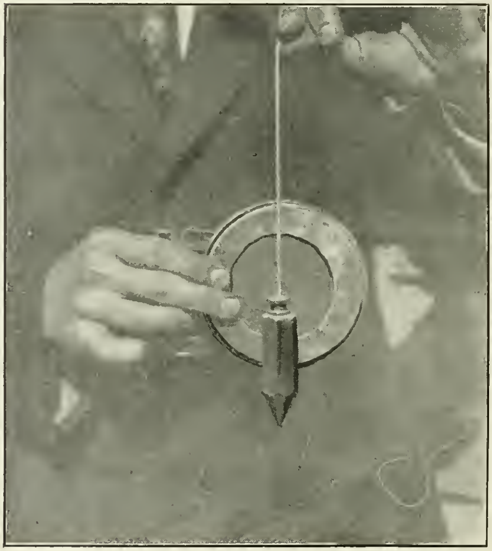
This scheme permits the paper to be run through the slot and over the board, and allows the roll to rest on the table. There is some advantage in economy also, since only so much paper as is actually required for the drawing need be used, and the sheet may be cut where necessary.

Bullseye Plumb-Bob Reflector

About a year ago I "evolved" a reflector that has proved quite efficient, being durable, of small size (it can be carried in the pocket), cheap, easily made and can be held in the proper position with the lamp, in one hand, leaving the other free to align the bob in setting line sights, says H. A. Schmieding, in *Coal Age*, Nov. 25, 1916. The manner in which this is done, as well as an idea of the construction, is shown by the illustration.

The frame of this reflector, or "bullseye," as it is called, is made by cutting the centers from two "push" lids from lard or syrup pails (the kind that are removed with a knife, screwdriver or coin), obtaining a ring about ¾ in. wide with a raised edge from each lid. Two circular sheets of clear mica cut to a little less than the outer diameter of the frame (not the hole) with "onion skin" paper between, form the ground or field. The paper is more transparent than tracing cloth, but is still sufficiently opaque to offer a good background when illuminated. It is also less affected by heat or moisture.

As the frames cannot be forced together close enough without distortion to clamp the mica, two ring gaskets of heavy blotting paper are placed between the mica and the tin, one on each side. This prevents the mica and the paper from shifting and excludes dirt and dampness.



THE REFLECTOR IN USE

To assemble, place the various parts in one of the frames (laid with the raised edge up), place the other frame in, also with the raised edge up, and force together by pinching the flanges together around the raised edges with a pair of pliers.

When in use the lamp should be held so that the flame is parallel to the mica. The paper or mica will seldom need renewing, but when renewal is necessary it takes but a few moments' time.

A wire handle arranged to hold the lamp could be soldered to the periphery of the outer frame (so as not to interfere with taking the reflector apart), if desired.

but I have not found this necessary, as the bob can be steadied with the fingers holding the bullseye and lamp, or after a little practice with the edge of the bullseye.

Several engineers in this section have adopted this reflector and express great satisfaction with it.

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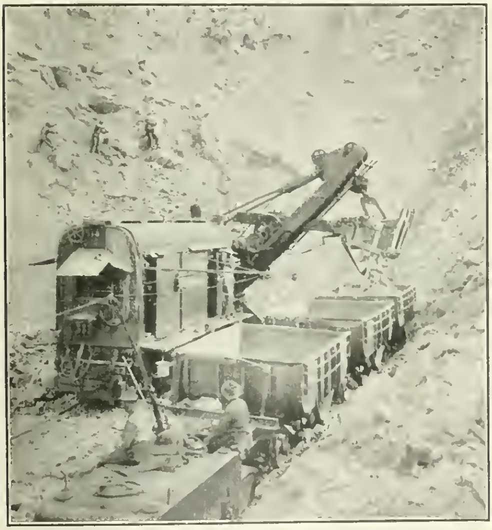
Electric Shovel at Granby Mine, Phoenix, B. C.

By C. M. Campbell*

Early in 1914 a Bucyrus 40-B electric shovel was purchased for use on the No. 2 tunnel level of the Granby mines at Phoenix, B. C. The reasons that seemed to justify the purchase of a power shovel were as follows: (1) Waste could be handled more cheaply by loading large masses direct instead of drilling and blasting and then handling from a lower level. The large quantity of waste to be handled, amounting to about half the total output, made this reason an important one. (2) Most of the ore could be handled fully as cheaply, with the additional advantage of having no development work. (3) Ore could be cleaned up to the sill floor, resulting in longer life for the shipping plant at that level and also eliminating a hoisting charge on some ore. (4) Where ore and waste were more or less mixed, a better separation could be obtained. (5) All mine cars could be loaded to their fullest capacity.



ELECTRIC SHOVEL IN USE AT GRANBY MINE, B. C.

The advantage of electric power over steam may be described in the words of an advertisement: "Why bother with coal, service pipes, water supply and other inconveniences common to all steam-driven shovels when you can do away with them by using electric shovels? Electric shovels are always ready for work at a minute's notice and are most economical to maintain and operate." As electric power was available, it was decided to purchase a shovel of this type.

During the period the shovel has operated, it has handled about 500,000 tons of material at a cost of about 15c. per ton. As a considerable amount of the ground in front of the shovel had been worked by underground methods, this was caved as much as possible and the broken rock drilled with small drills. In this way some saving was made in labor and powder charge, though this item is still large. A considerable amount of shooting was done where the face was low, necessitating frequent delays on account of blasting and track laying. Enough work has now been done to enable the shovel to have two positions in which to work. This lessens delays on account of lack of muck and makes it safer for the shovel crew, as the miners can be drilling and barring down at one place while the shovel is operating at the other. Another delay has been due to the fact that the shovel has had very little chance to work along the side of the orebody, but has had to work right into it. For this reason only one or two cars could be loaded at a time instead of a train. The introduction of 10-ton automatic side-dumping cars instead of smaller cars previously used has increased the capacity of the plant. These cars will allow a rock 4 ft. in diameter to pass through. When a rock larger than this is met with and not too large to be handled by the shovel, it is lifted by a chain or cable onto a side-dumping flat car. This makes it unnecessary to move the shovel for anything but large blasts.

The electric feature of the shovel has given entire satisfaction. The delay on account of shovel repairs amounted to only 3½% of the total time, and only a small part of this was spent in attendance on the motors and electrical equipment.

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*Superintendent, Granby Consolidated Mining, Smelting and Power Co., Phœnix, B. C.

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New Rescue Apparatus of the Bureau of Mines

Dr. John Scott Haldane, the noted English physiologist, recently delivered a number of scientific lectures at Yale University, New Haven, Conn., and Johns Hopkins University, Baltimore, Md. He took enough time from his lectures to visit the Pittsburgh experiment station of the United States Bureau of Mines. He expressed much interest in the various investigations that are being carried on in behalf of the miner and put on and wore the new Gibbs oxygen breathing apparatus, which is now undergoing severe tests by the rescuers of the bureau. In fact Dr. Haldane made the statement that although the apparatus had certain defects, which might be modified, it was the best apparatus that has yet been devised.

Dr. Haldane is said to have remarked that no matter how much he exerted himself when in the apparatus it never failed to supply him with the needed oxygen. In a recent article read before the Canadian Mining Institute James M. Stewart, speaking of apparatus in general, declared that "the amount of muscular energy expended must be made to correspond to the output of oxygen of the apparatus. The oxygen supply cannot be regulated to suit calls of muscular energy as they may arise in the mine. Cool, calculated work is what is needed to make a man wearing the apparatus a successful member of a rescue party."

Should the coördination of need of oxygen with its supply prove as perfect in the Gibbs apparatus as has been anticipated, then evidently an important step forward will have been made.

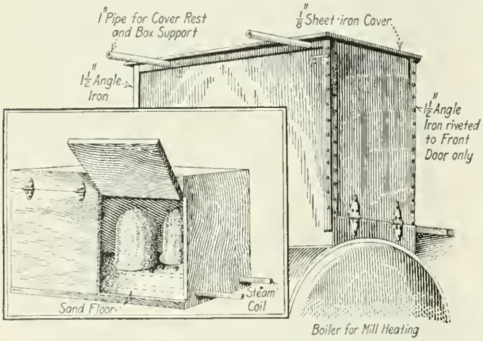
Details of Milling and Smelting

Crucible-Seasoning Chests

By Arthur C. Daman*

Considering the high cost and comparatively short life of the domestic crucibles used in refining gold and silver precipitates, it is advantageous to take all precautions in lengthening their life. We have inside and outside corrosion, cracking and other troubles. The least expensive and probably greatest life extender for crucibles is proper seasoning, especialy when they have become damp in transit or storage.

At the Commonwealth Mines, Pearce, Ariz., a wooden chest, with steam coils covered with sand, is used. The chest holds four crucibles, and by the time required, they are thoroughly seasoned. Since using this chest the life of a crucible has been increased from 10 to 25% which, considering the initial cost (between $50 and $60), amounts to quite a saving.


1" Pipe for Cover Rest and Box Support
1/8" Sheet-iron Cover
1 1/2" Angle Iron
1 1/2" Angle Iron riveted to Front Door only
Sand Floor
Steam Coil
Boiler for Mill Heating

TWO FORMS OF CRUCIBLE-SEASONING CHAMBERS

At the Churchill Milling Co.'s mill, Wonder, Nev., a sheet-iron seasoning box is placed above the mill heating boiler. As shown by the sketch, the top and front sides open on hinges, and the crucibles are lifted out by means of chain blocks.

The Nevada Hills Mining Co. at Fairview, Nev., keeps two or three crucibles in the bullion vault and inside of each is placed a 110-volt electric-heating element. This latter method is successful, though it takes a considerably longer time to season and costs more.

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Australian Stamp-Milling Hints†

In the modern Australian mill the rock breakers should be made to play a more important part in ore reduction than is the case at present. Not enough attention is paid to this department in the ordinary mill, and as a consequence, the duty per stamp in many Australian mills is very low.

Sufficient jaw-breakers of the Blake-Marsden type should be installed to reduce the ore at the start to 2-in. cubes. Screening should follow, and the oversize should be crushed in a Gates crusher set close enough to reduce the whole product to pass a 1-in. ring.

If the Australian stamp batteries were fed with ore reduced to this degree of fineness, the weight of the stamps and the height of drop could both be minimized, while the drop per minute could be increased with a corresponding improvement in the stamp duty.

It is considered that the crushing surfaces of the ordinary uptodate stamp shoe and die are far too small—only 9 to 10 in. in diameter. This diameter should be increased to from 12 to 14 in. This would necessitate enlarging the present type of mortar box or reducing the number of stamps now employed in each mortar to make room for the new arrangement.

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Matte Granulation in Missouri*

The matte granulator installed Mar. 1, 1915, had, up to Jan. 1, 1916, handled 18,735 tons of matte. Previous to its installation matte was cooled in small pots, broken by sledges, transported to a crushing plant and reduced to 1/4-in. size before feeding to the roaster bins. The costs by this method were $0.87 per ton for cooling and sledging, while crushing to 1/4-in. cost an additional $0.56; total cost, $1.43. Granulation by the new method costs a total of only $0.75 per ton, a saving of $0.68 per ton over the old method.

By the new method the matte tapped into 6-cu.ft. iron ladles is transported by electric crane to the granulator. Here it is poured into a cylindrical container constituted by a specially designed Traylor copper converter minus the tuyeres, but having a 20-in. opening at one end for the flue and equipped with oil burners. Inside measurements are 77x120 in.; lining, 9 in. of magnesite brick; tilting accomplished by a 50-hp. motor. To prevent metal losses, the container is covered by a swinging hood, except during pouring from the crane, which fits over the charge opening and connects with an 18-in. flue conducting fumes to the baghouse. Two oil burners are placed under the flue within the container, although one usually suffices to keep the matte molten. The consumption of 18° to 20° Bé. crude oil is 250 gal. per 24 hr., or 2 to 2 1/2 gal. of oil per ton of matte granulated. Air at 30 lb. pressure is supplied to the burners for atomizing the oil.

The granulation is accomplished by pouring the molten matte through two superimposed flat jets of water shooting horizontally into a concrete tank lined with cast-iron plates. The stream of matte is disintegrated into small shot-like particles before reaching the body of water. It is accurately directed on the jets of water by a so-called pouring box, the spout of which is 6 in. above and 12 in.

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*Mining engineer, 2678 Eudora St., Denver, Colo.

†Excerpt from "The Milling of Gold Ores," by J. McCombie, consulting engineer, Auckland, New Zealand; "Min. and Eng. Review," Oct. 5, 1916.

*Abstract from "Matte Granulation at Herculaneum, Mo.," by S. Paul Lindau, Herculaneum, Mo., and Hery B. Smith, Rivermines, Mo., to be presented to the New York meeting of the A. I. M. E., February, 1917.

in front of the upper nozzle. This box is lined with common brick, and the matte is poured directly into it by revolving the container. The pour holes are slots 2 in. wide by 8 in. high.

The average rate of pouring the matte is 3.2 cu.ft. per min. The water supplied to the two superimposed flat jets on which the matte impinges is 100 gal. per min. under a head of 10 ft.

The receiving granulating tank is constructed of concrete, 17 ft. long and 7½ ft. wide, the floor being plated with 1-in. cast-iron plates, and sloping at 30° into the conveyor trough. This degree of slope has been found sufficient to cause the granulated particles to run into the trough.

The granulated matte is removed from the tank by a dewatering drag conveyor placed to one side out of the way of the jets. This conveyor, running in a sectional cast-iron trough 4 in. deep by 15 in. wide and driven at a speed of 30 ft. per min. by a 10-hp. motor, elevates the matte over the slag track and discharges into standard-gage railroad cars. The latter are weighed and their contents sampled before emptying into the roaster bins.

In the end of the concrete tank opposite the nozzles, a V-shaped settling box takes the overflow water. This box prevents the loss of the coarser slime, while the finer material settles out in a series of settling tanks, one overflowing into the other. An excelsior filter finally clears the water before it enters the circulating pond. There are two series of settling tanks, one in use while the other is being cleaned out.

Some lead settles out of the matte while in the container, about 30 to 60 pigs of 65 lb. each, according to the condition of the furnaces, being poured out daily. In case lead goes over and is granulated with the matte, it manifests itself by a sputtering and popping on the surface of the water. After the matte has been poured down to the lead level, the operator turns the container backward and pours the lead into a ladle, whence it is molded into pigs.

This installation requires only two men per shift for operation, one to operate the container and one the crane. The forehearth tappers at the furnaces attach the crane hook to the ladles.

In summary, by the use of the granulator, 100 tons of matte per 24 hr., at a cost of only $0.75 per ton is granulated to the following screen analyses: On ¼-in. mesh screen, 5%; on 3/16-in., 1%; on ⅛-in., 11%; on 1/16-in., 35%; through 1/16-in. mesh, 42%.

⁂

Grondal Flotation Apparatus

To improve the opportunity for contact between ore particles and oil in flotation is the object of a newly devised apparatus. Hitherto as intimate contact as possible has been made either by stirring or by adding the oil to the ore during the process of fine grinding. The present invention seeks to secure moistening of the ore particles in the following manner: Oil is fed into a Körting steam jet, where the steam under pressure draws a large volume of air into the pipe leading to the bottom of a mixing chamber. The terminus of this pipe is formed by a funnel just above, which is the terminus of a pipe feeding the ore pulp suspended in water into the water-filled mixing chamber. The descending stream of ore pulp meets the stream of steam, air and oil rising from the funnel, resulting in effective agitation of the ore pulp and contact with the oil particles. The resulting bubbles buoy the ore particles to the surface of the mixing tank, where they flow over a partition into an adjacent Callow tank. Here the gangue particles sink and are drawn off through a valve, while the mineral particles overflow into a collecting launder. If desired, the gangue particles may be led into another similar device and again treated. The apparatus is the invention of Gustaf Grondal, a subject of Sweden, to whom has been granted United States Patent No. 1,202,512 of Oct. 24, 1916.

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Lubrication at Milling Plants

The standard of lubrication may be determined from a consideration of the frictional heat generated in any bearing, and thus by accurate temperature tests it is possible to make a comparison between different oils, according to *Chemical Abstracts* in review of articles in the technical press. Chemical tests of the oils are of no value for this purpose. The internal lubrication of steam engines with a cup feeding oil directly into the cylinder or valve is not satisfactory. The oil is carried out to the exhaust at once in a mass.

An improved oil atomizer for this purpose has a spoon-shaped open end leading the oil into the center of the steam pipe where the velocity is greatest. This breaks the oil up into a fine spray, and it is evenly distributed. Cylinder oils with a flash point lower than the steam temperature have been used successfully for superheated steam. This is because the flash point is determined at atmospherical pressure, and at the steam pressure it will have a higher value. There is no air present in the steam to affect the oil either. Oil elimination from feed water by electrical and other processes is referred to. Sometimes deposits of solids carried over by the priming of the boilers have been mistaken for carbonization of oil. It is necessary to drain water from crank chambers and reservoirs at frequent intervals. The continuous circulation of oil results in its "breakdown," owing to the action of heat, moisture and air. This is attended with an increase in the viscosity and the specific gravity, while acidity develops and sediment is deposited. Oil vapors from bearings and tanks are sometimes drawn into dynamos owing to the fact that oil in rapid circulation forms bubbles which burst into a fine spray in air. Petroleum acids as a result of the "breaking down" of the oil are distinct from the H_2SO_4 left in the oil from the refining processes. One main bearing of a dynamo should be completely insulated to obviate leakage current from passing through the bearings and decomposing the oil. The lubrication of various types of mining machinery and oils suitable for transformers and oil switches are described.

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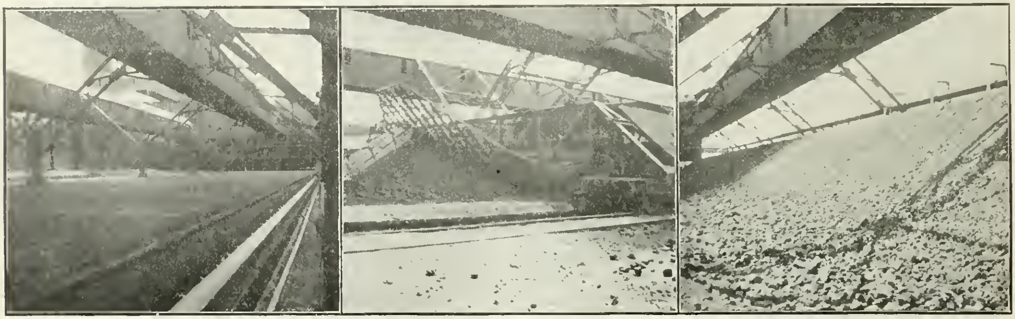
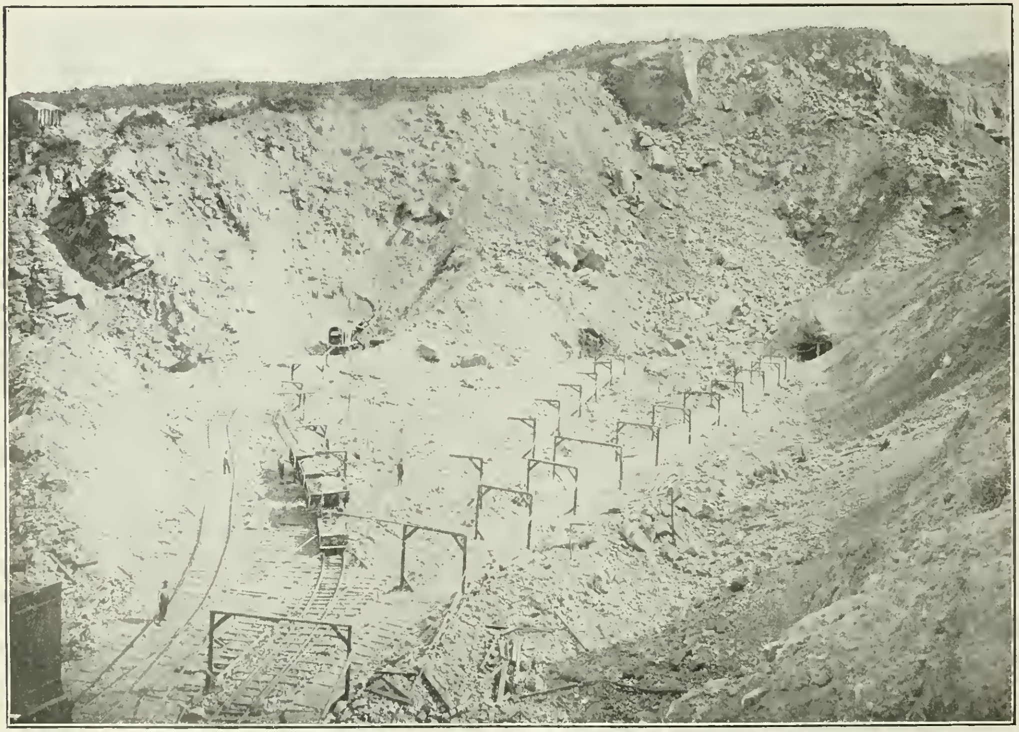
Alloys for Withstanding High Pressures [illegible] by S. D. Sheth [illegible] the [illegible] meeting of the Institute of Metals. As a suitable mixture for ordinary [illegible] cocks, pistons, [illegible] etc., he gives Cu [illegible], Sn [illegible], Zn, 19.2%, Pb, 6.5%. For high pressures he recommends Cu 82.00%, Sn 7.50%, Zn, 1.75%, Pb 7.75% and Cu, [illegible] Sn [illegible] Zn [illegible] Pb [illegible]. These alloys are hard to machine. He states also that a very small proportion of aluminum will make the castings porous throughout [illegible] the castings look sound. [illegible] mental.

Photographs from the Field



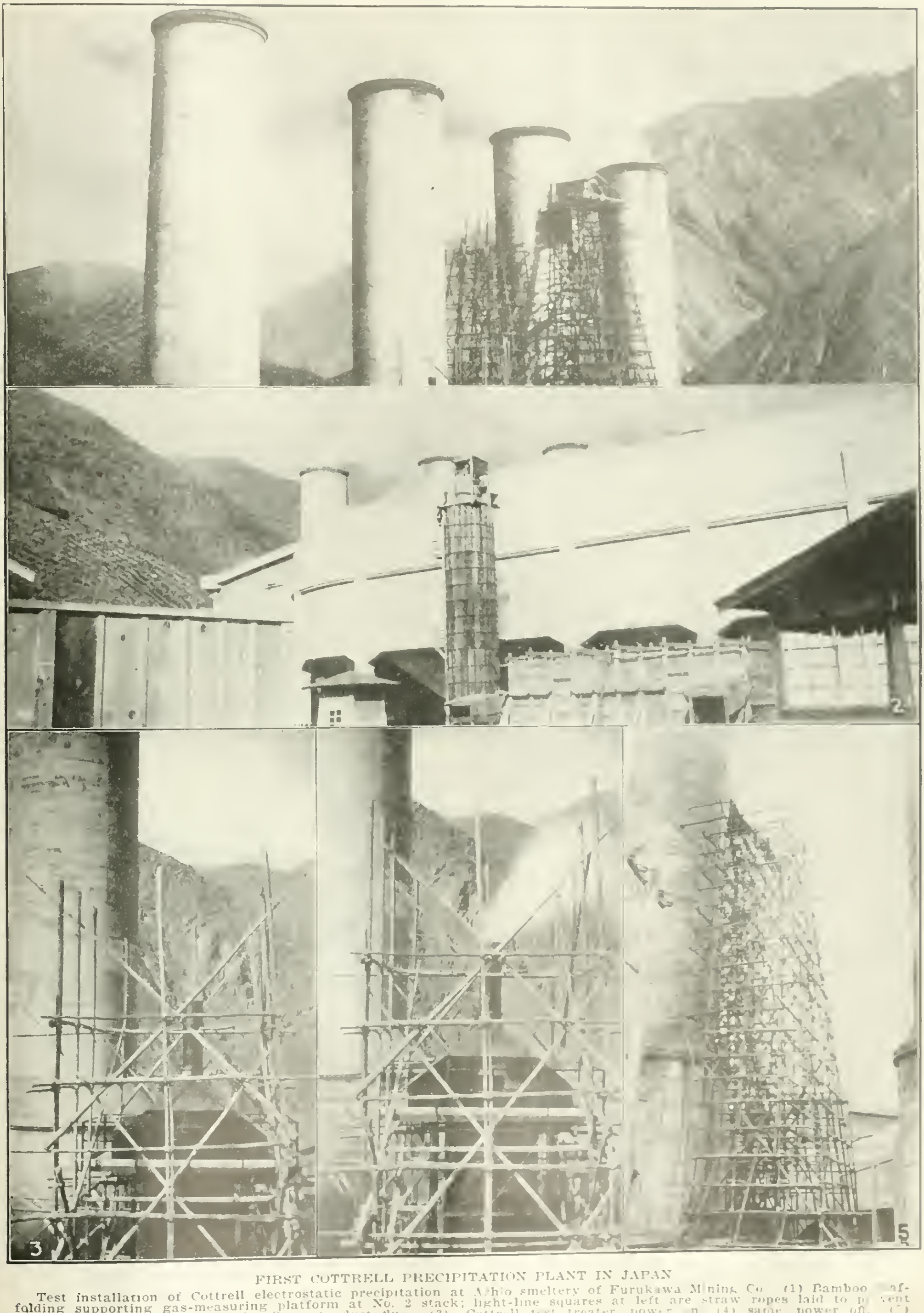
MESSITER BEDDING SYSTEM AT CALUMET & ARIZONA SMELTERY, DOUGLAS, ARIZ.

Bedding of ores, formerly only practiced by lead smelters, has become popular among copper smelters, particularly in the Southwest. The accompanying views, beginning at the right, show the ore bed formed, being reclaimed with a Messiter machine and the bed completely reclaimed.



OPENPIT OF THE GRANBY CONSOLIDATED'S COPPER MINE AT PHOENIX, B. C.

This openpit is being worked by an electric shovel—a Bucyrus 40-R. The pit has been widened to permit the use of two divergent tracks which reduce delays. Drilling and barring down is done in one part while shoveling is proceeding in the other. This is described more in detail on p. 979 of this issue.



FIRST COTTRELL PRECIPITATION PLANT IN JAPAN

Test installation of Cottrell electrostatic precipitation at Ashio smeltery of Furukawa Mining Co. (1) Bamboo scaffolding supporting gas-measuring platform at No. 2 stack; light-line squares at left are straw ropes laid to prevent erosion of mountain sides. (2) Concrete dust flue. (3) Cottrell test treater, power on. (4) same power off. (5) Bamboo scaffolding in process of erection, without saw or hammer; poles bound together by straw ropes.

Correspondence and Discussion

Not Always a Wildcat

I noticed in the issue of the *Journal* of Oct. 28, 1916, that a correspondent had discovered a brood of wildcats. I didn't know they came in broods. I am an old-time prospector and miner, but don't claim to know much about wildcats, mines and mining; though I am very anxious to learn. Therefore I ask the correspondent if he thinks the man is always correct in yelling "wildcat" on the slightest provocation. Isn't it possible that the cry "wildcat" might be in the interest of the big copper producers? He seems surprised that the United States Government doesn't get after the wildcats. Perhaps the Government is not anxious to put a stop to the development of new copper properties.

If this doubter is always correct, why were the United Verde, Hillside, Congress and the Vulture all turned down at different times? The Congress ran steadily for 22 years. The Vulture produced $17,000,000. Mr. Lawler is, or was, a rich man and he made it out of the Hillside. Ask ex-Senator Clarke what the United Verde produced. All these have been classed as wildcats in their time. Let me quote from a letter just received from an old Arizona friend. He says: "It is 20 years ago that we had the Ajo group of claims under option from old Tom Childs and Mr. Westbrook for $35,000. The best experts of that day examined the group, and they all pronounced it a wildcat and an impossibility. You sent one man from Colorado there, and he turned it down flat. There is a railroad built from Gila Bend and a large plant under construction. I understand the entire property, including the railroad, plant and mine, has increased its value many times." That was a wildcat that showed his claws and teeth to every expert that went near it.

My friend continues: "Of course you remember the old Mexican silver mine on Slim Jim Gulch and the Uncle Tom that you once had an option on from me, and the claim you located across the gulch opposite the Mexican Silver mine, that were all turned down and called the worst of wildcats by that foxy red-headed expert that started in to be abusive because you had the audacity to show him such wildcat property? Said he would just as soon advise men to invest in a school of herring in the sea as to put money into such wildcat property as I had showed him. The Mexican Silver mine is now called the Monte Cristo and has 2½ mi. of underground workings, and I understand Ezra Thayer has refused $1,000,000 for it. Furthermore, there has been sufficient work done on the Uncle Tom to show that it is a better property than the Monte Cristo. And the claim you had across the gulch from the Monte Cristo has sold for $500,000." They were all wildcats, and if stock companies had ever been formed and the stock offered to the public, the wildcat hunters would all have been bitten or scratched and would have died of rabies.

The effort to put any new mining property on its feet, and especially if it is done through the attempted sale of stock, gives some men spasms, and I often wonder if they are not the same men that call everything a wildcat until the ore is blocked out so they can measure it and take samples.

There is a class of men who would have us believe that the greatest crime on earth is to solicit money to develop a prospect. Such men in my opinion are a detriment to the mining industry. I have no copper or other stock for sale and don't know that I ever will have. If the wildcat hunter will take the trouble to investigate, he will find that a large percentage of the big bonanza mines were once prospects and that some of them not extra good-looking at that, and that the prospectors who discovered them got someone to put up the money to develop or sold to some company or individual who formed a company and sold stock in order to make mines of them. He will also find that at one time it was next to impossible to sell Calumet & Hecla at $3 a share and it was considered one of the greatest swindles ever offered to the American public. It is now $630 per share. I suppose that it was a wildcat, like many others! If every prospect is a wildcat and every man who attempts to raise money to develop the prospect is a criminal and should be prosecuted by the United States Government, then tell me, Where are we going to get mines? Order them from Sears & Roebuck, of Charles Williams Stores, I suppose!

Ruffin, N. C., Nov. 23, 1916. JOHN LORD.

[There is something in what our correspondent says. Doubtless many prospects have been rejected as worthless and have since proved to be valuable. Humans are likely to err. In condemning this particular kind of error, however, it should be remembered that many prospects have proved, upon development, to be worthless, and the chances are that most of those rejected after competent examination never could be made into mines.—Editor.]

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Winter Gravel Washing in Siberia

In the September issue of the *Mining Magazine*, of London, there appears an article by Reuben Edward Smith and myself on "Winter Washing at the Lenskoi Mines, Siberia." Owing to the fact that neither Mr. Smith nor myself was in London when the article went to press, an erroneous subheading was inserted, making it appear that the thawing of frozen gravel was one of the operations involved. As we clearly set forth in the body of the article, and as the writer has previously stated, the auriferous gravel now handled in the Lenskoi drifting operations is for the most part unfrozen. Even when encountered in a permanently frozen state, the thawing artificially is one of the underground mining operations and has no relation to the washing methods described in the article referred to. May I crave your space for the insertion of this letter so that no misconception may occur? CHESTER WELLS PURINGTON.

London, Oct. 23, 1916.

Testing Mine Rescue Apparatus*

By C. E. Pettibone†

SYNOPSIS—The author advocates a test of breathing apparatus by which parts of the apparatus are plugged and subjected to an internal pressure of 5 oz. Should this pressure, which is twice the maximum experienced in use in any part of the apparatus be retained without noticeable decline for one minute, the apparatus is regarded as sufficiently tight against any inleakage of dangerous gas in a poisonous atmosphere.

This paper describes some experiments that we have been conducting on the testing of mine rescue apparatus for Pickands, Mather & Co. I am desirous of obtaining a general expression as to the practicability of the test here described.

This test has been applied to the Draeger apparatus, which is the type of apparatus we are using. We believe, however, that the principles of this test can be applied to any type of rescue apparatus, it being only necessary to develop a few connections and make other unimportant modifications.

Many articles and much discussion have been devoted to setting forth the dangers that might arise and have arisen from leaks in breathing apparatus. Any consideration of the merits of different types of these apparatus has always brought up the question of negative pressure, or suction, and of the amount of the apparatus which is under such pressure.

In order to satisfy ourselves that leaks in the apparatus are important, we tried the following experiment with an apparatus not of the positive-pressure design. We sent several men into a smokeroom filled with formaldehyde fumes. All the men had good cartridges in their apparatus. They were told to come out as soon as they recognized the odor of the formaldehyde vapors. None of them had any trouble with his apparatus, and the men were called out.

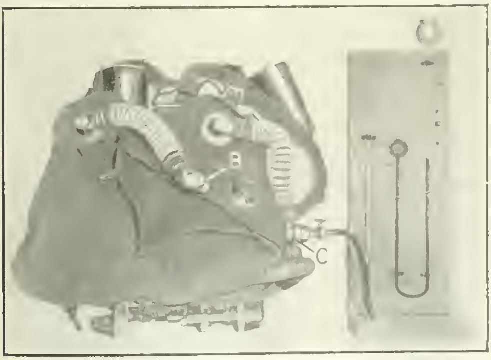

FIG. 1. TESTING THE WHOLE APPARATUS FOR LEAKS

A cartridge with a small hole was then inserted in the apparatus worn by one of the men, but none knew which man had the defective cartridge. In a short time the man with the punctured regenerator was obliged to retire. This test was tried several times, and in each case the man with the defective cartridge was unable to remain in the formaldehyde fumes.

A similar operation was tried with the Fleuss apparatus, a hole being cut in the inhalation tube that connects the breathing bag with the mouthpiece. Similar results were obtained. There was therefore convincing evidence that leaks in the apparatus would prove very serious, if not fatal, when operating in poisonous gases such as carbon monoxide. It was probably because of criticism of this character that the Draeger Oxygen Apparatus Co., several years ago, changed its apparatus to what is known as the positive-pressure type, in which a greater portion of the apparatus in use is placed under positive pressure. The ordinary tests, made with the liter bag and gauze, show only that the reducing valve and injector are furnishing the desired quantity of oxygen and are producing the required positive and negative pressures necessary to maintain the circulation of air through the apparatus. Neither of these tests will indicate leaks. We established this fact by testing the apparatus with the punctured potash cartridge mentioned previously.

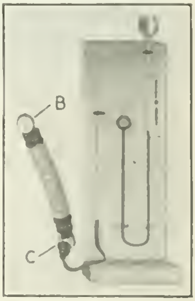

FIG. 2. PROVING THE FLEXIBLE TUBES

The "smokehouse test," which consists in wearing the apparatus in smoke or formaldehyde fumes, will not indicate leaks in parts of the apparatus that are under positive pressure, and it is questionable whether minor leaks in those parts that are under negative pressure would be discovered. Of course leaks of this latter type, if not determined in the smokeroom, would probably not be dangerous in the actual use of the apparatus, unless they become larger. But danger lies in the fact that such minor leaks would, in all probability, become larger and more serious while the apparatus was being worn in actual mine rescue work.

It was therefore felt that some more definite method of determining leaks was desirable. At first we used different kinds of rubber plugs, and made other provisions by which we were able to blank off the open ends of the apparatus. Then, by admitting oxygen from the cylinder, the entire apparatus could be put under pressure. The apparatus was then immersed in water, care being taken to keep the finimeter above the surface.

Many leaks that could not otherwise be determined were thus made apparent. But there were several objections to this manner of procedure. First, the pressure put on the apparatus was not known; consequently, it was not determined whether the apparatus was being overstrained; second, the constant immersing of the apparatus in water is unquestionably not beneficial.

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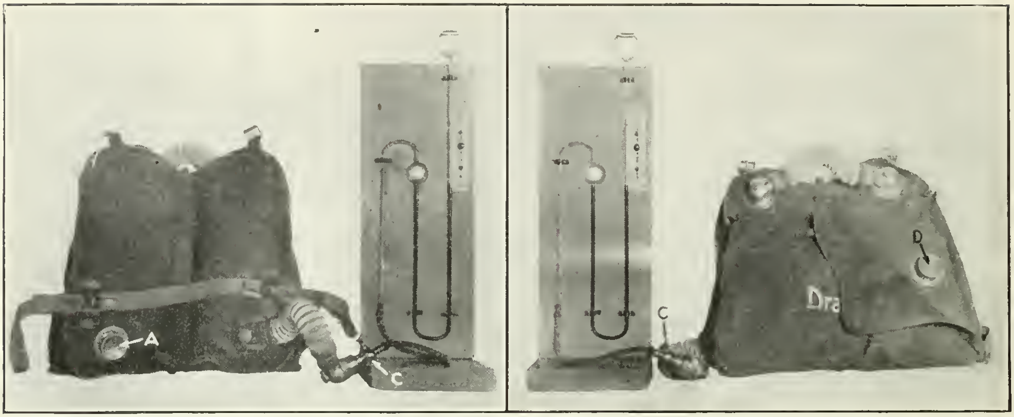
*Abstract of a paper read before the Mining Section of the National Safety Council, Oct. 20, 1916. The experiments described were conducted by H. L. Scheiber, Palatka, Mich.

†Director, Department of Safety, Welfare and Insurance, Pickands, Mather & Co., Cleveland, Ohio.



FIGS. 3 AND 4. U-TUBE IS ATTACHED TO THE BREATHING BAG AS SHOWN

Later, we were able to obtain from the Draeger company three testing parts by which the various connections could be blinded and whereby proper connection could be made to a pressure gage. These parts are lettered *A*, *B* and *C* in the various illustrations. We endeavored at that time to induce this company to make a cap for the relief valve of the bag, but it objected to doing this on the ground that some one might wear the apparatus with the cap in place over the relief valve.

We made two types of blanks for this valve, one which fits tightly over the valve and the other made by soldering up the relief valve of an old bag. The former blank is preferable, as it can be used without removing the relief valve. In the illustrations this valve is marked *D*. The Draeger company is now furnishing a blank for this purpose.

In all discussions, and in talking with sales agents of the various apparatus, I have never seen or heard of any figures that give the pressures actually existing in the different parts of the apparatus under normal operating conditions.

We developed a water U-tube, as shown in the various illustrations. This was graduated for the reading of pressures in tenths of ounces. By soldering a pipe in the side of a potash cartridge near the base, and by other connections, we were able to tap in on the circulation and obtain the pressures existing under normal operation at five different points in the apparatus. The following results are the average of tests of several apparatus with different men wearing them, and with the breathing bag set to release at +2¼ oz.:

Test No.	U-Tube Attached to	During	Minimum Pressure in Ounces
1	Inhalation tube between bag and mouthpiece	Inhalation	⅜
		Exhalation	1 to 2¼
2	Exhalation tube between bag and mouthpiece	Inhalation	¼
		Exhalation	1¼ to 2¼
3	Inhalation tube below bag	Inhalation	⅛
		Exhalation	1½ to 2¼
4	Exhalation pipe below bag	Inhalation	—⅛
		Exhalation	¾ to 2
5	Bottom of potash cartridge	Inhalation	½
		Exhalation	1½ to 2½

It will be understood that the pressure as measured is positive, except in the exhalation pipe below the bag during inhalation, where it is a negative pressure as indicated.

Thus the maximum pressures in the apparatus are 2½ oz. in back parts and 2¼ oz. in front parts. When the bag releases at 2¼ oz. in front, 2½ oz. are recorded in the back parts. This pressure is about what can be obtained by inflation with the lungs.

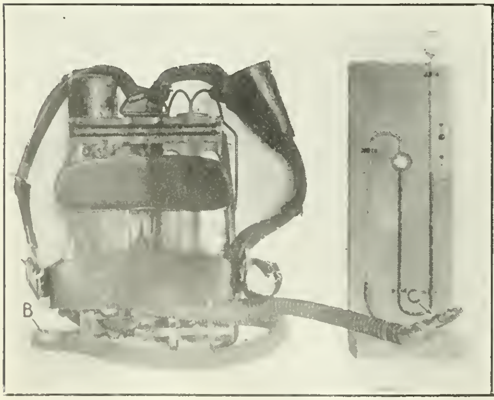


FIG. 5. TESTING ENTIRE BACK OF APPARATUS

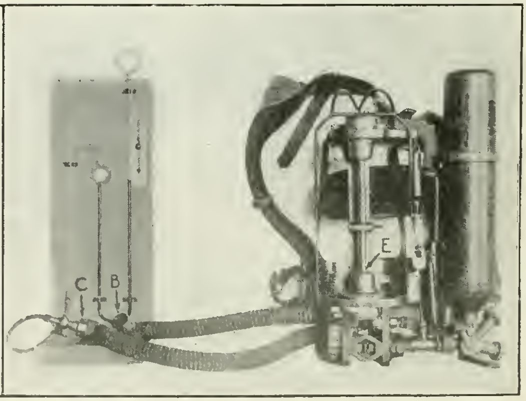


FIG. 6. PROVING TIGHTNESS OF BOTTOM PARTS

After determining the maximum pressure under which the apparatus operated—namely, 2½ oz.—we decided to test it with 100 per cent. overload—namely, at 5 oz. of pressure. We found it was impossible to make the apparatus so tight that the water in the U-tube would permanently remain at 5 oz. This was due unquestionably to infinitesimal leaks in the fabric and valves.

We found, moreover, that if the smallest possible pinhole was made in the potash cartridge, the pressure would be relieved and the water drop in not longer than one-half minute. We therefore decided that the apparatus should be considered as being in good condition when under a pressure of 5 oz., if the water did not fall in less time than one minute.

In operation, the U-tube is filled with water to a point just below the reservoir, and the scale is adjusted so that zero on the scale corresponds to the height of the water. Care must be taken to make sure that there are no bubbles of air in the column.

The tests are as follows: Test 1—Connect the entire apparatus as shown in Fig. 1. Blank off one tube at the top of the bag with the test plug *B*. Connect the other tube to the stop-cock *C* of the testing set and attach this to the U-tube. Plug up the release valve with the plug *D*. Admit oxygen very slowly from the cylinder until a pressure of 5 oz. is obtained. Shut off the oxygen. If the apparatus is free from leaks, the water will remain at this level or descend very slowly, taking longer than one minute to descend. If the test shows leaks in the apparatus, they may be located by testing portions of the apparatus as follows, but whenever a leak is located and corrected the entire apparatus should be connected up and retested. Test 2—Test the flexible tubes as shown in Fig. 2. Test 3—Using tubes tested in test 2, test the bag as shown in Figs. 3 and 4. In tests 2 and 3 inflation can be obtained from the lungs or a small pump. Test 4—Test the entire back of the apparatus as shown in Fig. 5.

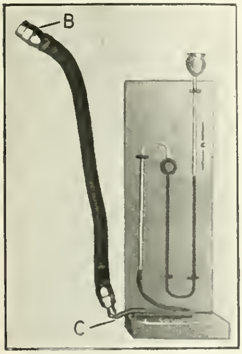


FIG. 7. PROVING CIRCULATION PIPES

If a leak is indicated, it is advisable to remove the potash cartridge and insert the cartridge plug *E*, shown in Fig. 6. It consists of two bell-shaped cups connected by a pipe fitted with a stop-cock. While the valves at the top and bottom of the potash cartridges are shut when the cartridge is removed, they do not close tight enough for this test.

Test 5—Test both circulation pipes, as shown in Fig. 7. Test 6—Using tested circulation pipes, test the bottom parts by closing the stop-cock in the cartridge plug described above, as shown in Fig. 6. Test 7—Test the entire back parts with the stop-cock in the cartridge plug open, using tested circulation pipes.

When a leak has been localized, it can usually be found by feeling with a damp finger. If not, the part may be immersed in water. The foregoing tests of the apparatus if made monthly, will maintain it in excellent condition. In case of actual rescue work, the testing of the entire apparatus, as described, consumes only a few minutes, and if desired, the usual pressure test of the reducing valve and the injector can be obtained from the U-tube. Of course, the smokehouse test can be employed in addition to those just described.

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Northwest Mining Association on Mining Law Revision

The Mining and Metallurgical Society of America has been the promoter of the general movement to secure an adequate revision of the mining laws of the United States. In this movement it has sought the coöperation of other organizations of mining men and found a ready and hearty response. In the preliminary effort to crystallize the opinion of mining men into approved general principles that should govern the drafting of the proposed detailed revised law, the society recently submitted a questionnaire to its own members and to the other organizations. This questionnaire was published in the *Engineering and Mining Journal* Oct. 14, 1916. In response to this questionnaire, the recent convention of the Northwest Mining Association adopted the following resolutions:

Whereas, It is generally understood and agreed in mining circles that a revision of our Federal mining laws has become absolutely necessary to the welfare of the mining industry of the United States; and

Whereas, It is the belief of the members of the Northwest Mining Association that any new code that may be enacted should be as free from restrictions as possible, offering every inducement to those wishing to prospect for mines and to operate them, and guarding only against fraudulent appropriations of public lands for purposes other than those pertaining to mining; and

Whereas, The Mining and Metallurgical Society of America has undertaken to draft an adequate bill for presentation to Congress, which bill shall cover all necessary changes in our present mining laws; and

Whereas, The mining committee of the said society has requested a statement of the views of members of this organization in respect to the proposed changes outlined in a questionnaire, dated Oct. 2, 1916; now, therefore, be it

Resolved, That this organization submit the following suggestions and replies to the aforesaid questionnaire as an official expression of the opinion of its members:

1. The phraseology, legal definitions and principles of administration of our present mining laws should be preserved to the maximum extent possible.

2. The new mining laws should cover clearly and definitely all classes of valuable mineral deposits other than coal.

3. The new laws should authorize mineral locations without discovery in any part of the public lands officially classed as mineral.

4. The new laws should authorize mineral locations upon discovery in any part of the public lands whether officially classed as mineral or nonmineral or set aside as reserves, hence

5. There should be an express provision permitting bona fide prospecting upon all public lands as above described, and protecting the prospector meanwhile.

6-9. Patents should not be granted unless a discovery of mineral has been made; provided, however, that this shall not apply to mill, tramway or tunnel sites or to other ground conclusively shown to be necessary to successful mining operations.

The number of claims patentable upon a single discovery of mineral should be limited to four contiguous claims, whether the same be grouped about the point of discovery or located along a well-defined strike or in series where no outcrop is apparent.

10-12. This organization strongly advocates the adoption of a standard claim 1500 ft. square (51.65 acres) because this is the square of the long side of our present [illegible] and introduces no fractions of 100 ft. Under the [illegible] abandonment of the extralateral right a claim of [illegible] is too large, while the difference between its area and [illegible] a claim 1320 ft. square is not sufficient to [illegible]. This organization is unalterably opposed to the adoption of a claim containing less than [illegible] acres, since smaller [illegible] would merely confuse locators and require more locations to be made.

13-14. For several practical and important reasons this organization is also unqualifiedly opposed to the idea of requiring claims to be located as subdivisions of surveyed sections or with lines running north-south and east-west on unsurveyed lands. Such conformity is both impracticable and unnecessary; to enforce it would be merely to place additional obstacles in the way of the prospector, particularly in rough or heavily timbered and brushed districts. No possible confusion could result from permitting the locator to use his own judgment in staking his claims, since all claims require readjustment when accurately surveyed, and fractions are bound to occur in any case and under any system. Moreover, the abandonment of the extralateral right will automatically remove practically all the difficulties introduced by our present system.

15-16. The number of claims locatable by one person or association should be unlimited.

17. The present regulations governing marking, notice and record of locations are susceptible of considerable improvement. They should be so changed that the public may easily discover (upon the ground) what land has been covered by claims and by whom. The present method of staking and marking is shiftless and temporary in a large majority of instances. The official surveyor alone should destroy all corner posts of abandoned claims after having noted their exact location for record wherever such notation is necessary; a penalty should be provided for the removal or destruction of corner posts by anyone but the surveyor. The locator should be permitted to stake his claims according to his judgment, provided only that they be so staked and the stakes so plainly marked that the boundaries of his claims may easily be followed.

18-19. Notice of location should be filed as soon as possible in the public office of record of the district or county in which the location is made, but not necessarily a United States Land Office. The latter is often too distant. Ninety days after location should be the limit for recording in the United States.

21-27. This organization strongly recommends and urges that the amount of the annual assessment work be set at $100 per claim or fraction thereof, as at present. Without extralateral rights this is sufficient; any larger sum would probably discourage prospecting.

All assessment work should be reckoned at the current wages of miners in the district.

Assessment work should be permitted upon one or more claims of a group of contiguous claims, provided that such work is so begun and continued as to constitute a development of the entire group.

If the amount of assessment work performed upon a single claim or fraction in a single year is in excess of $100, then the excess sum should be made a credit against the work to be done in the following year or years, at that rate, provided that no fraction of $50 be allowed.

If the amount of assessment work performed upon a group of contiguous claims or fractions of claims shall exceed a sum equal to the number of claims or fractions multiplied by 100, then the said excess should be made a credit against the work to be done in the following year or years, provided that no fractions of $100 be allowed.

In lieu of the performance of actual assessment work the owner should be permitted to pay into the office of record of the district (not necessarily a United States Land Office) the sum of $200 for each claim or fraction of a claim; and all sums so paid should be made a fund to be used in road building or in such other work as will better the mining conditions of the district in question.

All sums expended in the survey of claims should be counted as annual assessment work.

Any new law that is enacted should contain emphatic provisions that shall insure the honest performance of assessment work.

Every holder of a claim or fraction of a claim should be required to file an annual statement of his assessment work, and severe penalties should be imposed for the falsifying of these returns.

28-30. After careful scrutiny, existing patent regulations should be simplified wherever possible. Often at present they operate to cause vexatious delays. The question of monumenting groups, instead of claims, is open to debate, but it would seem best to monument each claim, as guides to an interested public, since some groups are very large. Absence of records in the recording office of the district should be the prima facie evidence of the nonexistence of conflicting claims.

31. This organization strongly urges the abolition of extralateral rights and hereby indorses Art. 5 of the memorandum of the New York Section of the Mining and Metallurgical Society of America.

32. Seven years after date of location, exclusive of time covered by pending adverse claims, is sufficient time for the payment and final entry.

33. Without question there should be granted the right of appeal from the decisions of the United States Land Office to a court of competent jurisdiction.

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Ontario Mineral Production

The Bureau of Mines of Ontario has collected returns from the metalliferous mines and works of that province showing the production for the nine months ending Sept. 30, 1916. Following are the figures for the period and, for purposes of comparison, figures for the corresponding period of last year. It will be observed that there has been a large increase in the aggregate quantity, and also in the quantity of nearly all the individual products, due to causes mentioned in the notes appended.

SUMMARY OF ONTARIO MINERAL PRODUCTION FIRST NINE MONTHS OF 1916

Product	Quantity 1915	Quantity 1916
Cobalt (ore), tons.	92	98
Cobalt oxide, lb	135,337	378,732
Cobalt. metallic, lb	76,979	172,055
Cobalt and nickel oxides (unseparated), lb	2,501	57,026
Copper ore, tons		1,715
Copper in matte, tons....	14,057	16,989
Gold, oz.. . ..	281,712	363,955
Iron ore, tons ...	302,586	271,034
Molybdenite (concentrates), lb .		15,845
Nickel, oxide, lb	142,483	54,152
Nickel, metallic, lb.	11,905	17,435
Nickel in matte, tons	24,054	31,046
Pig iron, tons ..	354,153	501,410
Silver, oz.....	17,178,629	16,203,091

The silver mines of the Cobalt district have definitely established their supremacy of the sources of the world's supply of this mineral. Notwithstanding the war which has closed the European markets, the shipments of cobalt oxides were much greater both in quantity and value, than in the first nine months of 1915. It will be observed that metallic cobalt is assuming an important place in the list. This is mainly due to its use in the manufacture of special alloys, principally stellite, for high-speed tools. Stellite is made of cobalt, chromium and tungsten and is finding a good demand from munition makers and other workers of modern hard steels.

The extraordinary rise in the price of copper, which averaged 27c. per lb. in New York during the nine months, has brought about the opening of several deposits of copper ore, chiefly west of Lake Superior, from which shipments have been made to British Columbia smelters. The most important of these mines is the Tip Top; another at Mine Centre has lately been shipping a carload of ore daily. The price received by the shippers has averaged 18.5c. per lb. for the copper contents. This figure has also been applied to the copper contained in the heavy shipments of matte from the Sudbury nickel-copper mines, and a considerable part of the increase in value of the copper is due to the higher valuation, although the quantity shipped was greater by 20%.

The gold output from the mines of northern Ontario is steadily increasing, being 28% in excess of that for the nine months of 1915. Hollinger Consolidated continues to be the chief producer, accounting for 47% of the total. Dome followed with 21% and McIntyre-Porcupine with 10%. The other considerable contributors in this camp are Porcupine Crown, Schumacher, Vipond and Jupiter, which together furnished 5.5%. Outside of Porcupine proper, Tough-Oakes yielded $519,149; Canadian Exploration, Crœsus and a small output from Dome Lake amounted to over $250,000. At Teck-Hughes (Kirkland

Lake) the mine has been developed and a mill built which will be put in operation as soon as the power-transmission line now being erected from Cobalt has been completed. Other prospects here—the Lake Shore, Wright-Hargrave, Kirkland Lake Gold Mines, La Belle-Kirkland and Sylvanite—are also being developed. This is a promising camp. In Gauthier township the Huronian mine is being worked under a lease. Several discoveries of gold were made during the summer in Benoit township, but there has not been time to prove their value. At Tashota; the Tash-Orn company has bought the Wells claim and has put in machinery to give it a thorough test. This company is also working the King-Dodds claims. A diamond drill has been operated on the Devanney, Reamsbottom and Clive claims.

There is a demand for molybdenite in Great Britain for making tool steel and several deposits of the ore in eastern Ontario have been opened and are being worked. There are dressing plants at Renfrew and Ottawa, the latter operated by the Dominion Mines Department. Ferro-molybdenum is also being made at Orillia and Belleville. The supply of molybdenite throughout the British Empire has been reserved as a war measure and a price of 105s. per unit fixed for concentrates delivered at Liverpool. This approximates $1 per lb. here.

The Canadian Copper Co. and the Mond Nickel Co. have been working their mines and smelteries at maximum capacity, and the output of nickel contained in the matte product of the furnaces for the nine months falls little short of that for the full year 1915. The production for 1916 will probably exceed that of 1915 by 20%. The valuation of the nickel in the matte has been increased from about 11c. per lb. (the figure adopted by the mining companies) in 1915 to 25c. per lb. in 1916. Nickel refineries are to be erected in Ontario by the International Nickel Co. and the British America Nickel Corporation, the latter of which is developing the Murray mine. Small quantities of metallic nickel are being produced from Cobalt ores by the Deloro Smelting and Refining Co.

The whole production of iron ore was from the Helen and Magpie mines of the Algoma Steel Corporation. At the latter the ore (siderite) is roasted previous to shipment. Four blast-furnace companies at Port Colborne, Sault Ste. Marie, Deseronto and Hamilton respectively, produced pig iron in quantity 41% greater than in the corresponding period of 1915.

The silver mines at Cobalt continue to produce, though on a slowly diminishing scale. The number of fine ounces contained in the shipments of the nine months was 975,538 below the record for the same period of last-year, but owing to the much higher prices that have prevailed for silver, the return to the mining companies was $1,719,571 greater. Silver started the year at 56.76c. per oz. and rose to a maximum in May of 74.27c. whence it receded to 63.06 in July, reaching 68.51c. again in September. In 1915 the monthly average was 49.75c. per oz. Nipissing still leads in production, Mining Corporation coming next, followed by Kerr Lake, Coniagas, McKinley-Darragh-Savage, Seneca-Superior, Temiskaming, etc. The flotation process is likely to assist materially in increasing the production of silver at Cobalt. It has been introduced at the Buffalo mine, where it is treating low-grade rock containing 5 or 6 oz. per ton. From the gold ores treated during the period 66,317 oz. of silver was obtained, and from the copper ores 607 oz.

Colorado Scientific Society on Mining-Law Revision

In response to the questionnaire[1] submitted by the Mining and Metallurgical Society of America to its own members and to other coöperating organizations of mining men, the Colorado Scientific Society made the following reply:

In arriving at their own members' report, the committee has given weight to the majority opinion among our membership, as indicated by replies received to the question-form mailed to members.

In view, however, of the obvious fact that the questions require special study of the subject which many members cannot be expected to have given, and also to the apparent lack of appreciation on the part of some members of the exact meaning of the questions, your committee members have based their report on their own convictions, resulting from mature study and not entirely on the majority opinions, especially where the majority is not pronounced.

Question 3, as propounded by the Mining and Metallurgical Society, reads as follows: "Shall actual discovery of a valuable mineral deposit be necessary to a valid location of a claim?" This question has evidently been misunderstood by many members, as is shown by their replies to succeeding questions. A valid location, particularly if it may be maintained in force as a location for an indefinite period, is an absolute title, and if discovery were not required as a preliminary for such a location, it would be tantamount to abolishing the discovery requirement altogether. While, therefore, a large majority of our members answered the question in the negative, their replies to subsequent questions indicate that this is not what they intended. We are inclined to think questions 18 and 21 have also been imperfectly understood. It is perhaps inevitable that any set of questions drawn up as the present list was drawn would prove in some respect misleading and that some questions of importance should be left unasked.

The following conclusions of your committee refer by number to the specific questions submitted in the list:

1 and 2. Your committee, and the membership of your society, answer these questions in the affirmative.

3 and 4. Your committee has not found itself able to reach an agreement as to whether the discovery requirement should be waived entirely. A majority of the committee are unwilling to see the requirement abolished but desire that actual possession of a delimited claim should be legalized pending bona fide effort to make discovery. There is general agreement that mineral locations should be permitted upon discovery on all public lands, whether officially classed as mineral or nonmineral.

5. Prospecting should be permitted, and the prospector protected, on land classified as nonmineral.

6 and 7. If location without discovery is permitted, patent should not be issued until discovery is made.

8. We see no merit in the suggestion that there should be a larger payment for land patented without discovery.

9. Your committee and the members of the society are evenly divided on the question whether one discovery should be sufficient for a group of contiguous claims under one ownership.

10 and 11. Your committee cannot agree as to area of claims. If the unit is made sufficiently small, they agree that there is some advantage in requiring claims to be rectangular, made of square units disposed in any form desired. Small claims, in the opinion of part of the committee, would be inadmissible unless an affirmative reply is given to question 9. No member of the committee favors a larger claim than 10 acres as a maximum, but some of the committee favor 2½-acre units with a maximum area of 20 acres, arranged as desired by the locator.

12. We consider it advisable that every claim should be independently monumented.

13 and 14. Your committee considers that the unsatisfactory condition of the public survey, the irregularity and unsatisfactory monumenting of existing sections in many localities and the difficulty of finding section corners without the assistance of a surveyor preclude the use of subdivisions of the public survey, however theoretically desirable such system might be.

It is desirable that all boundaries should be [illegible] south and east-and-west.

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[1] Questionnaire published in the "Engineering and Mining Journal," Oct. 14, 1916, p. [illegible]

15 and 16. There should be no limit to the number of claims any person or association is permitted to locate.

17. Existing regulations concerning the marking, notice and record of locations should be continued substantially as at present, but your committee thinks that the regulations should be revised and made more stringent, and that uniform Federal regulations should replace those of the individual states.

18, 19 and 27. It would seem that most of our members did not realize that this question implied a change in the place for record as well as the question of time for record.

Your committee is unanimously of opinion that the United States Land Office records should not be burdened with location certificates and affidavits of annual labor, in respect of claims the great majority of which are never patented.

Furthermore, the committe considers that the time allowed for record with the county recorder, in view of the improved facilities which now exist, might with advantage be shortened to 60 days.

20, 21 and 22. A majority of the replies to question 20 from our members is in the affirmative. A majority of your committee, however, prefers that the rate should be the same as that which has usually prevailed in Colorado; namely, $10 per acre.

It is thought not desirable to provide for a payment into the Land Office in lieu of the actual performance of assessment work on the ground.

23. The owner of a group of contiguous claims should be permitted to do the assessment work on one claim for the entire group, when the work performed benefits the group.

24. Your committee is emphatically of opinion that excess assessment work done in one year should not be credited to succeeding years.

25 and 26. Our members and the committee are unanimously of opinion that adequate provision should be made for the insuring of bona fide performance of annual assessment work.

In figuring its value, the cost of labor should be figured at the current rate in the district for a similar character of work.

27. Certificates of assessment work should be required annually, should specify the exact place and manner in which the work was performed, and should be filed in the office of the county recorder accompanied by vouchers or other corroborative evidence.

28 and 29. Proceedings for patent should remain substantially as now provided. We think that every claim should be monumented, and we incline to think it should be provided that every such monument should be visible from the next.

30. Your committee thinks it unadvisable to record locations in the Land Office at all, and it would therefore be inadmissible that absence of conflicting locations in the Land Office records should be taken as evidence that no conflicts exist.

31. Your committee approves the proposal for abolition of the extralateral right for future mineral claims, in the form proposed.

32. Your committee is unanimously of opinion that no requirement of patent within any fixed period should be exacted.

33. Your committee is unanimously of opinion that any new mining law should provide for appeal to the courts from decisions of the United States Land Office.

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Export Duties on Metals in Peru

Peru is placing high duties on all metal exports, according to a law recently passed by Congress and summarized in a consular report. The tax on copper is based on a graduated scale. That is, when the price of standard copper in London is from £60 to £65 ($292 to $316) per ton, the export tax will be 15s. ($3.65) per ton of 1,016 kg. (2,240 lb.) Above £65 ($316) the tax will be 2s. (49c.) additional for every pound sterling increase in price. Not only does this measure seriously affect the exports of copper, but the gold and silver contained in the copper bars exported are also taxable.

Fine gold is taxed at £10 ($48.66) per kg. The gold contained in copper and other metals pays a tax of £2 ($9.73) per kg. Silver is subject to a tax of 1s. per kg., when the price in London is quoted at 23½d. a troy ounce; above this price, 2½d. (5c.) more for each penny increase. Petroleum pays a contribution of only 1s. a metric ton. These taxes are required to be paid in drafts on New York or London at 90 days' sight. When the tax amounts to less than £40 ($194.66), it may be paid in English gold. The Chamber of Commerce of Lima fixes weekly the value per ton of standard copper and of the troy ounce of silver, being guided by the price quoted by the London Metal Exchange.

In addition to this export law, another measure was passed by Congres, which places customs duties on all imports of mining machinery, which heretofore, was free of duty.

At the present time (June, 1916) the producers of copper are paying the government on an average of about £7 ($34) for every ton of standard copper exported from the country. It is said that under the new law the Cerro de Pasco Mining Co. will have to pay over $1,000,000 yearly.

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Day Holdings in Hercules Mine

Wallace Correspondence

The story of the Hercules mine, how it made millionaires out of a group of poor men and incidentally transformed a notorious labor agitator into a peaceful and conservative citizen, has been told and retold until it is known to all who are familiar with the mining industry of the West. A new chapter to the fascinating story was announced in the *Journal* last week, a deed having recently been filed in the office of the county recorder transferring a one-sixteenth interest in the Hercules from Mathilde Cardoner to Eleanor Day Boyce. Mathilde Cardoner is the widow and heir of the late Damian Cardoner, who died about a year and a half ago at his home in Barcelona, Spain. The acquisition of this interest gives the Day family ownership of a little more than half of the bonanza mine and makes Mrs. Boyce the largest individual owner except August Paulsen, who owns a little more than one-fourth. The Hercules is a partnership concern, but there is more secrecy about its affairs than is maintained by the closest corporation. The county records, however, show how the ownership is distributed, and the shareholders are here given, the fractional interests being reduced to the smallest common denominator:

Harry L. Day, Wallace	$\frac{24}{256}$	August Paulsen, Spokane	$\frac{66}{256}$
Jerome J. Day, Moscow	$\frac{24}{256}$	L. W. Hutton, Spokane	$\frac{25}{256}$
Eugene R. Day, Wallace	$\frac{24}{256}$	F. M. Rothrock, Spokane	$\frac{8}{256}$
Mrs. Eleanor Day Boyce, Portland	$\frac{56}{256}$	Markwell family, Los Angeles	$\frac{25}{256}$
Mrs. Blanche Day Ellis, Portland	$\frac{4}{256}$		

The purchase of the Cardoner interest by Mrs. Boyce gives the Day family thirty-three sixty-fourths of the Hercules property. The consideration given in the deed is $1, and the real price paid is purely a matter of conjecture. When the will of the late Damian Cardoner was filed for probate, the interest was appraised at $250,000. It is assumed that the one-sixteenth brought not less than half a million dollars and possibly more. The mine is paying from two and a half to three millions a year.

At the time the bonanza strike was made in the Hercules, Damian Cardoner, a native of Spain, was the owner of a small general merchandise store in Burke, and he acquired his interest in the property from Harry Orchard, who is now serving a life sentence in the Idaho penitentiary for the murder of Governor Steunenberg. Orchard's confession implicated the heads of the Western Federation of Miners, who were arrested in Denver and brought to Boise, where their trial attracted national attention. The conveyance of the Cardoner interest to Mrs. Boyce and the fact that it was originally owned by Harry Orchard recalls some rather ancient but nevertheless interesting history in connection with early labor troubles in the mining districts of the West. In his confession giving the details of his murderous career, Harry Orchard asserted that he was employed by the Western Federation of Miners, and there are few who read his story and followed the trial of the Federation officers who doubt that he told the truth. But be that as it may, the significant fact now recalled is that the organization of the Western Federation of Miners was the outgrowth of the labor riots in the Cœur d'Alene district in 1892, in which Edward Boyce, husband of the purchaser of the Cardoner interest, was one of the conspicuous figures; that it was largely through his efforts that the Western Federation was organized, and that he was its first president. Seldom have the changes wrought by time presented a more striking spectacle. Harry Orchard, the tool of the Western Federation of Miners, is paying the penalty of his crimes behind prison walls, while Edward Boyce, the organizer of the Western Federation and for years its guiding spirit, comes into possession of the vast wealth which was once Orchard's and which might have been his now had he been touched by a more kindly fate when he peddled milk to the miners of Cañon Creek along with the more thrifty August Paulsen.

New Mining-Experiment Station

WASHINGTON CORRESPONDENCE

Seattle, Wash., will be the site of the Northwest mining-experiment station. The Secretary of the Interior on last Thursday announced that he approves the recommendation to this effect made by Van H. Manning, director of the Bureau of Mines. After having heard the arguments in favor of the various points contending for this station, it was concluded that Seattle is the most available. Since some opposition to the selection has sprung up, Director Manning has pointed out how careful and systematic was the investigation that resulted in the selection of Seattle. In this connection Mr. Manning said:

"All the data collected upon the trip were carefully weighed and all the respective claims presented by the different localities were considered. The various needs of the whole region under consideration especially in regard to interrelationship of its various parts, were modified and broadened by this careful study of the representations made by those best acquainted with the industry in each center.

"It has not been an easy matter to make a final decision on the location of the station, and even now the final decision is to a large extent based upon assumption as to the future policy with regard to the location of other stations and the extension of less formal coöperation to other existing institutions in the general region under consideration.

"As the result of careful consideration of the data collected regarding the problems to be undertaken and the facilities and coöperation offered in each case, I felt impelled to recommend that the station be established at Seattle, Wash., in cooperation with the University of Washington, and that work also be carried on in cooperation with the University of Idaho and the Oregon State Bureau of Mines. The station will be able to handle problems not provided for at the other stations by cooperative work, and will take care of the problems met with along the southwestern and southeastern coasts of Alaska. Moreover, by locating the station at Seattle, it will be possible to lay special emphasis upon electrometallurgical work, which is a matter of great importance to the northwestern part of the United States and to all the Alaskan coast as well."

The station in the Southwest and the one in western Alaska were agreed upon without controversy. In the Northwest, however, great difference of opinion among mining men as to the best point for the station early became evident. This resulted in Mr. Lane's sending Director Manning to make a personal investigation. Mr. Manning was accompanied by F. G. Cottrell, chief metallurgist of the Bureau of Mines, and Dorsey A. Lyon, who is to be in charge of the Northwestern station. This board was unanimous in its opinion that the station should go to Seattle.

Importance of Magnesium

WASHINGTON CORRESPONDENCE

Possibilities favor a great increase in the importance of magnesium mining, according to Frank L. Hess, the specialist of the Geological Survey who is in charge of the lesser used metals. Since the opening of the war a considerable production of this metal has resulted, and according to Mr. Hess the magnesium made in this country is considerably better than that formerly imported from Germany. The General Electric Co. is the most important producer, but the Norton Laboratories and the Electric Reduction Co. also have a considerable output.

Mr. Hess says that the properties of magnesium, and especially of its alloys, are not sufficiently well understood to permit of an exact forecast of the coming importance of this metal. He is very much impressed, however, with the attractive possibilities that are likely to come with the alloying of magnesium with some minor constituents, like the carbon in steel, which will improve its hardness, tensile strength and elasticity.

Investigations by the Geological Survey disclose that some, who are experimenting with magnesium, believe that the metal can be produced in large quantities at a cost as low as 15 cents. An important manufacturer, however, is of the opinion that technical difficulties in production will keep the cost considerably higher

Ferroalloys from Germam Slags

An invention that may have some bearing on one phase of Germany's manganese supply is found in a patent (U. S. 1,196,185, Aug. 29, 1916) recently granted to Friedrich von Holt, of Georgsmarienhütte, Germany, according to *Iron Age*, Nov. 16, 1916.

Taking furnace slags, comparatively low in phosphorus and often containing manganese, the inventor makes a specular iron rich in phosphorus, which he suggests can be used in making steel as a substitute for the usual additions, introducing the required amount of manganese and phosphorus for certain steels and producing ferrophosphorus directly, if little manganese is present.

The phosphatic slag is added to the charge of a gas producer. According to the inventor, the heat causes the basic constituents of the slag to combine with the silicates of the ash, while the phosphorus forms with the iron the desired ferrophosphorus. The operation of the producer is not unfavorably affected, it is claimed. High manganese slags, it is stated, produce the specular iron rich in phosphorus.

Australian Zinc Production*

During the year 1915 the mines of the Broken Hill division produced a total of 1,504,603 tons of ore, of which 47,025 tons was oxidized ore and the remainder sulphide. While this is a gain over the 1914 total of 1,441,966 tons, it is still a considerable decrease from the 1913 maximum of 1,744,177 tons. In 1913 the production of oxide ore was only 27,876 tons, compared with 92,970 tons in 1914 and the before-mentioned 47,025 tons in 1915.

Owing to war conditions the British, Junction North, Junction Lead, and Block 10 mines were closed down throughout the year, and employed a total of only 135 men as against 1,907 in the year 1914.

The companies engaged in treating zinc tailings piles produced a total of only 190,916 tons of concentrates, compared with 359,310 tons in 1914 and 506,661 tons in 1913.

The Broken Hill Proprietary Co.'s flotation plant treated 280,867 tons, of tailings, producing 69,985 tons of zinc concentrates assaying 46.54% zinc, 6.41% lead, and 12.79 oz. silver per ton.

The Sulphide Corporation put its new zinc plant into commission in October and closed down the old plant after a run of 9 years. The new plant consists of a long series of flotation mixers of special design with underhand belt drive in lieu of overhead bevel gear. The plant is so arranged that the early mixers discharge high-grade lead concentrates, while the later machines produce a zinc concentrate.

The Amalgamated Zinc plant treated 317,239 tons of tailings whose average assay value was: Zinc, 16.8%; silver 3.5 oz.; lead, 3.2%. The production of zinc concentrates totaled 91,663 tons whose average assay was: Zinc, 49.2%; silver, 7.9 oz.; lead, 5.7%.

The production of lead concentrates was 1,130 tons whose average assay was: Zinc, 11.5%; silver, 51.8 oz.; lead, 57.6%. The estimated value of the 1915 production was £525,212; no dividends were paid.

The Zinc Corporation plant did not run during 1915, having been shut down at the outbreak of the war in August, 1914.

Mining Future of Yerranderie*

The Yerranderie Division is included within the Southern Mining District of New South Wales, Australia. It has been regarded by mining men for some time as one of the most promising mining districts in the state. Last year is was recorded that the mining population of Yerranderie had decreased considerably, no new mines had been opened, very little prospecting had been undertaken, and all the small "shows" had closed down. The reasons advanced were the isolation of the field from the railway system, the state of the connecting road, the extremely heavy haulage charges and the exhaustion, to a large extent, of the richer ores as the workings of the old mines had extended.

Making allowance for the abnormal conditions arising from the war, there has not been any appreciable change during 1915. The future of the field is clearly dependent upon two factors—the construction of a railway so as to enable the immense deposits of second-grade ore to be treated economically and the proving of fresh deposits by way of extension of the existing field. It is hoped that the present inquiry by the Public Works Committee will result in the satisfaction of the first requirement and that the construction of a line of railway from Picton Lakes will eventuate in the near future. As to the second, the recent discoveries in the Peaks Silver and Lead Co.'s leases have gone a long way toward establishing what was considered a moot point, namely, a southwesterly extension of the rich ore zones encountered in the parent mines.

It is worthy of remark in this connection that the government has largely helped to prove the resources of the field, as the Peak Silver and Lead Co. has been assisted by grants from the prospecting vote, while P. Coffey's leases on the western edge of the present titles have been tested by bores under government supervision and are considered to be promising "shows." While the developments that have taken place will in a measure assist in maintaining, perhaps improving, the output, the crying need is the railway, which, besides materially reducing working costs, would encourage legitimate prospecting and expansion.

Alaska Placer-Mining Locations

By A. L. H. Street*

Under a recent decision of the United States Circuit Court of Appeals for the Ninth Circuit, a location of a placer-mining claim in Alaska by one person for another is void, unless there was previously recorded a power of attorney authorizing the location (Sutherland vs. Purdy, 23 Federal Reporter, 600). The decision is grounded upon the acts of Congress governing mining in Alaska, the court saying:

> Whatever the reasons that caused Congress to prescribe conditions in regard to the location of such claims in Alaska essentially different from those applicable to other portions of the country, its language is, we think, perfectly clear and unmistakable and of course must be taken to mean what it says.

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The Gold Yield of Queensland for August was 20,433 fine oz., of the value of £86,794, this being a decrease, when compared with the corresponding month of last year, of 1,501 oz. in quantity and £6,376 in value. The returns from Croydon showed an increase of 375 oz., and from Gympie of 965 oz., while there was also a small improvement at Chillagoe. On the other hand, there were decreases—at Charters Towers of 1,063 oz.; Cloncurry, 616 oz.; Etheridge, 185 oz.; Clermont, 396 oz.; Mount Morgan, 933 oz.; and Ravenswood, 90 oz. The dividends declared by gold-mining companies for the month totaled £3,750, and for the eight expired months of the year £177,558, the latter amount being an increase of £49,393 over that for the corresponding period of last year. The yield of gold for the eight months was 157,381 oz., of the value of £668,512, or a decrease, compared with the return for the corresponding period of 1915, of 14,086 oz. in quantity and £59,833 in value.

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*Abstract from Annual Report of Department of Mines, New South Wales, 1915.

*Attorney at law, 829 Security Building, Minneapolis, Minn.

Editorials

Statistical Position of Spelter

During the first six months of 1916 the American production of spelter was officially reported as having been 316,000 tons, giving an average of about 53,000 tons per month. The smelting capacity had been steadily increased during the period, and at the mid-year there were reported an aggregate of about 191,000 retorts, with 22,000 building or contemplated, giving a total prospective capacity of about 216,000 retorts.

At the present time it is reliably reported that about 220,000 retorts are ready for operation, and judging from actual results that are available, the United States is in a position to make spelter at the rate of 770,000 tons per annum. Assuming that 95% of the capacity is in use, we get an annual rate of about 731,000 tons, or about 61,000 tons per month. In addition to that we are already producing electrolytic spelter at the rate of not less than 2,500 tons per month, the product of the Anaconda company, which is putting its several units into operation one by one and has not yet attained its full scale of operations. The present American production of spelter is therefore about 64,500 tons per month. Whither is all this spelter going? And why should the spelter market lately have been so strong?

Before attempting to account for the disposition of the present production of spelter, let us try to account for what became of the output in the first six months of 1916. The production during that period, officially reported, was 316,255 tons. The exports were 78,201 tons. The domestic deliveries were 228,700 tons. Domestic deliveries averaged 38,000 tons and exports 13,000 tons per month, a total of 51,000 tons per month.

In accounting for the use of this spelter, there is available certain definite information, but to a considerable extent we must depend upon conjecture. We have definite information respecting the exports of spelter and of brass in bars and plates. Manufactures of brass exported are also reported, but only in terms of value. We may compute approximately the quantity by dividing by the average price for brass plus an advance representing manufacture. Let us add 10c. per lb., which is probably a low figure. We can approximate the consumption for galvanizing and sheet zinc from information communicated by the galvanizers and rollers. As to brass for domestic peaceful purposes, the figure must be chiefly conjecture. Before the war it used to be 20 to 25% of the total consumption of spelter, the latter being about 300,000 tons per annum. Reckoning 25% of 300,000, we get 7,500. Our estimated distribution of the monthly delivery of spelter in the first half of 1916 is as follows:

	Tons
Exports...	13,000
Galvanizing. .	13,000
Sheet .	4,000
Domestic brass ..	7,500
Brass exported in bars, etc	3,000
Brass manufactures exported	7 200
Lead desilverization	400
Castings, etc......	1 250
Unaccounted for	1,650
Total	51 000

Since the middle of the year two very striking things have occurred — the exports of spelter in slabs, etc., have increased to about 16,000 tons per month, while the exports of brass manufactures have increased to a probable 12,200. We state these figures on the basis of the average monthly exportation during the third quarter. The exportation of brass bars declined slightly. Employing these figures, together with those for other uses at the same rate as in the first semester, we get a probable delivery and distribution per month at the present time approximately as follows:

	Tons
Exports	16 000
Galvanizing	13 000
Sheet	4 000
Domestic brass	7 500
Brass exported in bars, etc	3,000
Brass manufactures exported	12 200
Lead desilverization	400
Castings, etc	1 250
Unaccounted for	1 650
Total	58 800

It is to be remarked that one kind of present consumption cannot be accounted for quantitatively, namely, the brass that goes into cartridges, the exportation of which is reported under the heading of "Explosives," and as the finished article in terms of value only.

Our estimate of spelter for brass manufacture totals 22,500 tons per month, corresponding with 15,000 tons, or 90,000,000 lb. of copper, which is just about what authorities in the copper trade estimate for the total copper delivery to brass manufacturers at present.

In this statistical study we disregard the position of spelter derived from scrap and waste products. Accumulations thereof probably were completely drawn into the market long ago, and the present production doubtless represents only the quantity that is constantly going round and round; that is, the galvanizer buys spelter, loses a part of it in dross, which is reworked by the dross smelter and by him is returned to the market.

At the present time we cannot draw very close deductions from any statistics. Many conditions are too much confused. The difference in time with which individual figures are correlated is in itself an element of uncertainty, especially at present. Closely connected with that is the effect of the railway embargoes and the stocks that manufacturers are carrying in their yards. Such stocks have probably been much larger this year than in ordinary times.

We can get but some glimmerings of ideas. Stocks in the hands of producers accumulated to the extent of about 10,000 tons from Jan. 1 to July 1. While production was increasing during that period, the maximum has not now been reached. Since July 1 there has been a great increase in consumption for brass-making. Such increase must at one time have outstepped the increase in production, and even may have diminished the stocks. The behavior of the market reflects something of that sort, which may have happened a couple of months ago.

New production is forging ahead, swelled by the advent of the Anaconda smelter and, although [illegible] checked slightly by cold-weather troubles in the natural gas districts, is probably on the point of outstepping consumption unless the latter advances beyond what the figures for the third quarter indicate.

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Respecting Munitions Contracts

It was announced last week that the Remington, Westinghouse and Midvale companies have compromised their rifle contracts with the British government. The number is cut down from 3,500,000 to 2,000,000, which are to be delivered at cost, plus reimbursement for the plant installed to make them. A year and a half ago people were all agog over the immense rifle contracts that were being placed. Every owner of a reasonably equipped machine shop wanted to get such a contract and begin making rifles. Later it developed that even so experienced a concern as the Remington was having trouble. The others appear also to have had trouble. Now they consider themselves lucky to get out of their contracts with a whole skin. This is a chapter in the history of American manufacturing wherein we cannot feel any pride.

If we may rely upon the gossip that is printed on the financial pages of the daily papers, some of the shrewd managers of rifle-manufacturing companies sold out their stock at high prices when the market capitalized expectations. Thus they got all that they hoped, and the disappointment falls on the later stockholders.

The experience of the rifle-manufacturing companies is not the only case of disappearance of expectations of large profits. There are others that have had to put great sums of money into plants and have incurred losses in doing so. We have no doubt that many big surpluses will eventually turn out to be largely in bricks and mortar, which may not be wanted for any useful purpose.

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The Rise of Steel Products

Steel has long been considered the index of general prosperity. If that is true now, the country must be considered prosperous indeed. Steel prices are high and are still advancing. The high level seems to be no brake upon further advances and buying is still heavy, advances in basic prices seeming to merely punctuate increasing consumption. The auxiliary companies of the Steel Corporation have been backward in taking advantage of maximum rates, but they have been compelled, at last, to fall into line and in some cases have made leaders of themselves. The demand for steel products, both for domestic consumption and for export, continues exceedingly great, finished and crude steel continuing to share in the demand and price increases.

It appears that the Entente Allies are going to depend less upon American shops for finished products in the future, for orders for shell steel in crude form have been more abundant for export. It is noted in the trade that J. P. Morgan & Co. has contracted for about 1,500,000 tons of blooms and other forms of crude steel for delivery during the last half of 1917. This tonnage has been placed in various mills, so that many will share in the benefits. The price at which this order is said to have been placed ranges between 4 and 4.25c., while the same kind of material for first-half delivery was sold at from 3 to 3.5c. at mill.

The European order will call for a great part of the available output of material of the kind, and is likely to lead to higher prices than those now prevailing. The steel will, according to advices, be rolled and machined at European mills. No doubt there will be further purchases of steel products for second-half delivery, but it is not likely that any orders approximating this one in magnitude will be seen.

The activity is not all due to foreign orders, though, for there is brisk demand and large consumption inside the country. Shipbuilding interests are particularly large consumers, both for actual ship construction and also for material extensions to their plants. The New York Shipbuilding Co. and the Newport News Shipbuilding and Drydock Co. have placed large orders for purposes of plant extension. Car builders and structural-material shops are also placing orders of great aggregate amounts, and rail mills are said to be exceptionally busy. Taking it altogether, the index is pointing to a record mark, and industry in practically all the other metals is correspondingly great.

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The Mexican Agreement

The daily press has been giving a great deal of space lately to a discussion of the terms of the latest agreement between Washington and the Carranza Government. We consider, naturally, that anything that will lead to a permanent arrangement for real settlement of disputes and a discontinuation of the sport of killing foreigners in Mexico will be a good thing, but we hope to be pardoned for withholding a belief in the efficacy of any treaty, no matter how many signatures it carries, while the impotence of the Carranza government in Mexico is so clear.

At the very moment the agreement is being considered a battle is reported to be in progress near Chihuahua, Villa forces attacking and Carranza forces defending the town. It would seem to be the natural thing for the Carranzistas to do, if they feel able, to continue their attacks upon the Villistas until they are completely defeated or dispersed. This, however, has not been the plan. On the contrary, Villa attacks—he is repulsed—he camps near Chihuahua—he attacks again—is again repulsed. Between each attack the Villistas refresh themselves, while at the same time the Carranza army returns to the city and accumulates *tortillas* and *frijoles* and then, after a little *siesta*, is ready for another battle. At this rate the difficulty will continue to the end of time, and what is the use of the written agreement? If the Carranza government cannot take care of itself, how is it going to protect anybody else?

⁂

There have been numerous stories respecting that copper consolidation, ranging from the pronouncement that it was 0.5% fact and 99.5% fancy to the wise but mysterious "Oh, there was really something in it, but it was disclosed prematurely." Anyway, talk simmered down to its being probably a consolidation only of Chile and Kennecott, to which Utah was added by some. The union of Utah with them would look like an unholy plural marriage. Utah has gone through the fire of criticism and has come out a seasoned investment stock, held widely for the sake of its dividends. Chile and Kennecott are big companies and new ones, whereof distribution has not yet taken place, at least not widely. Just before the week of the boom in copper, the tip on those stocks was widely circulated. Then the rumor of consolidation was sprung. During the following week both stocks declined sharply on heavy selling. Probably a good many people became stockholders of Kennecott and Chile near the top of the market who did not intend to be permanent ones, but may find that they are.

BY THE WAY

A dispatch to the New York *Evening Post*, from Montreal, points out that with reference to the endeavors made by some leading American bankers to create sentiment in investment circles favorable to British and French loans unsecured by collateral, it is taken as being the results of intimations from the British authorities to the effect that unless such loans are granted, continuance of the excessive shipments of gold will be necessary. In view of the exceptionally large stocks of gold controlled by the three leading Powers of the quadruple Entente and of the large monthly production of mines in British territory, it is believed that London could without undue effort continue to send gold in even greater quantities—this without dangerously weakening the specie basis of the British and French currency issues.

* * *

Charles M. Schwab, of Bethlehem Steel fame, tells about his 20,000 partners in the *American Magazine*. In telling how he increased the efficiency of one of his departments, he says:

> It was near the end of the day; in a few minutes the night force would come on duty. I turned to a workman who was standing beside one of the red-mouthed furnaces and asked him for a piece of chalk.
>
> "How many heats has your shift made today?" I queried.
>
> "Six," he replied.
>
> I chalked a big "6" on the floor and passed along without another word. When the night shift came in they saw the "6" and asked about it.
>
> "The big boss was in here today," said the day men. "He asked us how many heats we had made, and we told him six. He chalked it down.
>
> The next morning I passed through the same mill. I saw that the "6" had been rubbed out and a big "7" written instead. The night shift had announced itself. That night I went back. The "7" had been erased and a "10" swaggered in its place. The day force recognized no superiors. Thus a fine competition was started, and it went on until this mill, formerly the poorest producer, was turning out more than any other mill in the plant.

* * *

In a report on the "Exploration of the Valley of the Amazon" (thirty-second Congress, Second Session, Senate, Executive Document No. 36, 1853), Lieut. William Lewis Herndon gave a brief but interesting account of mining in the Morococha district of Peru, in which he sojourned for a short time while en route for the headwaters of the Amazon. Shortly after passing Chiglla and Bella Vista, he chanced to meet on the road an old schoolmate, whom he had not seen or heard of since they were boys. This friend, Shepherd, was the engineer and head machinist of the mines at Morococha. Herndon continues:

> We arrived at Morococha at 5 p.m. This is a copper-mining hacienda, belonging to some German brothers named Pflucker, of Lima, who own also several silver mines of the neighborhood. The copper and silver of these mountains are intimately mixed; they are both got out by smelting; though this operation, as far as regarded the silver, had been abandoned and they were now beginning the process of extracting the silver by the mode of grinding and washing, after having tried the via humida (or method of washing in barrels, used in Saxony) and failed.
>
> The copper ore is calcined in the open air, in piles consisting of alternate layers of ore and coal, which burn for a month. The smelting is then done in a [illegible] built of fire brick imported from the United States and sufficient heat is employed to melt the copper which runs off into a [illegible] below, the scoria being occasionally drawn off with long iron hoes. The copper in this state is called eje, it has about 60% of pure copper, the residue being [illegible], etc. It is worth 15c per lb. in England, where it is refined. There is a vein of fine coal 18 mi. from the hacienda which yields an abundant supply. It is bituminous, but [illegible] and of great brilliancy.
>
> The hacienda employs about 100 [illegible]; more are desired, but they cannot be had at this time because it is harvest and the Indians are gathering the corn, barley and beans of the valleys below. A man will get out about 1000 lb. of copper ore in a day. I do not think the mines were at work during our stay, at least I saw or heard nothing of them. I could not either get statistics concerning the yield of these mines or the cost of working them, and I thought that I noticed some reserve on this subject.

* * *

We receive many prospectuses, but of them all, we think this one holds the record:

PROSPECTUS

THE THREE BUTTES AND CONSUMNES COPPER MINES

Embracing 30 square miles in extent. Largest copper deposit in the United States. Perhaps in the world.

Vast mountain ranges of copper, gold, silver, antimony, molybdenite and iron.

Huge deposits alunite slate rich in potash salts.

Large deposits crystalline marble, best statuary and building stone.

All material exist on this property for the manufacture of cement and lime on an extensive scale.

A giant low-grade ore proposition. One thousand million tons of ore in sight.

Copper ores of pyrite, chalcopyrite and tetrahedrite.

Two rivers and two large creeks flow thru this property. Furnishing an abundance of water power for the generation of all sorts of electric power.

Huge gorges cut in remote ages by the present streams reveal the extent of this giant deposit and its wondrous formation.

A great per cent. of this property owing to the steep precipitous mountain sides can easily be mined by side hill quarry and electric shovel.

The Diamond and Caldor R.R. cuts thru the southern end of this property.

75 miles in a direct line to tidewater.

Easy access by wagon road and railroad.

3,000 to 4,000 ft. above sea level.

Situated in El Dorado County, Calif. and in townships 9 & 10 north and ranges 13 east, M. D. M. and in latitude about 30 degrees 40 minutes north and in longitude 120 degrees and 33 minutes west.

Five hundred million feet of the highest grade merchantable saw timber of sugar pine, yellow pine, spruce, cedar and fir.

About one million dollars worth of development work has been done. Mostly for gold.

This property is large enough for several large companies to operate for hundreds of years.

A full detailed report will be sent to all interested parties. Also representative samples of the ore.

S. L. W[illegible]

Pleasant Valley, El Dorado Co., Calif.

We really don't care so much for gold now, because we are getting plenty of that from Europe. Everybody is anxious, however, to secure more potash, statuary marble, cement, antimony, molybdenum, and some of the other things that are in this horn of plenty. Say, here is our chance!

Personals

C. M. Weld returned to New York from Cuba on Nov. 27.

J. V. Richards, of Spokane, has gone to California to report on mines on the Mother Lode.

C. D. Kaeding has changed his address from South Porcupine, Ont., to Riverside Hotel, Reno, Nev.

J. H. Lang, of Vogelstein & Co., 42 Broadway, New York, returned on Nov. 17 from a trip to Europe.

Charles F. Willis, director of the Arizona Bureau of Mines, was a visitor at Washington, D. C., last week.

Dr. J. K. Clement served as director of the Bureau of Mines during the absence of Director Manning last week.

Karl L. Kithil, who had been named to take charge of the Bureau of Mines experiment station at Tucson, Ariz., has resigned.

George Otis Smith, director of the United States Geological Survey, has returned to Washington after an absence of two weeks.

E. V. Neelands has resigned as general manager of the British Guiana Gold Concessions Co., Ltd., and has returned to Canada.

J. R. Holcomb has been appointed superintendent of the Wilmington Steel Co., by President A C. Dinkey, to succeed W. J. Stoop, resigned.

V. F. Marsters, geologist for the New York & Honduras Rosario Mining Co., has returned to the United States. He is at present at Rushville, Ind.

F. G. Cottrell, chief metallurgist of the Bureau of Mines, is expected at Washington on Dec. 8 He has been on an extended trip through the West.

Prof. Francis A. Thomson has recently been engaged in making an examination of quartz properties near Pierce City, Idaho, for New York interests.

Dr. John A. Brashear, Pittsburgh, together with Ambrose Swasey, of the Warner & Swasey Co., Cleveland, sailed for China, from Vancouver, B C., Nov. 24.

Roy R. Horner has been named to take charge of investigation of metal-mining methods for the Bureau of Mines. His headquarters will be at Salt Lake City.

Henry F. Collins has resigned the executive management of the Huelva Copper and Sulphur Mines, and has accepted the position of consulting engineer to the company.

Stanley C. Bullock, who returned to England from Chile last year to enlist and is now serving at the front, has received promotion to the rank of captain in the Royal Engineers.

Jesse Scobey, managing director of the La Luz and Los Angeles Mining Co., arrived at Bluefields, Nicaragua, on Nov. 2, and left for Prinsapolka on Nov. 4, on a visit of inspection.

Frank R. Corwin has resigned as assistant superintendent of the Consolidated Arizona Smelting Co., to accept a position as assistant superintendent of the International Smelting Co., at Miami, Ariz.

Van. H. Manning, director of the Bureau of Mines, was in New York last week in consultation with Dr. L. D. Ricketts and John Hays Hammond regarding matters coming before the Anaconda Smelter Commission.

John A. Davis, head of the mining experiment station at Fairbanks, is on his way from Alaska to Washington, D. C., to confer with Director Manning, of the Bureau of Mines, in regard to the work of the station.

Lewis R. Ferguson, of the Portland Cement Association, is accompanying R. J. Wig, of the United States Bureau of Standards, on a trip along the Atlantic and Pacific coasts for the purpose of examining various concrete structures exposed to sea water.

R. S. Foster, safety engineer for the Butte mines of the Anaconda Copper Mining Co., has resigned to take a similar position with the Doe Run Lead Co. at Flat River, Mo. Mr. Foster will be succeeded by T. Oaas, formerly assistant safety engineer and C. E. Calvert, formerly shiftboss at the Berkeley mine, has been named assistant safety engineer.

Obituary

Franklin Morey, father-in-law of Clarence H Howard, president of the Commonwealth Steel Co., died of pneumonia at the family residence, 5501 Chamberlain Ave., St. Louis, Mo. He was 85 years old and a mining engineer by profession.

He was known, moreover, as having been the first man to exhibit an arclight in New York At a time when this form of electric lighting was considered impracticable, he went to New York, displayed his invention with the old and imperfect carbon, and carried his point. It was conceded at once that he had a valuable invention. Developments since have resulted in the present perfection of electric lighting.

Morey was born in Rome, N. Y., and went to Denver more than sixty years ago. He arrived there early in 1856. He returned to Missouri just before the outbreak of the civil war and organized a company in St. Louis that was held in reserve until the trouble ended.

He is survived by a daughter, Mrs. Clarence H. Howard, and by two sons, Frank L. Morey, secretary of the Commonwealth Steel Co., and Arthur T .Morey, one of the managers of that concern.

Societies

Engineers' Society of Western Pennsylvania The regular monthly meeting of the society will be held in the society rooms, Oliver Building, Pittsburgh, on Tuesday, Nov. 21, 1916.

American Society of Mechanical Engineers will hold its annual meeting at the Engineering Societies Building, 29 West 39th St., New York, on Dec. 5 to 8, 1916. A varied and interesting program, particularly in technical papers, has been prepared.

Metallurgical Society of Missouri School of Mines.—The Metallurgical Society effected a permanent organization, Nov. 14, 1916. The following officers were elected: T. P. F. Walsh, president; H. A. Horner, vice-president; and C. L. Epperson, secretary-treasurer. An executive committee, consisting of professors Mann and Clayton, Horner, Epperson, and T. P. F. Walsh, chairman, was elected to draft a constitution and make all necessary arrangements for a successful year. The society, meeting every two weeks, intends to devote its time to metallurgy, ore dressing and chemistry.

The American Association for the Advancement of Science and about forty national scientific societies affiliated with it will meet in New York City from Dec. 26 to 30, 1916, under the auspices of Columbia University, New York University, the College of the City of New York, the American Museum of Natural History and the other scientific and educational institutions of the city. Dr. Charles R. Van Hise, president of the University of Wisconsin, will preside. The address of the retiring president will be given by Dr. William Wallace Campbell, director of the Lick Observatory. The executive committee consists of Henry F. Osborn, chairman; J. J. Stevenson, M. I. Pupin, Charles Baskerville, N. L. Britton, Simon Flexner, E. B Wilson and J. McKeen Cattell, secretary.

Industrial News

The Lidgerwood Manufacturing Co., of New York, has opened a branch office in the Hibernian Building, Los Angeles, Calif. Charles A. Baechtold will be in charge of this office.

The Layne & Bowler Corporation, of Los Angeles, Calif., has recently sold to the Joplin Peacock Zinc Corporation, of Joplin, Mo., a high capacity pump for the dewatering of their mine, the pump is equipped with a special oil-bearing thrust for carrying the weight of the long line of the shaft. A. E. Bendelari, of Picher, Okla., has also bought from this company a large turbine centrifugal pump for dewatering his mine, the pump has a capacity of lifting 2,000 gal. per min. from a depth of nearly 300 ft. below the head of the shaft.

Trade Catalogs

Plymouth Gasoline Locomotives. The J. D. Fate Co., Plymouth, Ohio. Catalog No. 3; pp. 96; 6x9 in.; illustrated.

Crude and Fuel Oil Burners. Schurs Oil Burner Co., Los Angeles, Calif. Catalog No. 8. Pp. 56; 6x9 in.; illustrated.

Ingersoll-Rogler Air Compressors. Ingersoll-Rand Co., 11 Broadway, New York. Form No. 3130; pp. 24; 6x9 in.; illustrated.

Little David Pneumatic Riveting Hammers. Ingersoll-Rand Co., 11 Broadway, New York. Form No. 8311; pp. 16; 6x9 in.; illustrated.

Water Controlling Apparatus. Rodney Hunt Machine Co., Orange, Mass. Catalog No. 30; pp. 112; 6x9 in.; illustrated. Flumes, stand pipes, gates, valves, etc., made by this company are shown.

Vasco Vanadium Steel. Vanadium-Alloys Steel Co., Pittsburgh, Penn. Folder describing various types of this steel and containing information as to the study of alloy steels in general and uses of same.

Gold Dredges. The Yuba Construction Co., 433 California St., San Francisco, Calif. Catalog; pp 28; 9x12 in.; illustrated. This shows photographs of dredges constructed by this company and which are now operating.

New Patents

United States patent specifications listed below may be obtained from "The Engineering and Mining Journal" at 25c each. British patents are supplied at 40c. each.

Concentrator. Everett Richard Shahan, St. Paul, Minn. (U. S. No. 1,205,673; Nov. 21, 1916.)

Crushing, Grinding or Pulverizing Machinery. George H. Fraser, New York, N. Y. (U. S. No. 1,205,613; Nov. 21, 1916.)

Crushing Roll. Ray C. Newhouse, Milwaukee, Wis., assignor to Allis-Chalmers Manufacturing Co., Milwaukee, Wis. (U. S. No. 1,205,474; Nov. 21, 1916.)

Drill—Pneumatic Hammer Drill. Henry Schumacher, Denver, Colo. (U. S. No. 1,205,485; Nov. 21, 1916.)

Electrolysis—Process and Apparatus for Recovering Metals from Liquids. Charles E. Holland, New York, N. Y., assignor to Metals Electro-Recovery Co. (U. S. No. 1,205,207; Nov. 21, 1916.)

Flotation—Method of Concentrating Ore by Flotation. Gustaf Gröndal, Djursholm, Sweden, assignor to Beer, Sondheimer & Co., Frankfort-on-the-Main, Germany. (U. S. No. 1,202,512; Oct. 24, 1916.)

Leaching Ores and Other Products. John Edward Rothwell and Hugh Blackie Lowden, Denver, Colo., assignors to Colorado Iron Works Co., Denver, Colo. (U. S. No. 1,205,936; Nov. 21, 1916.)

Magnesium—Process of Producing Magnesium Compounds. Samuel Peacock, Philadelphia, Penn., assignor, by mesne assignments, to Marsden, Orth & Hastings Co., Inc., New York, N. Y. (U. S. No. 1,205,659; Nov. 21, 1916.)

Shaft Hanger. Joseph Dierdorff, Columbus, Ohio, assignor to the Jeffrey Manufacturing Co. (U. S. No. 1,205,601; Nov. 21, 1916.)

Sintering—Process for Sintering Fine Ores, Flue-Dust, Purple Ore and the Like. Carl Giesecke, Bad Harzburg, Germany. (U. S. No. 1,205,944; Nov. 21, 1916.)

Sintering Machine. Frederick W. Yost, New York, N. Y, assignor to American Ore Reclamation Co, New York, N. Y. (U. S. No. 1,204,633; Nov. 14, 1916.)

Slimes—Apparatus for Treating Slimes. David Cole, Tucson, Ariz. (U. S. No. 1,205,327; Nov. 21, 1916.)

Slimes—Art or Method of Treating Slimes David Cole, Tucson, Ariz. (U. S. No. 1,205,326; Nov. 21, 1916.)

Sulphuric-Acid Chamber. John Harris, Sheffield, England, and David Hibbert Thomas, Morriston, Wales. (U. S. No. 1,203,615; Nov. 7, 1916.)

Sulphuric Acid—Method of Manufacturing Sulphuric Acid. Andrew Miller Fairlie, Copperhill, Tenn. (U. S. No. 1,205,723; Nov. 21, 1916.)

Titanium—Method for Producing Composite Titanic-Oxide Products. Louis E Barton, Niagara Falls, N. Y., assignor to the Titanium Alloy Manufacturing Co., New York, N. Y. (U. S. No. 1,205,144; Nov. 21, 1916.)

Tuyere—Walter D. Ross, Jr., Anniston, Ala. (U. S. No. 1,205,568; Nov. 21, 1916.)

Water Jacket. Henry Rude, West Allis, Wis., assignor to Allis-Chalmers Manufacturing Co, Milwaukee, Wis. (U. S. No. 1,204,688; Nov. 14, 1916.)

Assessments

Company	Delinq.	Sale	Amt.
Atlantic, Ida	Dec. 9	Jan. 9	$0.001
Buffalo, Ida	Nov. 15	Dec. 12	0.005
Challenge, Nev	Nov. 29	Dec. 20	0.05
Christmas, Utah	Nov. 20	Dec. 16	0.005
Con. Virginia, Nev	Dec. 8	Dec. 29	0.05
Cottonwood King, Utah	Nov. 14	Dec. 1	0.005
Eagle Mtn., Ida.	Dec. 22		0.001
East Hercules Ext., Ida.	Jan. 2	Feb. 2	0.0005
Emerald, Utah	Nov. 15	Dec. 9	0.00½
Eureka, Ida	Dec. 9	Jan. 9	0.001
Exchequer, Nev.	Dec. 5	Dec. 27	0.03
Federal Ely, Nev.	Dec. 2	Dec. 20	0.005
Four Timbers, Ida	Dec. 2	Jan. 2	0.002
Hector, Ida	Dec. 22	Jan. 16	0.005
Idaho-Nevada, Idaho	Nov. 15	Dec. 16	0.002
Idora, Ida	Nov. 24	Dec. 23	0.005
Iron King, Ida	Dec. 9	Jan. 9	0.001
Lehi Tintic, Utah.	Nov. 8	Dec. 2	0.0025
Lion Gold, Utah	Nov. 13	Dec. 5	0.0025
Mayflower, Ida	Dec. 23	Jan. 25	0.005
Mexican G. & S., Nev.	Nov. 25	Dec. 18	0.10
Mines Dev., Utah	Nov. 17	Dec. 7	0.30
Naildriver, Utah	Nov. 4	Dec. 4	0.01
National Lead, Ida	Nov. 25	Dec. 26	0.001
Nevada-Stewart, Ida	Nov 14	Dec. 2	0.002
New Hope, Ida.	Oct. 11	Dec. 11	0.002
North Star, Ida.	Oct. 10	Dec. 5	0.001
Paloma, Utah			0.015
Pittsburgh Cons., Utah.	Nov. 17	Dec. 8	0.0175
Reindeer Queen, Ida	Dec. 16	Jan. 22	0.005
Rico-Argentine, Colo.	Nov. 18	Dec. 5	0.01
Silver Moon, Ida	Nov. 25	Dec. 23	0.005
Sonora, Ida	Nov. 15	Dec. 6	0.004
Tarbox, Mont	Dec. 22	Jan. 13	0.005
Tiberius, Ida	Dec. 21	Jan. 12	0.00075
Utah United, Utah	Nov. 15	Dec. 4	0.01
Wallace M., M. & R., Ida	Dec. 8	Jan. 8	0.0025

The publication of this table will be discontinued after Dec. 30, 1916.

Editorial Correspondence

SAN FRANCISCO—Nov. 22

Mother Lode Mines in Amador County have resumed underground work and some of the mills are running. Most of the properties have nearly a full complement of men and all expect by Dec. 1 to be in fairly good running shape, both as to mine extraction and ore treatment.

New Oil Wells drilled in California fields total 627 for 10 months of 1916. The present rate of work, according to the view of the state oil-and gas supervisor, will continue for the remainder of the year, giving a total of more than twice as many new wells as were completed in 1915. The rising price of oil has caused activity in all fields similar to that of six years ago. Although a great deal of the work is being done on land already known to be productive, there are wildcat wells in most of the fields which, if successful, will develop new oil areas. All of these prospective additions, however, will probably not equal that made by the opening of the Midway field in 1910. The possibility of northward extension in the Coalinga field will be demonstrated by a well now being drilled. A number of wells are drilling in the region northeast of the old McKittrick field. In the vicinity of Los Angeles, three wells are drilling on the low range of hills between Long Beach and Beverley. This region is of particular interest for its oil possibilities. North of Ventura two companies are drilling in new territory, one finding some of the lightest oil yet recorded in the state. There is more activity in the Santa Maria field than for many years and extensions of proved land near Cat Cañon and Casmalia are practically assured. This section of the field produces the heaviest oil in the state and production could be advanced by constructive action on the part of the Federal Government in dealing with oil lands already developed.

DENVER—Nov. 23

Roosevelt Tunnel will probably be in condition for the resumption of driving about Dec. 10. Timbering of the Elkton shaft continues rapidly and work at the tunnel breast will be resumed as soon as this timbering is completed. The breast is about 2,100 ft. ahead of the Elkton shaft but no work has been at the face since Nov. 17.

Wellington Mine at Breckenridge was materially improved in equipment during the last summer by the erection of a new commodious boarding house, an addition to the mill building for the enlarged flotation department, the installation of a second roaster and the construction of large ore-storage bins. Two adventitious finds have been recently made in the property, a blind vein being exposed while sinking a shaft for the known Oro vein and another blind vein being uncovered during the digging of a ditch to convey water to the new boarding house. Both veins are similar in mineral contents to the other veins worked for several years and are probably members of the same system.

Deep Mining is the slogan for Cripple Creek these days. Contrary to the fears of numerous authorities in the early days of the district, development at depth has proved the mineralization not only fully equal to that in the surface or oxidized zone but in some instances better. This condition is reflected prominently in the mining-stock markets of which Cresson is an example. The recent disclosure on the 1,800 level of Vindicator is noteworthy, the shoot having been drifted on for 700 ft. and crosscut 40 ft.; it is said to average nearly 1¼ oz. gold per ton. The new flotation mill at the Vindicator mine is making an extraction of around 80%; experiments are being conducted to increase this percentage.

Kokomo-Robinson District, just over the range north of Leadville, near the head of Ten Mile Creek, in Summit County, is active. Geologically, the measures compare closely with those at Leadville, the shoots being chiefly masses of silver gold-lead-zinc ores occurring as replacements in limestone. This region languished because of low prices for silver and heavy penalties exacted for zinc, and time has been required to overcome the former prejudices against it. The average altitude is high and the open season for prospecting and performing surface improvements is short so that the winter, already set in, came soon enough to prevent several projects attaining their stride this year. Another year will witness greater activity than this. The old Robinson mill (sometimes spoken of as the Wilson mill) has been completely remodeled by the Progress Mining and Milling Co. and is being operated as a custom plant, the complex lead-zinc ores from local mines being concentrated by flotation and on tables. The working force at the mill is comprised, almost exclusively, of experienced millmen who are refugees from Mexico. Among the mines furnishing ore to the plant are the Robinson Tunnel (adjacent to the mill), [illegible] and Colonel Sellers. Elk Mountain Mining and Milling Co., new owner of the Willis mine and mill, mines about 50 tons per week. The Michigan mine produces from 200 to 300 tons weekly. R[illegible] Eagle mine, leased by Bryant & Ritch, shipped 75 tons during October.

LEADVILLE, COLO.—Nov. 23

Leadville's Output fluctuates with the seasons and the recent months probably represent maximum production. Therefore, to be conservative, it is prophesied that the average production for the year will be found to be about $1,500,000 per month. Indications are strong that 1917 will send these figures up considerably for there are several important projects now approaching their productive stage as, for instance, the Leadville Unit, the Empire Zinc Co., the Downtown Mines Co. operations, etc. Trackage is now being laid for switching purposes to the Jamie Lee shaft of the Leadville Unit on Fryer Hill and to the McCormick shaft of the Empire company on Carbonate Hill.

The Labor Situation has not changed, except that the crisis which was expected immediately following election has failed to materialize. The matter, however, is far from being settled. The union leaders are still busily engaged with their organizing campaign and report that they are meeting with success. This ceaseless effort on the part of the workers is looked upon with suspicion by the operators who believe that, in spite of the declaration of the union stating there will be no strike, a successful organization of the miners in the district can lead to nothing else. The operators continue to stand pat on their refusal to treat with representatives of the Western Federation of Miners. The state industrial commission, which was to investigate the situation and recommend what changes seemed advisable, has done nothing as yet. Although the strike topic has lost a great part of its interest for the present it is looked upon as subject for future consideration. It is rumored that unless the union secures part of their demands, a strike will be called in the spring. The uncertainty created by the unsettled conditions is causing important developments planned for the coming year to be held in abeyance. Unless a decision in the matter is reached, the posibility of a future strike will tend to check big mining in the district.

BUTTE, MONT.—Nov. 23

Anaconda Safety Methods were given a high compliment by H. J. Rahilly, of the U. S. Bureau of Mines, who has been in Butte. After a visit to the mines of the company he stated that it has the most advanced and practical methods of rescue work and accident elimination of any mining company in United States. September record shows not a single death in any of company's 27 Butte mines. Only 23 accidents incapacitated men for two weeks or more. In that month 321,104 shifts were worked.

A Sequel of the Cold Snap of last week was the closing of the Anaconda company's Butte copper mines for the night of Nov. 17 to allow the Washoe and Great Falls smelteries to catch up in treating the accumulation of ore that had frozen in transit and in bins during the cold spell. Company's zinc mines were all kept going. At the company's Great Falls works, the third unit of the new zinc plant will be put into operation within a few days. The three units will take care of the present output of the zinc concentrator at Anaconda and, with the two units yet to be completed, will be able to turn out approximately 6,000,000 lb. of zinc a month. The final units are expected to go into commission by the end of the year.

Injunction Asked by Minerals Separation, Ltd., to prevent paying dividends or transfer of assets by Butte & Superior Mining Co., presents a new phase in the suit of Minerals Separation against Butte & Superior. Alleging that the Butte & Superior company is disposing of its assets and its enormous war profits in excessive dividends to stockholders and is negotiating sale or amalgamation of its properties to the American Zinc, Lead and Smelting Co. in order to defeat any judgment which may be rendered against it for infringement of patent, the Minerals Separation, Ltd., on Nov. 20 filed a motion in the Federal Court to "increase greatly" the present $75,000 bond, or to enjoin the company from declaring dividends. No specific amount for the enlarged bond was mentioned in the motion. The matter was left to the discretion of Judge Bourquin of the Federal Court, who has set Nov. 25 as the date for hearing arguments. Attorneys for the defendant company claim that in view of the present status of its case against the Butte & Superior company, Minerals Separation was entitled to no bond to secure a possible judgment. That the decision of the Circuit Court of Appeals [illegible] B[illegible] first decision [illegible] taken at the [illegible] it of any kind [illegible] the reversal has been [illegible] pending [illegible] in the United States Supreme Court, where the matter now rests for final decision. That further [illegible] the defendant company holds $2,000,000 worth of American Zinc stock, representing [illegible] of any damages which may be awarded. The decision of the Supreme Court is expected in the near future.

SALT LAKE CITY—Nov. 24

American Fork District is unusually active this season. In addition to some of better known properties such as Pacific, Dutchman, [illegible] Eagle, Miller Hill, etc., many other properties are being worked. The Pacific, which has just paid a dividend, is rapidly bringing its mill to completion. The Green Leasing Co., operating the Yankee, has a shipment of high-grade silver-lead ore ready for the market. Tunnel work is being done under contract at the Osborne [illegible] Big [illegible] working, and work is to be resumed at the Wasatch Range, the tunnel of which is now in [illegible] ft. New company, Silver Side Mining, has been organized to operate claims near fork of cañon; tunnel in 45 ft. is to be continued 200 ft. under contract; ore is silver-gold. Work at the [illegible] Hill, at head of Silver Flat Creek, is being pushed; No. 2 tunnel—in 100 ft.—has cut low grade copper ore.

OATMAN, ARIZ.—Nov. 21

Three Important Mills will be in operation in 1917 in the Oatman district; these will be at the United Eastern, Tom Reed and Big Jim properties. The United Eastern mill is practically completed, and will be grinding in about [illegible] days; this mill was designed by Otto Wartenweiler of Los Angeles, and will have a capacity of [illegible] tons per day. Additional milling capacity is to be provided at the Tom Reed as a result of the developments in the Aztec claim. Orders have already been placed for electrical equipment and for some mill equipment, as from five to seven months is required for delivery. Preliminary specifications for the Big Jim mill are completed, but before making final decision as to equipment, Manager A. G. Keating will spend a month or two studying the latest methods being used in the gold and copper plants throughout the country. The Big Jim mill will be placed just west of the working shaft of the company. These three companies all have important ore reserves with probabilities of much more being opened up. Milling by a new process has been started at the Gold Dust plant; the equipment consists of a Marks rotary pulverizer and a Zimmer centrifugal separator or amalgamator. Cheap milling costs are claimed for this equipment, but the mill has not been in operation long enough to demonstrate these claims.

DULUTH, MINN.—Nov. 25

Shipments of Over 21,000,000 Tons of iron ore had left the Duluth, Missabe & Northern Ry. docks up to Nov. 22, or 6,000,000 tons more than the entire 1915 tonnage from these docks.

Hammell-Feigh Suit at Duluth is attracting some attention in the Cuyuna range. Patrick Hammell has brought suit against Thomas Feigh, wealthy mine owner, for one-half interest in Cuyuna range properties, stated to be worth $5,000,000. Feigh owns the fee to a property under lease to Northern Pacific interests and the latter have just inaugurated mining operations. It is assumed that this is the [illegible] in [illegible]. Hammell claims an agreement of many years' standing whereby he was to select lands of mineral value and Feigh was to furnish the money, the profits to be divided equally.

Graft Cases at Hibbing will shortly come up for trial, the grand jury having reported 29 true bills in Hibbing village and Stuntz township, naming the following citizens: Victor E. Power, mayor; D. D. McE[illegible], ex-treasurer; R. M. Hitchcock, proprietor of "Hibbing Daily Tribune"; Claude M. Atkinson, proprietor of "M[illegible] Ore"; D. D. H[illegible], recorder; Rupert [illegible], [illegible]; John Curran, trustee; R. I. Burrows, trustee; W. I. R[illegible], ex-manager of water, light, [illegible] and building [illegible]; [illegible] M[illegible], supervisor Township of Stuntz; Albert D[illegible], supervisor, Township of Stuntz; S[illegible], citizen; and John Mah[illegible]. These men were all out under bail. [illegible] the [illegible] village on earth [illegible] defied the mine operators, who [illegible] of the taxes, but their [illegible] gence seems now to be [illegible]

ISHPEMING, MICH.—N[illegible] 2[illegible]

Shipping Season Is Drawing to a Close in the Lake Superior district, the [illegible] greatly hindered operations [illegible] going out from the Michigan [illegible] not be many more cargoes to go from Minnesota. Many of the pit properties have been closed for the year, and the underground mines have commenced to stock ore for shipment next season. The railroads have been bothered considerably because of ore freezing in the cars, and on one day last week the Great Northern road had many cars of frozen ore at the Allouez docks, as well as 100,000 tons frozen in the dock pockets. A great deal of extra expense was required to unload the ore, steam being made use of freely. Many of the Lake freighters are now carrying grain and are through with the ore business until next spring. The Lake freights for next year have already been set, the price to be $1 a ton from the head of the Lakes to Lake Erie ports, 90c. from Marquette, and 70c. from Escanaba. This is an advance of 50c. a ton over the existing rates. Some "wild" cargoes are now being handled at $1 a ton, the Shenango Furnace Co., which is through shipping its own ore for the year, having charters with other companies at that figure. The company has five boats, each of which has a capacity of over 10,000 tons. Now that the vesselmen have set their rates for 1917, the mining companies will not be slow in making their next year's prices. This is the first instance in years where the Lake rates have been set in advance of ore rates. It is generally believed that iron ore will get an advance of from $1.25 to $1.50 a ton, which would not be a large increase, when the pig-iron and steel prices are taken into account. The mining companies will have to pay 50c. more a ton to get their ore down the Lakes, and mining costs will be greater. The steel Corporation has announced an increase in wages of 10%, which will include the employees of the Oliver Iron Mining Co. The other iron-ore companies will also announce an advance, a decision having been reached at a meeting of the large operators in Duluth.

HOUGHTON, MICH.—Nov. 24

Coal Situation in Northern Michigan, where it is impossible to get any more coal this winter, excepting by rail and then at such great freight rates as to put the price at a prohibitive figure, is illustrated by the Winona's predicament. It may become necessary for the Winona to shut down, owing to the lack of coal supply. Not a mine in the Lake Superior district has all the coal needed. Unless there is a short winter, there will be difficulties in the spring.

All Lake Copper Mines will show increased outputs this year over 1915, which was looked upon as about the maximum copper production of the district. The output for the Lake Superior district in 1916 will be between 260,000,000 lb. and 265,000,000 lb. of copper, this estimate being based on the performances of the properties to date and the expectation for the next 40 days. Notable increases have been shown in three properties, subsidiaries of the Calumet & Hecla. They are the Allouez, now going its best stride and likely to show a 12,000,000-lb. rate at present (yet counted as only a 10,000,000-lb. producer under average normal conditions), the Ahmeek and the Isle Royale. All three of these properties are doing better than ever before in their history. Isle Royale and Allouez are showing not only greater rock tonnage but greater percentage of copper than ever before. Ahmeek is maintaining its unusually high average. Calumet & Hecla will do better than in 1915 and so will Copper Range, Mohawk, Quincy and other standard producers, but there will be no sensational increases as each of these properties made remarkable records in 1915. Copper Range mines are maintaining their high-grade rock, especially at the Champion.

JOPLIN—Nov. 25

Improved Railroad Service to Oklahoma mines is in sight. A. H. Rogers, president of Southwest Missouri Railroad Co., has announced intention of his company to extend interurban line now running from Carthage—through Joplin—to Galena, Kan., to Baxter Springs, Kan., and it is known he contemplates extension from there to mines of Picher-Cardin-Century section, which is only two or three miles farther. From the other end, the O. K. & M., which recently established service from Miami through Commerce to Picher, has just announced purchase of two new modern cars which it will use to improve service.

Shortage of Electric Current is doing more to curtail the output from this district just now than any other one thing. The long drouth has made it nearly impossible for the local company to produce current from water power at its Spring River dam, and the low water is causing much boiler trouble at its steam generators at Riverton. The company is now installing an expensive plant for water purification and has purchased another turbine and is promising a largely increased supply of current not later than Jan. 1. Meantime, out of more than 200 mills electrically equipped in this district, not one is being permitted to operate straight through as would, in almost every instance, be the program if there was no curtailment of electric current. At Granby, the lead smeltery of the American Zinc, Lead and Smelting Co. has been closed, through the withholding of current, and the big Klondike mill is operating only at about one-half capacity When this plant was designed it was originally intended to use steam, but electricity was ultimately decided upon and it was this that brought the first power lines to Granby.

TORONTO—Nov. 24

The Alleged Shipment of Nickel from Canadian ore to the Germans is a controversy that is becoming fiercer and arousing strong public feeling. It forms the principal topic at political gatherings and in newspaper discussion. On Nov. 23 last, the first official statement as to the position of the Canadian government respecting the recent phases of the question was made by Hon. Arthur Meighen, Solicitor-General, at a meeting held here. He strongly emphasized the point that had the exportation of nickel from Canada been stopped, the manufacture of munitions for the Allies in the United States would have been hindered and a year and a half would have elapsed before it could be refined in Canada for use in the war. In working out the system of control the Ministry had acted strictly in acordance with the advice of the British government. "The government of Great Britain," he went on to say, "through its Committee on Enemy Supplies is in daily, weekly, monthly control of all the output of the International Nickel Co. in so far as that output goes overseas, or into plants in the United States. They are in a position to know who should receive it and who should not. I am in a position to say and at the proper time to prove that not a pound goes to a factory in the United States, or to a vessel from that country, save with the approval of the British Admiralty and the British government." In reply to the statement that no nickel had come from New Caledonia to the United States since the war began, he quoted records of shipments to show that during 1915 a total of 3,462 tons of nickel matte was received by the United States Nickel Co. from New Caledonia and that up to August of the present year the shipments amounted to 2,630 tons. This was equivalent to a production of 150 tons per month in addition to 100 tons per month produced in the United States as a byproduct of copper, over which Canada had no control. Mr. Meighen dealt with the charge that Henry R. Merton & Co., the British agents of the International Nickel Co., had been convicted of trading with the enemy, stating that this was early in the war and that the Merton company had since been reorganized, the shares formerly owned by Germans being now held by British subjects.

The Mining News

ALABAMA

GRAPHITE MINING is very active, especially in Clay County. Over 18 graphite mills in operation or under construction.

FLAKETOWN GRAPHITE CO. (Mountain Creek)—Shipping one car per week from this station in Chilton County; F. R Taber, president. Another mine in this section may be operated after Jan. 1.

ARIZONA

Cochise County

PEERLESS COPPER (Dragoon)—Work resumed; will drill 50-ft. holes with Sullivan diamond drill; V. C. Joslyn, general manager.

BISBEE COPPER MINING AND DEVELOPMENT (Bisbee)—Has begun shaft sinking on Pauline claim, although hoist is not expected for fortnight. Two churn drills are reported to be in operation.

HILLTOP METALS (Rodeo, N. M.)—Haulage and development tunnel through mountain, 3,200 ft. practically completed; tunnel cut several copper and lead oreshoots; over $100,000 worth of machinery purchased; plans extensive development; building wagon road to Rodeo, N. M.; smeltery being considered.

Gila County

INSPIRATION (Miami)—Hoisting and crushing plant broke record by hoisting and crushing 21,300 tons in one day.

INSPIRATION NEEDLES (Miami)—Drill hole No. 1 down 815 ft.; preparing to begin holes Nos. 3 and 4; two additional Star drills ordered.

IRON CAP COPPER (Copper Hill)—Vein 18 ft. wide on 600-ft level, containing iron and copper sulphides. High-grade ore in winze from 900-ft. level; vein 4 ft. wide in places.

ARIZONA COMMERCIAL (Copper Hill)—Shipping 150 tons daily. Vein on 14th level is about 50 ft. wide, with 15 ft. of smelting ore. Sinking Copper Hill shaft to 16th level. Pumping about 700,000 gal. daily; pumping capacity now 1,500,000 gal. About 160 men working.

MIAMI CONSOLIDATED COPPER (Miami)—Made a shipment of 6% oxidized ore to Old Dominion smeltery. Drill hole No. 1 located; purchased five patented fractions lying between property and the Inspiration Needles and Southwestern Miami.

Mohave County

MIDNIGHT (Chloride)—Rich strike reported on 200-ft. level; operated by G. S. Holmes and associates under option.

BIG JIM (Oatman)—Approximately 240,000 tons of ore practically assured; oreshoot opened for a length of 740 ft. Further sinking to be done at once.

UNITED EASTERN (Oatman)—Housing of mill is practically completed and most of machinery is in place. Main working shaft is being connected with lower level (665-ft.) of old workings, equivalent to 790 ft. in new shaft.

Pinal County

ARIZONA RAY COPPER CO. (Ray)—Churn drill No. 1 working three shifts; second drill on property and third ordered. Hole No. 1 lost; hole No. 2 down 100 ft. on Nov. 24. Edmund L. Hiatt, superintendent.

LAKE SUPERIOR & ARIZONA (Superior)—Rumored consolidation with Magma will not take place. Now stated that Magma will buy for cash one claim projecting into Magma territory, near recent developments in rich ore. Some outlying claims may be consolidated with Lake Superior & Arizona, the financing to be done by certain Magma stockholders.

Yavapai County

JEROME DAISY (Jerome)—Shaft through iron capping and into schist.

UNITED VERDE CONSOLIDATED COPPER (Jerome)—Diamond drills delivered on ground

TIP TOP (Prescott)—High-grade silver ore struck on 350-ft. level.

NEWS MINING CO. (Jerome)—Reported optioned to Calumet & Arizona Mining Co., of Warren, Ariz.

VERDE MONSTER (Jerome)—New company being organized by T. F. Shea and other Jerome men; two million $1 shares; property, 600 acres, about 2 mi. southwest of Jerome.

UNITED VERDE (Jerome)—Stated to be making preparations to steamshovel large body low-grade ore near old smeltery site; may carry steamshovel operations down to old Hampton stope.

LOMA PRIETA MINES CO. (Skull Valley)—This Prescott company is developing group of 27 claims in Copper Basin district, adjoining Commercial Mining Co. Chalcopyrite encountered at 62 ft. in shaft, which is in ore at 150 ft.; sinking to 500 ft. At 140 ft., two drifts run for 200 ft. A. B. Peach, superintendent; T. G. Norris, of Prescott, president. May build 100-ton mill.

CALIFORNIA

Amador County

ARGONAUT (Jackson)—Resumed operation with 40 stamps dropping

KENNEDY (Jackson)—Operation resumed underground and progress being made on the surface; probably have 100-stamp mill in full operation by end of month.

PLYMOUTH CONSOLIDATED (Plymouth)—Output for October was 7,900 tons; estimated value, including concentrates, £10,778. Working expenses, £5,254; development, £1,396; surplus over working and development, £4,128; capital expenditure, £1,370.

ORIGINAL AMADOR (Amador)—Mill completely remodeled. Regrinding in Hardinge mills, 8 ft. by 22 in. and 8 ft. by 36 in.; capacity increased from 150 to 250 tons per day. New development on 850 level north and south drift satisfactory. Ore better grade than formerly. Deepening of shaft will begin on Dec. 1; contemplates sinking to 1,500-ft. point. Tailing dam raised 5 ft. to increase capacity necessary. A. A. Busey, manager.

Butte County

MASCOT (Oroville)—This old producer in Morris Ravine will be equipped with the mill formerly at the Cape Horn mine. Recently the lost vein was found by W. T. Baldwin, who will develop the property. Other properties in the district are busy, including the Bumble Bee, the Banner and the Butterfly.

Calaveras County

TULLOCH (Angels Camp)—Being developed under bond by Thomas I. Lane, who is sinking a three-compartment shaft

CALAVERAS CONSOLIDATED (Melones)—Tunnel advancing rapidly. Six new 2-ton side-roll-dump cars installed and bungalow completed for Superintendent James A. Davis.

UTICA (Angels Camp)—Discontinued use of air on winze hoist; remodeling hoist to electric drive. Reported that Stickels mill will drop full number of stamps as soon as hoist is in operation.

BRUNNER (Angels Camp)—Added to the Tulloch in the development being prosecuted by Thomas Lane. Paying bonus on extra footage made by miners in sinking at the Tulloch, resulting in rapid work and larger pay for the men than any other underground men in the camp.

Nevada County

IN MEADOW LAKE DISTRICT, near Truckee, the Old Man Mountain mine reported sold by H. D. Ramsey with other properties in the district for a sum approximating $100,000. Peter Bokay, owner of the Bokay Bonanza, has leased other properties. A. Huber reports good ore in the Lucky Strike. Ore has been found in the Freeman claim by P. D. O'Connor. In the spring, development promises to be active in all parts of district.

Plumas County

TEFFT (Quincy)—The property situated on Crescent Hill, 5 mi. south of Quincy, recently purchased by H. H. Kelly, of Santa Ana, and associates. New roller mill and other machinery installed. Will be driven by gasoline engine. Large amount of milling ore on the dump, result of development by former owner. New mill capacity 50 tons in 24 hr.; will be operated on half time during winter. J. F. Groover is superintendent.

Tuolumne County

JUMPER (Jamestown)—High-grade ore reported by leasers in Golden Rule claim. In the last three years much gold produced by the leasing system; both men and company satisfied with results.

SPRINGFIELD TUNNEL (Columbia)—Only a few men at present retained to keep property in condition for early resumption of operaton. Prospecting with Keystone drill, electrically driven, will be inaugurated to ascertain exact position and value of gravel.

Yuba County

YUBA CONSOLIDATED (Hammonton)—Yuba No. 16 launched Nov. 26. Dredge will be same size as No. 15, but will have two stackers to reclaim Yuba River channel.

COLORADO

Clear Creek and Gilpin Counties

GRAND-CLEAR CREEK (Empire)—Work under way again on this property in Daly district. Tunnel in 600 ft.

EMPRESS (Freeland)—Acquired recently by Gilpin Tungsten Production Co. Development will begin at once through 500-ft. crosscut tunnel.

ARGO LEASING CO. (Empire)—Building for new mill finished and machinery now arriving. Property consists of 22 claims in Daly district.

GIBSON (Central City)—Repairing the 400-ft. shaft. Milling-grade ore opened on 150-ft. level and gold-silver ore assaying $80 per ton on 250-ft. level. Mine belongs to Star of the West group.

GILPIN-ORION (Central City)—Merged with Combination Mining and Milling Co., a Denver organization owning mining interests in Grand County. Gilpin company has 40 acres on Bob Tail Hill; deal provides development fund for this property.

PITTSBURGH CONSOLIDATED (Freeland)—Work resumed under management of J. C. Sturdevant. Old producer, but now filled with water; being drained through McClelland tunnel. Property comprises nine claims and Dover mill at mouth of Fall River.

Gunnison County

VICTOR (White Pine)—Worked by lessees. Lead and zinc carbonate ores shipped.

BON TON (Pitkin)—I. L. Johnson contemplates adapting the Quartz Creek mill to flotation to recover molybdenite.

COLORADO COPPER (Iola)—Leased Anaconda mine; steam hoist and boiler being installed and sinking will be resumed.

San Juan County

PIKE COUNTY (Ophir)—Under development by Louis Lomax, of Telluride.

CROWN JEWEL (Silverton)—Ore being packed from this mine to Silverton.

CARRUTHERS LEASING (Telluride)—Aerial tramway between mine and new mill completed and in operation.

SANTA CRUZ (Ophir)—Being developed by Wichman & Co. Lessees are shipping payable ore from development.

FRANK WALLER (Howardsville)—New vein opened in No. 2 tunnel. Gold-silver-lead ore being shipped from west drift.

BROADGAUGE MINING AND MILLING (Silverton)—Shoot good-grade ore opened in lower tunnel of this Burns Gulch property.

KITTIMAC (Silverton)—Two shifts working; considerable development work under way. Mill operating steadily after being thoroughly overhauled and new Hyde classifiers installed. Buildings all repaired for winter and several snow-breaks built above them and the tram towers.

Summit County

MICHIGAN (Kokomo)—Both iron and lead ores being shipped; latter from shoot recently discovered.

SURPRISE (Frisco)—Shipping lead-silver ore. Mine operated by lessees. Tunnel being driven to cut vein below old workings.

MASONTOWN (Frisco)—Development work under way. Considerable ore opened. Mine equipped with good hoist and milling plant.

IDA BELLE (Montezuma)—High-grade lead-silver ore opened in second adit level by lessee Joe Childers. Shipments recently made; ore of last strike of much higher grade. Mine will be worked all winter, but shipments must be discontinued on account of snow as ore has to be packed to Keystone station.

Teller County

BLACK DIAMOND (Cripple Creek)—Developed recently by Gibbs & Co. Sorted ore produced during development assays 2 oz. gold a ton.

ELKTON (Elkton)—Main shaft being retimbered from the collar down to 25 ft. below 200-ft. level, and active development will be resumed.

ACACIA (Cripple Creek)—New oreshoot has been opened in Shurtloff vein on 1,200-ft. level at a point 150 ft. north of the South Burns shaft. Lessees Quinn & Burrows have opened body of $70 ore at junction of Shurtloff and American Eagle veins on 1,100-ft. level.

MARY McKINNEY (Anaconda)—Shaft now 1,360 ft. deep. Included in present year's work is a drift advanced to the main vein on the 12th level; at a point about 300 ft. west of the shaft a pockety body of payable ore was opened; development in north heading continues; some flat veins of payable ore were opened in eighth level, and drifting is in progress on the ninth level to open these veins. Station on bottom level is nearing completion and crosscut will soon be started to the main vein; distance is estimated at 330 ft.; as soon as crosscut reaches vein a drift will be advanced each way from the intersection. Development on the 11th level continues, although no payable ore has been encountered recently.

IDAHO

Shoshone County

HYPOTHEEK (Kingston)—Officials deny option has been given to Rex Consolidated. Sinking shaft from 1,100 to 1,300 level.

HECLA (Burke)—Addition to mill will be completed by Dec. 15, which will increase capacity from 450 to 700 tons per day. Hecla now uses Stewart mill, owned by Federal company; lease will expire when above addition is completed.

COEUR d'ALENE ANTIMONY MINING (Kellog)—At annual meeting, capital stock increased from 500,000 to 1,500,000 shares; voted to investigate question of local treatment of concentrates. Shoot of ore, 3 to 6 ft. wide, opened for nearly 500 ft. Shaft to be sunk additional 100 ft.

MORNING (Mullan)—Output will be largely increased after Dec. 15, when Stewart mill, at Wallace, will be utilized. The Stewart mill has a capacity of 500 tons and the Morning mill 1,000 tons. It is understood that both will be run at capacity. Properties owned by Federal Mining and Smelting Co.

NORTHERN LIGHT (Wallace)—Fourth vein cut at this Pine Creek property recently; it is 26 ft. wide, a third of which is of shipping grade, both lead and zinc; vein was cut in crosscut from shaft at depth of 400 ft. Three other veins have been explored at depth of 200 and 400 ft.; disclosed considerable ore. Ben G. Harmon, manager. Control of company is owned in St. Paul.

MARYLAND

ALUMINUM CO. OF AMERICA (Pittsburgh, Penn.)—A subsidiary, known as the Aluminum Ore Co., has bought 150 acres at Sollers Point, near Baltimore, where it is reported a plant is to be erected for treatment of bauxite.

MICHIGAN

Copper

ALLOUEZ (Allouez)—Shipping 2,000 tons to the mill daily.

CENTENNIAL (Calumet)—Shipping 600 tons daily. Grade improves as northern boundary is approached.

MOHAWK (Mohawk)—Refined copper output for October, 1,233,46[illegible] lb., as against 1,115,762 lb. in September.

ADVENTURE (Greenland)—Shipments will be made to the Winona mill about Dec. 1 from the Butler and Knowlton lodes.

VICTORIA (Victoria)—New tables being installed at the mill will increase capacity from 5[illegible]0 to 700 tons. Twelve rock drills ordered.

MICHIGAN (Rockland)—Drifting on the Evergreen lode will be started soon. The 27[illegible]-ft. drift on the Ogimah lode has shown good mineralization; fault encountered on the Butler lode.

WHITE PINE EXTENSION ([illegible])—Having trouble in taking care of water coming through to the 200-ft. level. Some pumps will be ordered; as soon as the water is taken care of sinking will be resumed. Drifts at 200-ft. level are in rock, running about [illegible]0 lb. copper to the ton.

CALUMET & HECLA (Calumet)—Leaching plant is running successfully and has required no changes from original plans; because of delay in receiving material only one-half of plant is operating, but plant will be brought up to 2,000 tons capacity early next year; will probably be increased to 1,000 tons later. Company is shipping [illegible],000 tons daily from the conglomerate lode, in which 170 drills are now being operated.

FEDERAL SYNDICATE CO. (Calumet)—Recently organized under the laws of South Dakota, with 1,000,000 shares of $1 par value, to develop about [illegible]60 acres, supposed to be on the Kearsarge lode, southeast of the Phoenix; also negotiating with the Charles Kingston estate for 100 acres additional in same region. A. C. S[illegible] and Dr. P. D. MacNaughton, P. L. DeV[illegible] and Ernest LeDuc of Duluth are interested. Dr. P. D. MacNaughton, of Calumet, is secretary-treasurer.

Iron

JONES & LAUGHLIN ORE CO. (Ishpeming)—Operations have stopped at the pit property at Iron Mountain Lake. Will be resumed in spring.

CORRIGAN McKINNEY (Crystal Falls)—No more lake shipments will be made; over 500,000 tons have been sent out this year. Considerable ore remains in stock at some of the mines.

MINNESOTA

Mesabi Range

HAWKINS (Nashwauk)—Two men killed Nov. 21 by premature blast in the openpit.

GREAT NORTHERN ORE (Duluth)—Company has announced that it is now asking $1.50 a ton more for its iron ore. M. A. Hanna Co. sells the ore.

SMITH (Hibbing)—Butler Bros. have taken lease and started stripping. About [illegible]0 men employed now. Will be heavy shipper in 1917. Property is west of big Mahoning and Hull Rust pits.

HULL-RUST (Hibbing)—One day this week 1,800 ore cars were loaded in the pit by steam shovels. This is a new Mesabi Range record; average this year has been about 1,000 cars daily.

Cuyuna Range

NORTHWESTERN IMPROVEMENT CO. (Ironton)—Initial steps being taken to sink shaft on the Feigh property in Sec. 10, 16-29, near the Pennington pit. Operation will be under direction of the Great Northern Ore management.

ONAHMAN IRON CO. (Manganese)—At annual meeting, held in Duluth, W. P. Myers was elected president; W. A. McClaran, vice-president and general manager; M. A. Dunning, treasurer, and C. A. Lanigan, secretary. All are Duluth men. Company operates the Ferro mine.

SULTANA MINES CO. (Ironton)—This name was adopted at annual meeting of the Cuyuna-Sultana Mining Co. Company has acquired new property in Sec. 31, 17-29, about 1½ mi. north of the Sultana mine. The new property has been christened the Clarke mine.

MISSOURI

Joplin District

PIQUA (Granby)—Mine taken over by Edward McElhany, of Joplin, and others. Mill being overhauled.

E. J. PRATT (Webb City)—Optioned 60-acre tract near Baxter Springs, Kan., to Oklahoma men for $80,000.

KING JACK (Commerce, Okla.)—Another cave-in, in which a rougher jig and set of rolls were lost, has caused final abandonment of this property.

BLUE JAY (Miami, Okla.)—This new 250-ton mill being built by Commerce Mining Co. on tract just east of Blue Goose property at Cardin. To be ready by Feb. 1.

OWOSSO (Joplin)—At Duenweg property field shaft is being driven by raising. When complete will enlarge capacity of mill to 600 tons. Sheet-ground mine; operations at 2[illegible]8 ft.

BETHEL (Miami, Okla.)—Planning construction of third mill on 60-acre lease near Cardin. Two mills, known as Bethel and Demande, now making about 25 tons concentrates daily.

BALDRY (Joplin)—Opening second shaft on rich silicate property south of city. Made three cars of concentrates in three weeks with two men in ground. Has lead at 120 ft. and [illegible] mine at 1[illegible]5 ft.

SCHOOLHOUSE (Carterville)—This sheet-ground mine taken over by Chapman-Hoxley Mining Co., of Joplin. Will increase mill to approximately 1,000 tons daily [illegible]. Expect to start [illegible].

DICK TURPIN (Joplin)—This plant, down since last spring, expected to start [illegible]. Principal owner, [illegible] Sharp, of K[illegible], [illegible] on Mexican border as [illegible] K[illegible] National Guard, recently returned home [illegible].

KLONDIKE (Granby)—[illegible] owned by A[illegible] [illegible] S[illegible] [illegible] current [illegible] in a few weeks, third [illegible] to be connected with tram [illegible] road with gasoline lo[illegible]. [illegible] third shaft at 28[illegible] ft., [illegible]

MONTANA

Lincoln County

SNOWSTORM MINES CONSOLIDATED (Troy)—Employing between 500 and 600 men to hasten work preparatory to starting operations—expected to take place before end of year. Mill and buildings, flume and railroad are nearing completion. Considerable ore has been broken down at mine ready for treatment as soon as equipment is ready to receive it. Town of Troy growing rapidly has opened bids for municipal water system and made plans for other important improvements.

Madison County

CONREY PLACER MINING (Ruby)—Dredge No. 1 began leaking recently and sank to the bottom of its pond. A force of men is now engaged refloating dredge and making repairs.

REVENUE CONSOLIDATED GOLD MINES (Norris) This company, main office, Hirbour Block, Butte, is sinking main shaft, now 300 ft. deep. Faulted Revenue vein encountered in Bowker winze and is expected to be cut by shaft at 360 ft. Company has also acquired Columbus and Lexington groups. G. D. B. Turner, president.

Mineral County

RICHMOND MINING, MILLING AND REDUCTION (Saltese) This company operating Richmond group near Adair, Idaho, has acquired half interest in adjoining St Lawrence group formerly controlled by Finch-Campbell estates and the Sutherlands, of Wallace, Idaho.

Silver Bow County

DAVIS-DALY (Butte)—Nordberg hoist, ordered some months ago for the Colorado mine, has been shipped from Milwaukee.

EAST BUTTE (Butte)—October production was 1,650,160 lb. copper; lowest since June. Continuing development from Shaft No. 1 below 1,800 level.

NORTH BUTTE (Butte)—Has closed contract with Anaconda for treatment of 150 to 300 tons of zinc ore daily. Zinc ore developed lately on 2,000-ft. level. Company's property abuts Elm Orlu and Black Rock mines.

BUTTE & SUPERIOR (Butte)—October statement of production, filed with court, showed 53,542 tons of ore mined and milled, resulting in 14,191 tons of concentrates, valued at $56.89 a ton Cost of flotation was $2.82 per ton of concentrates.

BUTTE & GREAT FALLS MINING (Butte)—Word has been received that capital to carry on program of development has been raised. Operations were recently suspended, pending results of an effort to raise required funds by assessment. Company may enter old Neihart field, in Cascade County, to reopen some of the old silver mines, having optioned the Lexington and Ingersoll mines. R. M. Green, manager.

TUOLUMNE COPPER MINING (Butte)—October shipments to smeltery amounted to 52 cars, netting $20,000. November production expected to be double that amount. Estimated that there are 100,000 tons of ore in old stopes that can be profitably mined at present copper prices. At company's properties in eastern section, development is progressing rapidly and they are expected to be in shape for extracting ore by end of year.

BUTTE-DETROIT COPPER AND ZINC MINING (Butte)—Officially stated that arrangements with Davis-Daly company have been made to treat zinc ores from latter company in Butte-Detroit mill. Mill was built some years ago to treat ores from company's Ophir mine, in the southwestern section of Butte camp. After some alterations it will be capable of handling 500 tons of ore a day, 150 tons to be furnished by Davis-Daly and balance by ore now being developed in Ophir and in zinc mines, owned by other companies.

NEVADA

Humboldt County

ROCHESTER MINES CO. (Rochester)—October cleanup $57,800. East vein on 250-ft. level is stated to have widened to 18 ft.

NEVADA PACKARD MINES CO. (Rochester)—Initial dividend of 5c. per share, or about $58,235, declared payable Dec. 20. The 100-ton mill is to be doubled in 1917.

Lyon County

MASON VALLEY (Thompson)—Smeltery will be started as soon as coke supply can be obtained. Bluestone and Mason Valley mines being reopened.

Nye County

TONOPAH ORE PRODUCTION for week ended Nov. 18 was 9,597 tons, valued at $188,366, comparing with 9,757 tons for the previous week. Producers were: Tonopah Belmont, 2,725 tons; Tonopah Extension, 2,380; Tonopah Mining, 2,000; Jim Butler, 1,150; West End, 529; Rescue-Eula, 251; Halifax, 158; McNamara, 94; Monarch Pittsburg, 62; North Star, 52; miscellaneous, 178 tons.

JIM BUTLER (Tonopah)—Profits from October operations, $32,633.

TONOPAH BELMONT (Tonopah) Profits for October, $90,872

GREAT WESTERN CONSOLIDATED (Tonopah)—Two new pumps now in place; will resume development on 1,150-ft. level within few days. Also plans to sink shaft deeper.

TONOPAH MINING (Tonopah) October profit was $42,110 from treatment of 8,055 dry tons ore; average value, $15.60 per ton. Bullion produced was 134,590 oz., valued at $114,200.

NEW MEXICO

Grant County

BATTLESHIP (Lordsburg)—This group will be explored by churn drills; W. H. Scarborough, owner

SILVER KING (Central)—Leased by C. M. Becker, N. M. Cndabac and G. H. Howze; have started work and will soon ship two carloads gold-silver-lead ore per week.

CARLISLE (Steeplerock) Entire face west drift on 500-ft. level in sulphides, lead, zinc, copper, gold and silver; more copper showing with depth.

CHINO (Santa Rita))—South of the "Hearst Pit," more than two acres reported to contain orebody 300 to 500 ft. thick, which averages 1⅓% to 1½% copper.

AUSTIN-AMAZON COPPER (Silver City)—New organization of Charles Davis and D. M. Jackson, of El Paso, M. W. Porterfield and John M. Wiley, of Silver City, to develop and operate claims in Burro Mountains.

EBERLE (Mogollon)—Drifts being advanced both north and south from 50-ft. level in exploratory shaft, equipped with Fairbanks-Morse 15-hp. gasoline hoist and compressor plant. Ore from development sent to custom works. Oaks Co., operator.

HANOVER COPPER CO. (Hanover)—G. A. St. Clair, of Duluth, Minn., has taken principal interest and will operate property on company account in futnre. Mine is in Hanover Gulch and is principal zinc producer in this section; leasers in October shipped 31 cars of zinc ore. F. G. Walker is now manager.

Sierra County

SHERIFF MINING (Rincon)—Close corporation of El Paso sheriffs to develop deposit of 50% pyrolusite; shipments pay exploration expense and profit.

Taos County

MEMPHIS RED RIVER MINING CO. (Raton)—This company installed flotation plant at its property near town of Red River. Equipment includes C I. W. ball mill, Dorr classifier, M.-S. type cells and Card tables. W. D. Kershner, president.

OREGON

Baker County

TABER FRACTION MINES CO. (Baker)—James A. Howard and associates, who have optioned the Taber Fraction and Rastus claims, near Sumpter, have shipped three cars and are working 10 men on development.

HOMESTEAD-IRON DYKE MINES CO (Homestead)—Flotation plant, which began operating Sept. 25, has been working satisfactorily, a 92% extraction being obtained from heads averaging about 3% copper. Mill is of 150 tons daily capacity and uses Janney 7-cell machines. Concentrates averaging 11% copper are shipped to International smeltery at Tooele, Utah. Emmet F. Galligan, superintendent.

UTAH

Beaver County

PALOMA (Milford) Main incline down to 650 and being sunk to 700 level. On 600, ore carrying copper and lead opened in two places.

CREOLE MINING (Milford)—Stock listed on Salt Lake Exchange; company has 9 claims in Lincoln mining district, 12 mi. from railroad. Development done through 200-ft. shaft, and approximately 1,100 ft. of tunnels, winzes, drifts, etc. Ten men are employed. Returns from 1916 shipments, $41,000—ore carrying copper, silver, lead and gold. N. W. Haire, president.

MOSCOW (Milford)—October shipments amount to 10 cars of lead-silver ore and two cars of zinc ore. So far in November nine cars shipped, and total production of 12 to 14 cars expected Ore being mined in all parts of old workings. Drift being sent out from new shaft for old workings, which will gain added depth of 300 ft., or total of 1,100 ft. All ore will be sent out through new shaft, which is nearer railroad

Juab County

KING WILLIAM (Eureka)—Being reorganized; old stockholders on paying ½c. per share will secure equal number of shares in new company.

DRAGON CONSOLIDATED (Silver City) Ore carrying gold, copper and silver mined adjoining Iron Blossom. Forty tons of milling ore daily shipped to Tintic Milling Co. Iron ore also being shipped

Salt Lake County

UTAH COPPER (Bingham) October production 20,324,520 lb., making output for four months over 80,000,000 lb. Further increase in production facilities contemplated.

OHIO COPPER (Bingham) Mill treating over 2,000 tons daily, under lease to General Exploration, extended to Dec. 1. Property recently inspected by Eastern stockholders.

CARDIFF (Salt Lake)—October shipments were about two cars per day, ore being hauled by team 3 mi. to South Fork, and from there by tractors to Midvale.

UNITED STATES SMELTING (Midvale)—Lead smeltery at Midvale is operating. Working forces recently increased. Huff electrostatic plant is treating between 70 and 80 tons daily from the company's wet concentrator.

BINGHAM AMALGAMATED (Bingham)—Work to be resumed on company account after lapse of some years. From 600-ft. inclined shaft, on 300 level, will drive toward limestone contact. This limestone in adjoining Congor prodncing 30 to 50 tons copper ore daily.

NEW QUINCY (Park City)—Ore of better grade is being mined. Drifting to west on main level for ore opened in a raise. Two feet of ore reported on east side.

ONTARIO (Park City)—Shaft caved for about a hundred feet, and 1,700 level will be flooded. Due to soft ground Company was timbering. Work will be snspended for about two months in this part of mine until timbering and repairs can be completed. Hoist may be installed, and work done on 600 level.

VIRGINIA

VIRGINIA SMELTING CO (West Norfolk)—Leaching plant recently destroyed by fire now operating. Rebuilding of plant proceeding under contract with heavy penalties for delays of completion after Jan. 1, 1917.

Halifax County

GROVES COPPER MINE (Keysville)—In northern section of Virgilina district, George S Groves reports production about 4,000,000 lb. of copper during last few months from 8% ore, taken from a 3- to 6-ft. vein; two shafts, 100 ft. deep; 500 ft. of drifting. Shipping car of ore daily to West Norfolk smeltery, and expects to double output when installation of new equipment is completed. Plant capable of hoisting 100 tons per day.

CANADA

British Columbia

COAST COPPER CO. (Trail, B. C.)—Sinking 400-ft. prospecting winze on claims recently optioned at northern end of Vancouver Island.

RAMBLER-CARIBOO (Slocan)—Contract closed with United States Zinc Co. for sale of 1,000 tons of zinc concentrates. Basis of settlement to be $34 flat for 33% zinc and 28-oz. silver. Net returns to mine will be about $23 per ton, after deducting freight and duty.

Ontario

ORE SHIPMENTS from the Cobalt district over the Temiskaming and Northern Ontario Ry. are reported by Arthnr A. Cole, for the month of October, as follows: From Cobalt proper, 1,552.80 tons by the following companies: Aladdin Cobalt, 20.50 tons; Beaver, 40.77; Coniagas, 74.20; Cobalt Comet, 64.38; Crown Reserve, 95.27; Kerr Lake (by Dominion Reduction Co.), 97.85; Kerr Lake Mining Co., 30.23; La Rose, 126.98; Mining Corporation of Canada, 36.96; McKinley-Darragh, 167.53; Nipissing, 649.18; O'Brien, 64.91; Right of Way, 42.03; Trethewey, 42.01. From New Liskeard, by Casey Cobalt, 27 tons; from Elk Lake, by Miller Lake-O'Brien, 28.30 tons; Reeves-Dobie, 11.50; total silver-ore shipments, 1,619.60 tons. From Temagami, by Dominion Rand, 79.29 tons of pyrites; from Porquois Junction, by Alexo, 237 tons of nickel ore.

INSPIRATION (Porcupine)—Diamond drilling has started.

GOLD REEFS (Porcupine)—Sinking shaft from present depth of 30 ft. to the 100-ft. level.

LAKE SHORE (Kirkland Lake)—Installation of new 7-drill compressor is practically completed

BEAVER (Cobalt)—New vein, 5 to 7 in. wide, opened for 20 ft. on 600-ft. level, carries high-grade ore.

OPHIR (Cobalt)—A 7-in. vein, carrying cobalt, nickelite and some silver, struck in the crosscut at 425-ft. level.

PLATT (Porcupine)—Under option to Coniagas; has been getting good results in diamond drilling. Several veins cut

GIFFORD (Cobalt)—Decided to increase capital from $250,000 to $1,000,000; will be offered to shareholders at 5c. per share; money to be used in further development.

SCHUMACHER (Schumacher)—Opened new vein, east drift for 30 ft. showing 7 ft. of ore.

KEORA (Porcupine)—Has let a contract for diamond drilling.

McINTYRE (Schumacher)—At joint meeting of directorates of the McIntyre, McIntyre Extension and Jupiter companies, Nov. 23, a tentative basis for amalgamation was decided on The offer of the McIntyre, if accepted, will be submitted to shareholders for ratification.

NICHOLS COPPER CO. (26 Broad St., New York)—This company has secured option on 160-acre pyrite property, near Mokomon, 31 mi. from Port Arthur, Ont., on the Canadian Northern Ry., belonging to B L. Morrison, of Port Arthur. Purchase price is $100,000. Shafts and test pits will be sunk and diamond drilling undertaken

The Market Report

Metal Markets

NEW YORK—Nov. 29, 1916

In all of the metals, business was rather dull during the last week, but all were very strong, lead becoming more conspicuous than it had been previously. Copper was strong from being sold out. Spelter was regarded somewhat suspiciously

Copper, Tin, Lead and Zinc

Copper Transactions were in even less volume than in the previous week, being very light indeed. The major market continued to be for delivery in the second quarter of 1917, sales being made at the equivalent of 32¼@32¾c., cash, New York. There were still buyers for that delivery and earlier, and the reason that no more business was done was owing more to the inability of producers to sell than to absence of buying power on the part of consumers. However, it was absolutely clear that buying was no longer of the insistent reckless character of a fortnight previous, and manufacturers who are uncovered are more disposed to stay so and take their chances. There were some transactions for delivery in the third quarter of 1917, and even during the entire second half of that year, but these were confined to certain quarters and seemed to evince a desire by producers to take time by the forelock and place all the copper that could be at high prices.

There was an acute demand from Europe for nearby copper, but neither producers nor anybody else could supply it, so that was the end of the matter. Japanese cathodes, December-January delivery, were reported being sold in France on the basis of £175, which would correspond with 36c., and dealers' prices for December wire bars in England were reported as being 37c.

In this market December copper was quoted at 34@35c. (offered at the latter), and first quarter at 33½@34c., while for second quarter 33c. was asked at the close, all regular terms.

The average price on sales of copper by producers for the first half of 1917 varies among the several agencies, but ranges from about 26½c. to about 27c.

Copper Sheets—The base price for copper sheets has been advanced to 42c., this figure being for hot rolled. Wire is based on 38c.

Tin—In the early part of the week only small business was done. On Monday there was good business, but after that the market became dull. At the opening, spot was 45¼c., futures 44½c. At the close spot was 45¼c. and futures 44⅝c.

Lead—Business was less in volume than in the previous week, but the scarcity of near-by lead became more acute. Independent producers easily realized 7¼c. in the New York market, and corresponding prices in St. Louis, but the A. S. & R. Co. maintained its previous prices and booked business at them with its regular customers, but named higher prices or refused to quote to those who are not its regular customers. Japan bought lead from American producers, paying from 7⅜ to 7¾c., f.o.b., Pacific Coast. The strength of the situation is evinced by lead being sold from the interior to go overland to the Pacific Coast.

The Granby works in Missouri were so badly damaged by cyclone recently that they had to be put out of commission.

The Nassau Smelting and Refining Co. received an order from the government for 100,000 lb. of lead, at 7.12c. per lb., for the District of Columbia, and an order for 300,000 lb. for the Frankford arsenal was given to L. Vogelstein at 7.125c. per lb.

Spelter—Prices continued to advance, although only a relatively small business was done. Europe did not buy. The major part of the business reported was for forward delivery, there being some first-quarter contracts, some second-quarter and some good tonnages placed for first half. It became quite clear that prompt spelter is not so scarce as has been intimated, and while there has been no pressure to sell it indeed the reverse—there is plenty for sale at an advance. It is suspected that supplies have been held back in order to cover sales of futures, for which considerably lower prices have been accepted than what are asked for prompt delivery. High-grade spelter is 20c. asked, but it probably can be obtained for less, perhaps 18c.

The official statistics of Norway show that in 1915 there were imported into that country 29,582 metric tons of spelter against 16,566 in 1914. The exports were 22,627 and 16,517. These figures may be taken as indicating the extent of the electrothermic zinc refining at Sarpsborg and Ilen.

The Anaconda company is now producing about 2,500 tons of electrolytic spelter per month.

Zinc Sheets—The price of zinc sheets has again advanced, on Nov. 24 the base being placed first at $20 and later at $21 per 100 lb., f.o.b. Peru, Ill., less 8% discount.

Other Metals

Antimony—Market steady at 11½c. There was no great demand and, on the other hand, producers weer rather reluctant to sell at present prices.

Quicksilver—Market receded to $77. San Francisco reports, by telegraph, $75; market steady.

Nickel—The price of nickel remains unchanged at 45@50c. per lb., electrolytic commanding an additional 5c. per lb.

Aluminum—Price is nominally a shade lower 63@65c. per lb. for No. 1 ingots, New York.

Gold, Silver and Platinum

NEW YORK—Nov. 29

Gold—The net import of gold into India for October, 1916, was about £1,216,500.

Silver has advanced owing to heavy buying for London account. Part of the purchases no doubt rae intended to replenish stock in China, which has been depleted to a large extent by sales some months ago in unusual directions, and part of the buying has been for English Government requirements. Market closes steady to firm.

Under date of Nov. 9, Samuel Montagu & Co. of London, reports that the market has developed considerable strength chiefly as a consequence of firm exchanges front China, where the export season is in full swing. Chinese pressure was felt in other markets more than in that of London, but prices here responded in quick sympathy and somewhat sensational advances have been recorded.

The Indian Bazaars contributed to the competition for supplies as well as the more distant East, while the demand for coinage continues to be active.

The Indian currency figures below seem to indicate that purchases for the Indian Mint are not keeping pace with its requirements.

Platinum—Unchanged at $105 per oz.

Palladium—Unchanged at $75 per oz.

Zinc and Lead Ore Markets

Platteville, Wis., Nov. 25—Quotations for the district are according to the following figures: Base price per 2,000-lb. ton for material assaying 60% zinc is $98 for premium ore down to $95 for medium grades. Base price per 2,000-lb. ton for material assaying 80% lead ore is $90. Shipments for the week ended Nov. 25 were 2,787 tons of zinc ore, 108 tons of lead ore, and 601 tons of sulphur ore. For the year to date the figures are: 118,586 tons of zinc ore, 4,009 tons of lead ore and 28,999 tons of sulphur ore. Shipped during the week to separating plants, 2,954 tons of zinc ore.

Joplin, Mo., Nov. 25—Price quotations per 2,000 lb.: Blende, high, $107.15; 60% zinc, premium ore, $105; medium grades, $100@95; low, $90. Calamine, per ton 40% zinc, $60@50. Average selling price, all grades of zinc, $81.67 per ton.

Lead, high price, $90.87; base, $91@86; average selling price, all grades of lead, $88.21 per ton.

Shipments of the week: Blende, 8,013 tons; calamine, 618 tons; lead, 1,128 tons. Value, all ores the week, $8[illegible]5,200; 47 weeks, $[illegible],604,180.

A buyer seeking a few carloads of lead for shipment into Canada upset the even tenor of prices in some localities, forcing the base price up to $91 for two or three choice bins of galena. Zinc prices were advanced for choice bins $10 per ton and there was an increase of $[illegible] per ton in the average selling price. Where lack of water, the shortage of hydro-electric power or gas troubles have not prevented an increasing output, efforts to increase the output are met with a lack of mine help, several hundred miners having left for the west during the dull summer.

Other Ores

Molybdenum Ore—Quoted at $1.75@1.85 per lb. of MoS_2 contained. Last week we quoted erroneously $1.85 per unit, meaning per pound.

Antimony Ore—Nothing but small business reported.

Manganese Ore imports into the United States for September amounted to 7[illegible] tons. The imports in July, August and September have been 232,199 tons. The total to Oct. 1, 1916, was 469,222 tons, against 173,9[illegible]2 tons to Oct. 1, 1915, and 215,274 tons to Oct. 1, 1914. The British imports to Oct. 1, 1916, were only 18[illegible] tons. The monthly rate for the first nine months of this year is 52,1[illegible]6 tons, against a previous record of 28,757 tons per month in 1913.

Imports at Baltimore included [illegible]00 tons of iron ore from Cuba.

Tungsten Ore—Market active, both on foreign and domestic demand. Europe is reported having bought approximately 100 tons and asking for more. We quote $18 per unit at the close.

Iron Trade Review

NEW YORK—Nov. 29

It appears that the buyers of foundry iron have been expecting the pig iron market to act in the same manner that the steel market has done lately, and the buying for delivery in the second half of 1917 at a price [illegible] higher than that of three months ago [illegible] speculation. There have been large sales of rails for that delivery, and also considerable [illegible]

SILVER AND STERLING EXCHANGE

Nov.	Sterling Exchange	Silver New York, Cents	Silver London, Pence	Nov.	Sterling Exchange	Silver New York, Cents	Silver London, Pence
23	4.7569	73[illegible]	34[illegible]	27	4.7569	74	35[illegible]
24	4.7569	73[illegible]	34[illegible]	28	4.7569	73[illegible]	35[illegible]
25	4.7569	73[illegible]	35[illegible]	29	4.7569	74[illegible]	35[illegible]

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine.

DAILY PRICES OF METALS IN NEW YORK

Nov.	Copper Electrolytic	Tin Spot	Lead N. Y.	Lead St. L.	Zinc St. L.
23	3[illegible] @32[illegible]	45[illegible]	7.00 @7.25	6.90 @7.15	12[illegible] @12[illegible]
24	32[illegible] @32[illegible]	4[illegible]	7.00 @7.25	6.90 @7.15	12[illegible] @12[illegible]
25	32[illegible] @32[illegible]	4[illegible]	7.00 @7.25	6.90 @7.15	12[illegible] @12[illegible]
27	3[illegible] @32[illegible]	45[illegible]	7.00 @7.25	6.90 @7.15	12[illegible] @12[illegible]
28	32[illegible] @32	45[illegible]	7.00 @7.25	6.90 @7.15	12[illegible] @13
29	32[illegible] @32[illegible]	45[illegible]	7.00 @7.25	6.90 @7.15	12[illegible] @13

The above quotations are our appraisal of the average of the major markets based on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for the deliveries constituting the major markets, reduced to basis of New York, [illegible] except where St. Louis is the normal basing point.

The quotations for electrolytic copper are for [illegible] ingots and wirebars. Electrolytic copper is [illegible] on regular terms [illegible] including freight to the buyer's works and is subject to a discount for [illegible]. The difference between the price [illegible] New York [illegible] 0.2[illegible] [illegible] The price of [illegible] cathodes is 0.05 to 0.10c. below that of [illegible]. Quotations for spelter are for ordinary Prime Western brands. We quote New York price at 17[illegible] per 100 lb. above St. Louis.

Some current freight rates on metals per 100 lb.: St. Louis-New York, 17[illegible]; St. Louis-Chicago, 6.3c.; St. Louis-Pittsburgh, 13.1c.

LONDON

Nov.	Copper Standard Spot	Copper Standard 3 Mos.	Copper Electrolytic	Tin Spot	Tin 3 Mos.	Lead Spot	Zinc Spot
23	144	139	164	[illegible]1	193[illegible]	[illegible]	[illegible]
24	144[illegible]	140	165	190[illegible]	192	[illegible]	[illegible]
25							
27	147	141	168	[illegible]	[illegible]	[illegible]	[illegible]
28	145	13[illegible]	16[illegible]	1[illegible]0	1[illegible]	[illegible]	[illegible]
29	150	142	169	189	1[illegible]	[illegible]	[illegible]

The above table gives the [illegible] London Metal Exchange. All [illegible] sterling per ton of 2,240 lb. [illegible] electrolytic [illegible] 3 [illegible] of London [illegible] sterling per 2,240 lb. with American [illegible] the following [illegible] at 4[illegible] [illegible] 4.29 [illegible] 30 [illegible] 6.43 [illegible] £4[illegible] [illegible] 1[illegible] 6.2[illegible] of plates, both domestic and for export. In the steel trade, mills have endeavored to restrict contracts for the future to material covering work for which orders were actually in hand. The foreign demand for pig iron is what has sent prices to a high level.

PITTSBURGH—Nov. 28

Wire products have been advanced $3 per ton, effective yesterday, making nails $3, base, this being the second $3 advance this month. Nails are now double their low price of nearly two years ago, but are still 20c. a keg below the price early in 1900. Nearly all steel prices are at record high levels. Three widely different commodities, sheet bars, plates and rivets, are at three times their price in December, 1914, while practically all other steel products are double priced at least. Prices have become largely nominal, however, as there is little business being done in the familiar form of open contracts and steel required for specific purposes brings different prices according to delivery and other conditions.

The market situation has become still more tense. While it seems impossible for some consumers to pay current prices there is no sign of any break impending and it is suggested that there would be more export buying if domestic consumers should reduce their requirements.

Car shortages are this week more pronounced than ever, and a real cold snap, in keeping with the time of year, would doubtless produce transportation conditions that would result in iron and steel output being curtailed. Hopes are entertained of better car supplies, however, owing to the ruling that cars must be returned to the lines owning them, a movement favorable to the steel industry as the roads serving it own more cars than they have had in their possession, while the Lake shipping season is now practically ended and this should release many cars.

Pig Iron—Pig-iron prices have been advancing almost from one sale to the next. Furnaces are making up for their freedom last August, in selling pig iron for first half of 1917 delivery at the going market or even at cut prices, and are asking very high prices for what little iron remains for the period, or for the much larger tonnage that is unsold for the second half. If price advances are a criterion the market is extremely strong. The local market is now at the highest point in at least a third of a century. A transaction out of line even with the sharply advancing market as testified by other sales is the purchase, according to general report, of 34,000 tons of basic iron for second-half shipment to an Eastern steel works at $30, valley. The market as generally viewed is up $2 a ton on bessemer and basic and $1 on foundry, in the week. We now quote: Bessemer, $33@35; basic, malleable and foundry, $28@30; gray forge, $27.50@29.50, f.o.b. valley furnaces, 95c. higher delivered Pittsburgh.

E. W. Mudge & Co., merchants in coke, pig iron and steel, have purchased Claire furnace at Sharpsville, Penn., controlled by M. A. Hanna & Co.

Steel—Offerings of unfinished steel are still more restricted and the market is practically nominal at about $55 for billets and $57 for sheet bars, bessemer or openhearth. Rods are $65@70 and forging billets $70@75.

Iron Ore

British Imports of Iron Ore, nine months ended Sept. 30, were 4,709,046 gross tons in 1915, and 5,481,509 in 1916; increase, 772,463 tons.

The ore-carrying rate from ports at the head of Lake Superior for 1917 has been established at $1, net, an advance of 50c. over the rate for 1916. Although earlier in the season an advance of 25 to 35c. was talked of, it has been recognized for some time that in all probability the advance will be 50c., and the action of several leading shippers in making contracts for the season at $1 a ton caused no surprise. Most of the vessel tonnage has already been tied up, and it is probable that the contracts which have just been made will govern on a very large percentage of business to be done, but some vessel owners are holding a part of their tonnage in reserve with the expectation that they will be able to place it at a wild rate higher than the season rate. The new rate is equivalent to $1.10 gross, the highest rate which has prevailed since 1900, when the contract rate was $1.25, while the wild rate for that year averaged 84½c. The starting of iron ore selling for next year has been delayed while awaiting fixing of the ore carrying rate, and it is probable that the new prices of iron ore will be determined shortly. The feeling among many ore men is strong in favor of an advance of at least $1 25 per ton, in favor of an advance up to $1.50. It is probable that the new rate will be somewhere between the two.

Coke

Connellsville—Car shortages are more serious and have cut down production further. Many consumers doubtless stand in need of more coke, but do not attempt to buy in the spot market, as prices are already extremely high. Odd lots purchased fix the market at $7.25@7.75 for spot furnace. Some first half coke could be had at $4@4.50, but consumers are indisposed to take hold. Foundry is $9@10 for spot and $5.50@6.50 for contract, per net ton at ovens.

STOCK QUOTATIONS

N. Y. EXCH.†	Nov. 28
Alaska Gold M.	13
Alaska Juneau	8
Am.Sm.&Ref.,com.	116⅛
Am. Sm. & Ref., pf.	116½
Am. Sm. Sec., pf. A	100½
Am. Sm. Sec., pf. B.	96
Am. Zinc	56½
Am. Zinc, pf	79
Anaconda	98
Batopilas Min.	1⅜
Bethlehem Steel	625
Bethlehem Steel, pf.	155
Butte & Superior	69
Chile Cop.	32
Chino	67½
Colo.Fuel & Iron	55
Crucible Steel	84¼
Dome Mines	22½
Federal M. & S.	16
Federal M. & S., pf.	45
Great Nor., ore ctf.	44¼
Greene Cananea	52¼
Homestake	132
Inspiration Con	69½
International Nickel	47
Kennecott	56⅞
Lackawanna Steel	102½
Miami Copper	45
Nat'l Lead, com.	67¼
National Lead, pf.	112⅞
Nev. Consol	29
Ontario Min	6¼
Quicksilver	2¼
Quicksilver, pf.	2
Ray Con.	32⅛
RepublicI.&S.,com.	86½
Republic I. & S. pf.	116
Sloss-Sheffield	84
Tennessee Copper	24¼
U. S Steel, com	126⅛
U. S. Steel, pf	121⅜
Utah Copper	121¾
Va Iron C. & C.	64½

N. Y. CURB†	Nov. 28
Buffalo Mines	1.15
Butte & N. Y.	2¼
Butte C. & Z	15¾
Caledonia	.45
Can. Cop. Corpn.	2 1/16
Cashboy	.06
Cerro de Pasco	42⅞
Con. Ariz. Sm	2¼
Con. Coppermines	3⅜
Con. Nev.-Utah	.28¼
Crystal Cop	⅛
First Nat. Cop.	4⅜
Florence	.70
Goldfield Con	.50
Goldfield Merger	05¼
Granite	.43
Hecla Min.	8¼
Howe Sound	7⅜
Jerome Verde	1½
Joplin Ore & Spel	.50
Kerr Lake	4 11/16
Magma	57
Majestic	.75
McKinley-Dar-Sa	60
Mother Lode	.36
Nevada Hills	.21
N. Y. & Hond	16½
Nipissing Mines	9
Oro	‡.03½
Ray Hercules	5⅛
Rochester Mines	.72
St. Joseph Lead	21¼
Standard S. L.	1⅜
Stewart	.25
Success	.55
Tonopah	6¼
Tonopah Ex.	4¼
Tribullion	.25
Troy Arizona	.76
United Zinc	5¼
White Knob, pf.	2⅜
White Oaks	4½
Yukon Gold	2⅛

SAN FRAN.*	Nov. 28
Alta	.03
Andes	.20
Best & Belcher	.05
Bullion	.02
Caledonia	.30
Challenge Con	.05
Confidence	‡.20
Cons. Imperial	‡.01
Con. Virginia	.08
Gould & Curry	.03
Hale & Norcross	.11
Jacket-Cr. Pt.	.03
Mexican	.21
Occidental	.65
Ophir	.19
Overman	.03
Savage	.06
Seg Belcher	.02
Sierra Nevada	.22
Union Con.	.55
Utah Con.	.02
Belmont	4.95
Jim Butler	.98
MacNamara	.07
Midway	.20
Mont.-Tonopah	.21
North Star	.15
Rescue Eula	.26
West End Con.	.70
Atlanta	.07
Booth	.07
C.O.D. Con	.02
Comb. Frac.	04
D'field B.B.	.06
D'field Daisy	‡.05
Jumbo Extension	.25
Round Mountain	.36
Sandstorm Kendall	.04
Silver Pick	.30
Argo	.06
Ariz. Central	.08
Big Jim	1 43¼
Lazy Boy	.07
Nellie	.30
Tom Reed	2.25
United Eastern	4.50
United Western	.05

BOSTON EXCH.*	Nov. 28
Adventure	4½
Ahmeek	120½
Algomah	1½
Allouez	78
Ariz. Com., ctfs	16½
Bonanza	40
Butte-Ballaklava	2¼
Calumet & Ariz.	91
Calumet & Hecla	625
Centennial	23½
Copper Range	76¾
Daly West	3
East Butte	17⅜
Franklin	11
Granby	105
Hancock	20
Helvetia	.75
Indiana	4½
Island Cr'k, com	63
Island Cr'k, pfd	92½
Isle Royale	38½
Keweenaw	5
Lake	14
La Salle	5¼
Mason Valley	7
Mass	16½
Mayflower	3½
Michigan	4¼
Mohawk	100
New Arcadian	6¼
New Idria	15
North Butte	26⅛
North Lake	2¼
Ojibway	1⅛
Old Colony	3
Old Dominion	77
Osceola	98¼
Quincy	96
St. Mary's M. L.	104
Santa Fe	2⅜
Shannon	10⅛
Shattuck-Ariz.	32
So. Lake	6
So. Utah	.25
Superior	18½
Superior & Bost.	7⅞
Tamarack	44½
Trinity	7¼
Tuolumne	.95
U. S. Smelting	75¾
U. S. Smelt'g, pf	51¼
Utah Apex	3⅜
Utah Con.	21
Utah Metal	7¼
Victoria	6¾
Winona	5½
Wolverine	54
Wyandot	2

BOSTON CURB*	Nov. 28
Alaska Mines Corp.	.83
Bingham Mines	10⅜
Boston Ely	.75
Boston & Mont.	.75
Butte & Lon'n Dev.	62
Calaveras	5⅜
Calumet-Corbin	.02
Chief Con.	2⅜
Cortez	.25
Crown Reserve	.40
Davis-Daly	5⅞
Eagle & Blue Bell	1¼
Houghton Copper	1¾
Iron Cap Cop., pf	12
Mexican Metals	.51
Mines of America	2¼
Mojave Tungsten	2¾
Nat. Zinc & Lead	.65
Nevada-Douglas	1 11/16
New Baltic	3¼
New Cornelia	18
Ohio Copper	.35
Oneco	.90
Rex Cons.	.60
Rilla	.07
United Verde Ext.	40½

SALT LAKE*	Nov. 28
Big Four	1.15
Black Jack	06
Cardiff	7 50
Colorado Mining	.22
Crown Point	.05
Daly-Judge	8.00
Emma Cop.	2.37½
Empire Copper	1.50
Gold Chain	.18
Grand Central	.58
Iron Blossom	1.62½
Lower Mammoth	.10
May Day	.10½
Opohongo	.01¼
Prince Con	1.30
Seven Troughs	.03
Silver-King Coal'n	3.22½
Silver King Con	4.50
Sioux Con	.15
So. Hecla	1 60
Uncle Sam	09
Wilbert	.09
Yankee	23

TORONTO*	Nov. 28
Bailey	.07½
Beaver Con	.46
Chambers Ferland	.17
Coniagas	4 85
La Rose	.55
Peterson Lake	18
Right of Way	05
Seneca Superior	‡ 09
T. & Hudson Bay	73.00
Temiskaming	65
Wettlaufer-Lor	.11
Dome Exten	.29½
Dome Lake	60
Foley O'Brien	70
Hollinger	6 90
Jupiter	26
McIntyre	1.75
Newray	1.20
Porcu. Crown	.69
Vipond	.39
West Dome	.33

STOCK QUOTATIONS—Continued

COLO. SPRINGS	Nov. 28
Cresson Con	8 75
Doctor Jack Pot.	.09½
Elkton Con	.10
El Paso	.40
Findlay	.01
Gold Sovereign	.07
Golden Cycle	2.79
Granite	.65
Isabella	.23¾
Mary McKinney	.28
Portland	2.05
Vindicator	1.65

LONDON	Nov. 16		
Alaska Mexican	£0	12s	6d
Alaska Tre'dwell	2	17	6
Burma Corp.	4	0	0
Cam & Motor	0	11	6
Camp Bird	0	7	0
El Oro	0	8	3
Esperanza	0	10	0
Mexico Mines	3	15	0
Nechi, pfd	0	12	0
Oroville	0	16	9
Santa Gert'dis	0	10	9
Tomboy	1	1	3

* Bid prices. † Closing prices. ‡ Last Quotations.

MONTHLY AVERAGE PRICES OF METALS

Silver	New York			London		
	1914	1915	1916	1914	1915	1916
January	56 572	48 855	56.775	26 553	22.731	26.960
February	57 506	48 477	56 755	26.573	22.753	26.975
March	58 067	50 241	57 935	26 788	23 708	27.597
April	58 519	50.250	64 415	26.958	23 709	30.662
May	58 175	49.915	74 269	26.704	23.570	35.477
June	56.471	49 034	65 024	25 948	23.267	31.060
July	54 678	47 519	62 940	25 219	22.597	30.000
August	54.344	47 163	66 083	25 979	22.780	31.498
September	53.290	48.680	68.515	24 260	23.591	32.584
October	50.654	49 385	67.855	23.199	23.925	32.361
November	49.082	51 714	71.604	22 703	25.094	......
Dec.	49.375	54 971	.	22 900	26.373	......
Year	54 811	49 684	...	25 314	23.675	......

New York quotations cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

Copper	New York		London			
	Electrolytic		Standard		Electrolytic	
	1915	1916	1915	1916	1915	1916
Jan	13 641	24 008	60 756	88.083	65.719	116.167
Feb	14 394	26 440	63.494	102.667	*	133 167
Mar.	14.787	26.310	66.152	107.714	*	136 000
April	16 811	27.895	75 096	124.319	*	137.389
May	18 506	28.625	77.600	135.457	*	152.522
June	19 477	26.601	82.574	112.432	95.333	137.455
July	18.796	23.865	76.011	95.119	91.409	125 500
Aug.	16 941	26.120	68.673	110 283	82.333	126.304
Sept.	17.502	26.855	68.915	113.905	85.250	134.071
Oct	17 686	27.193	72.601	122.750	88.000	142.523
Nov.	18.627	30.625	77.744	....	93.273	....
Dec.	20.133	......	80.773	....	100.430	....
Year	17.275	......	72.532	....	....	....

Tin	New York		London	
	1915	1916	1915	1916
January	34.260	41.825	156.550	175 548
February	37.415	42.717	176.925	181 107
March	48 426	50.741	180.141	193.609
April	47.884	51.230	166.225	199.736
May	38.790	49.125	162.675	196.511
June	40.288	42 231	167.636	179.466
July	37.423	38 510	167.080	168.357
August	34 389	38.565	151 440	169.870
September	33.125	38.830	152.625	171.345
October	33.080	41.241	151.554	179.307
November	39 224	44.109	167.670	....
December	38.779	....	167.000	....
Av. year	38.590	....	163.960	....

Lead	New York		St. Louis		London	
	1915	1916	1915	1916	1915	1916
January	3.729	5.921	3.548	5 826	18.606	31.167
February	3.827	6.246	3.718	6.164	19.122	31.988
March	4.053	7.136	3 997	7 375	21.883	34 440
April	4.221	7.630	4 142	7.655	21.094	34 368
May	4.274	7.463	4 182	7.332	20 347	32 967
June	5 932	6.936	5.836	6 749	25 170	31 011
July	5.659	6.352	5.531	6.185	24 611	28 137
August	4 656	6.244	4.520	6.088	21.946	29.734
September	4.610	6.810	4 490	6.699	23.151	30.786
October	4.600	7.000	4.499	6.898	23.994	30.716
November	5.155	7.042	5.078	6.945	26.278	......
December	5.355	...	5 266	......	28 807	......
Year	4 673	...	4.567	......	22.917	......

Spelter	New York		St. Louis		London	
	1915	1916	1915	1916	1915	1916
Jan.	6.386	16.915	6 211	16 745	30 844	89 810
Feb	8 436	18 420	8 255	18 260	39 819	97.762
Mar	8 541	16.846	8 360	16.676	44 141	95.048
April	10.012	16 695	9 837	16.525	49.888	99 056
May	14.781	14.276	14 610	14.106	68 100	94.217
June	21 208	11 752	21 038	11.582	100 614	68.591
July	19.026	8 925	18 856	8.755	97.250	50.750
Aug.	12.781	8.730	12 611	8.560	67.786	51.587
Sept.	13 440	8 990	13 270	8.820	67 841	52.095
Oct.	12 800	9.829	12 596	9 659	66.536	54.159
Nov.	15 962	11.592	15 792	11 422	88 409	....
Dec.	15 391	.....	15.221	.	89 400	....
Year	13.230	.....	13 054		67 553	....

New York and St. Louis quotations, cents per pound, London, pounds sterling per long ton. * Not reported.

Pig Iron, Pitts.	Bessemer‡		Basic‡		No. 2 Foundry	
	1915	1916	1915	1916	1915	1916
January	$14.59	$21.60	$13.45	$18.78	$13.90	$19.70
February	14.55	21.16	13.45	18.93	13.90	19.51
March	14.55	21.81	13.45	19 20	13.95	19.45
April	14.55	21 65	13 45	18 95	13.95	19.45
May	14 61	21 78	13 60	19 11	13.83	19.58
June	14 70	21 95	13 67	18 95	13.77	19.34
July	14 94	21 95	13 91	18 95	13 68	19.20
August	16 01	21 95	15 31	18 95	14.75	19.25
September	16 86	22.88	15 95	19.58	15 70	19.53
October	16 95	24.61	15 96	21.26	15.80	21.51
November	17 57	..	16 47	.....	17.20	......
December	19 97	.....	18 44	.....	18.95	......
Year	$15 82	.	$14 76	....	$14.95	......

‡ As reported by W. P. Snyder & Co.

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The Mining Industry of Bolivia

By Joseph T. Singewald, Jr.,* and Benjamin LeRoy Miller†

SYNOPSIS—Bolivia has no seacoast. Three-fourths of its area is little known. Remainder high tableland and mountains; cold, dry, barren; present wealth chiefly mineral. Principal values tin and silver. Copper likely to be second. Bismuth important. Also tungsten and antimony. Value of latter in 1915 over $4,000,000. Mineral deposits mainly in eastern range—gold in north, copper near Corocoro, lead and zinc in south. Tin most widely distributed, bismuth often associated, antimony in other veins in vicinity.

There are two countries in South America without seacoast—Bolivia and Paraguay; but the latter has direct connections with the sea by means of navigable rivers, so that Bolivia stands unique as the truly inland country of that continent. As regards climate, topography, natural resources, population and development, Bolivia consists of two distinct parts—the *altiplanicie,* or high plateau and the bordering mountain ranges, and the region to the east of the main Andean chain known as the *yungas* and the country beyond. The latter portion, constituting nearly three-fourths of the total area of about 500,000 sq.mi., is comparatively inaccessible, for the most part little known, much of it inhabited by savage Indian tribes and, though destined to be of great agricultural value in years to come, today produces only relatively small quantities of rubber, coca, cocoa, coffee, etc. It is a region of no present importance in the Bolivian mining industry.

PAY DAY AT UNCIA TIN MINE

TYPICAL INDIAN MINERS OF BOLIVIA

The *altiplanicie* is a high tableland nearly 500 mi. long and over 100 mi. wide with an almost constant altitude of about 12,500 ft. At its northern end, on the boundary between Bolivia and Peru, is Lake Titicaca, the highest body of navigable water in the world. To cross the lake by steamer requires more than twelve hours. This tableland divides the Andes into two distinct chains that bound it on the east and west respectively, the highest peaks rising above it to elevations of 20,000 ft. and more. It is from this part that the mineral production of Bolivia is derived. So highly did the great Peruvian scientist, Raimondi, regard the mineral wealth of this region that he referred to it in most extravagant terms as "a table of silver supported by columns of gold." Climatic and living conditions are most rigorous here. Though lying within the tropics, the climate, on account of the high altitude, is anything but tropical. There is a dry season and a rainy season, but the latter is rainy only in comparison with the former. The total rainfall is small, with the result that low temperature and aridity combined make a very barren and desolate-looking country. In fact, it would be incapable of supporting even its present sparse population if it were not for the wealth derived from its mines; and this portion of Bolivia, which today is really *Bolivia*, would become an almost uninhabited waste if its mineral wealth should reach exhaustion.

That Bolivia is distinctly a mining country is attested by the fact that three-fourths of her revenue from export duties is obtained from those levied on her mineral products. Though it has been subject to considerable fluctuations, particularly in the case of the individual metals, the mineral production of Bolivia has been gradually increasing in recent years. In the accompanying table the output of the various metals is given for the past six years and, for purposes of comparison, the average annual production for the periods 1900 to 1902 and 1910 to 1914 is shown separately.

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*Associate in economic geology, Johns Hopkins University, Baltimore, Md.

†Professor of geology, Lehigh University, South Bethlehem, Penn.

This table shows a number of very interesting changes that have taken place in the mining industry of Bolivia during recent years. First of all it shows a great revival of that industry during 1915 after its almost complete paralysis during the latter half of 1914. The extent of this paralysis is indicated not only by the decrease of one-third in the value of the exports of mineral products during 1914 over those of 1913, but even more in the decrease in export duties derived from them, which amounted to more than 50%. In 1915 the value of the exports was nearly thirty million dollars, a figure only a little less than that of 1913 (which represents a maximum) and greater than those of the preceding years. This record was achieved, however, only through unusual production of several of the rarer metals.

Gold mining in Bolivia does not and never has amounted to much, notwithstanding the fact that gold was the objective of the Spaniards and that the search for it led to the discovery and colonization of the West Coast countries. Bolivia has achieved its greatest fame as a silver producer and in the colonial days proved a veritable treasure house for the Spaniards. Potosi, Colquechaca and Oruro literally poured wealth into the Spanish coffers in those days, and the richest of all was Potosi. It is claimed for the Cerro Rico de Potosi, the hill on which the mines are located, that it has furnished more metallic wealth than any other area of equal size in the world, its production being estimated at over $2,000,000,000 in silver, of which more than $200,000,000 went to the Spanish Crown as taxes. Silver mining is rapidly declining in Bolivia, however, and whereas from 1900 to 1902 it contributed nearly 54% of the total metallic production of the country, during the five years 1910-14 it averaged only 6.3% and in 1915 only 3.7%. Not only has there been this great relative decrease, but the absolute decrease was from $5,300,000 in 1900 to $1,092,647 in 1915.

STATISTICS OF BOLIVIAN MINERAL PRODUCTION

Year	Gold Dollars	Gold Oz.	Silver Dollars	Silver Oz.	Copper Dollars	Copper Metric Tons	Lead Dollars	Lead Metric Tons	Zinc Dollars	Zinc Metric Tons
1915	.	....	1,092,647	2,475,884	..	. .	.	...	.	. .
1914	118,695	5,790	984,686	2,325,916	1,728,441	3,874	60,489	1,555	54,417	3,755
1913	61,664	3,008	1,083,406	2,613,794	1,278,870	4,020	137,377	1,765	86,829	7,367
1912	51,619	2,518	1,673,393	3,985,177	1,318,745	4,707	83,649	1,075	128,400	8,961
1911	35,985	1,770	1,785,115	4,112,540	555,230	2,950	9,162	343	144,938	9,798
1910	......	....	2,130,976	4,597,331	695,312	3,212	276	30	169,264	11,897
Annual Average										
1910-14	66,991	3,362	1,531,555	3,526,952	1,115,321	3,753	58,191	954	116,830	8,356
1900-02	39,323	.....	5,070,120	....	544,376	.....	6,533	...	825	.....

Year	Tin Dollars	Tin Metric Tons	Bismuth Dollars	Bismuth Metric Tons	Antimony Dollars	Antimony Metric Tons	Tungsten Dollars	Tungsten Metric Tons	Total Value
1915	19,268,862	39,312	1,071,125	568	4,216,050	13,085	293,462	499	29,762,967
1914	16,529,119	37,260	924,899	438	11,913	186	166,654	276	20,579,613
1913	26,375,244	44,595	774,991	390	4,829	62	161,641	283	30,964,857
1912	23,438,987	38,614	783,784	382	8,886	91	202,220	476	27,689,683
1911	20,482,336	37,073	819,518	415	26,622	312	89,956	292	23,948,862
1910	14,399,417	38,548	748,411	311	37,774	525	55,109	210	18,236,539
Annual Average									
1910-14	20,245,021	39,218	810,321	387	18,005	235	135,116	307	24,283,911
1900-02	3,468,606	......	264,400	...	16,814	...	6,571	...	9,417,568

In recent years copper has become the most important of all the metals, and most of the countries that have shown great increases in their mineral production have been those with great copper resources that have been developed. The fact that Bolivia has not become a great copper-producing country accounts for the slow increase in the value of the products of her mines. However, the value of the copper output has shown a constant rise, fairly rapid in the last few years, so that the 1915 production was nearly ten times that of 1900 and from two to three times that of the years immediately preceding 1915. It is hoped that the copper-mining industry may be still further stimulated through the advent of American capital in the Corocoro district, as properties there have been investigated by American engineers. If these properties are acquired, it will mark the first large investment of American capital in a Bolivian mining enterprise and again emphasize the attractiveness of South American copper deposits over deposits of the other metals.

In common with the other South American countries, the lead- and zinc-mining industries have undergone but little development. As was explained in the article on Peruvian mining[1], this does not mean there is a dearth of such deposits, but rather that with high costs and a limited amount of capital the deposits of the more valuable metals are developed first and lead and zinc must await more favorable conditions and times.

Whereas Bolivia was famous in years gone by as a silver producer, her fame as a mining country today rests on her tin-mining industry. Tin has been worked in Bolivia for many years, but the importance of the tin deposits was not realized until the last decade of the past century, when she rapidly became the most important (lode) tin-producing country in the world. By 1900 the value of her tin output had reached 3⅓ million dollars and constituted 37% of all her mineral production. During the five years 1910-14 it averaged over 20 million dollars and constituted 83% of her total mineral production. The maximum output was reached in 1913, when it amounted to over 26 million dollars. After dropping to 16½ millions in 1914, it rose again to over 19 millions in 1915, but owing to a great increase in production of certain of the other metals, it made up only two-thirds of the total value of the 1915 production of metals. As regards the future of Bolivian tin mining, the concensus of opinion seems to be that the maximum has been reached and that new finds will not be more than adequate to compensate the exhaustion of older deposits. The prospects are favorable for the continuance of the present production for some years to come, so that tin mining will continue for a long time to be the most important branch of Bolivian mining; but it is to be expected that its relative prominence will suffer because of the development of other branches.

In addition to the metals mentioned, notable amounts of bismuth, antimony and tungsten are produced. The most important of these has been bismuth, the production of which has undergone an almost constant increase. Furthermore, Bolivia is by far the world's most important producer of bismuth ores. From a little over $100,000 in 1900, the value of the output increased to nearly $1,100,-

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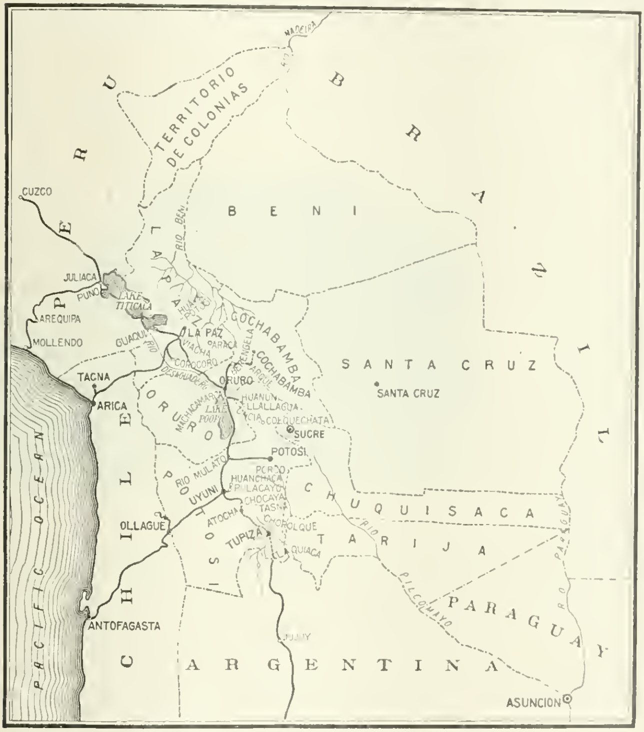
[1] "Eng. and Min. Journ.," Vol. 101, May 13, 1916, p. 848.

000 in 1915, and in that year barely fell short of the value of the silver production. While no great rise in this industry can be expected, by reason of the limited demand for bismuth and the fact that the Bolivian output supplies such a large part of the market, the indications are that it is well capable of holding its own. Tungsten is a metal subject to great fluctuations in price and consequently the output of tungsten ores fluctuates greatly. With this fact in mind and also that in 1913 an export duty became effective, the figures of production indicate a slow growth of the tungsten-mining industry, with considerable latent possibilities for expansion. The 1915 output was the greatest recorded and the abnormally high prices now prevailing will certainly establish a new high record in 1916. The most phenomenal showing made in the Bolivian mining industry in 1915 was that of antimony. It, likewise, is subject to great fluctuations, due to instability in price, but had never achieved any great importance in Bolivia. From 186 tons in 1911 the high prices prevailing in 1915 were responsible for an increase in that year to 13,085 tons, with a value of $1,216,050, which exceeds that of any other metal except tin. Before the end of the year the demand for ore had already slackened, and the 1916 figures are not likely to equal those for 1915.

In the past silver and tin have been the principal products of the Bolivian mines, and since 1900 they have constituted jointly 90% of the total value. Owing to the increasing importance of copper mining and more particularly to the unusual activity in that of the rarer metals in 1915, these two metals made up only a little over 70% of the total in that year. In the future silver is likely to yield its place to copper, and tin and copper will be the most important metals produced in Bolivia. The 1915 rank of antimony is only temporary, but there is the possibility that bismuth may outrank silver and compel the latter to drop to fourth place. Opposed to this is the view that silver mining has declined to a large extent, on account of neglect due to the greater attractiveness of tin mining during the development of that industry, and that from now on attention will revert to silver mining and greater activity may be anticipated in it. There is no basis for expecting a great increase in the output of the other metals, so that the increase in Bolivia's metal output will be determined largely by the course of copper mining in that country. The mineral deposits of Bolivia are found principally in the eastern range of the Andes from Lake Titicaca to the Argentine border, a belt having a length of about 500 mi. There are a few isolated groups of hills with the *altiplanicie*, geologically a part of that range, that are likewise mineralized; as for example, the Oruro hills. The western range, which lies principally in Chile, is characterized by recent volcanic activity and has not been so generally mineralized. Its most important deposits are the nonmetallic deposits of sulphur and borax that lie chiefly in Chile. Extending longitudinally across the *altiplanicie* is the copper belt in which Corocoro lies. Consequently most of the mining districts of Bolivia are found within a belt about 100 mi. wide on the east side of the railroad that traverses the *altiplanicie* along its eastern edge. Deposits of all the metals are nearly coextensive with the main eastern range of the Andes, but those of commercial importance seem to be grouped about certain more or less well-defined centers. Gold mining is confined almost entirely to the department of La Paz. The Chuquialguillo placer near La Paz, for a time an important producer, is idle, and the gold output has been derived chiefly from the Olla de Oro and Incaoro mines (both owned by American capital), which lie to the east and north of La Paz respectively. Almost the entire silver production comes from the districts of Huanchaca, Oruro and Potosi; but the province of Sud Chichas, in the southern part of the department of Potosi, will soon be an important producer. At Chocaya and other neighboring places ores carrying good silver values are being mined and the silver is to be recovered by lixiviation.



THE PRINCIPAL MINING REGIONS OF BOLIVIA

Nine-tenths of the Bolivian copper production comes from the Corocoro district, which lies outside of [illegible] mineralized belt of the eastern Andes, on the [illegible] itself, within a belt of copper deposits that [illegible] or less continuous [illegible] the entire length of the [illegible] The remainder of the output comes as [illegible] the ores of the Compañia Huanchaca de Bolivia at Pulacayo, from those of the Aramayo Francke Mines, Ltd., to the south of Pulacayo, and from Oruro and Potosi.

The lead ores are derived almost entirely from southern Bolivia in the region about La Quiaca. They are packed in on llamas and mules to the latter place and exported via Argentina. In 1913 over three-fourths of the lead ores went out by this route. The zinc ores come entirely from the Pulacayo mines. As stated, the actual occurrence of lead and zinc ores is far more widespread than is indicated by these few producing points.

The tin deposits are the most widely distributed of the Bolivian mineral deposits and are being worked throughout the extent of the Cordillera Real, or eastern range. Nevertheless ten important centers of production account for nine-tenths of the total production, and these from north to south are Araca, Oruro, Machacamarca, Huanuni, Llallagua, Uncia, Potosi, Sala Sala, Chocaya and Chorolque. Simon I. Patiño's mines at Uncia and Huanuni produce nearly two-fifths of the total. The Uncia and Llallagua mines, which work different parts of the same group of veins on the same mountain, together produce over two-fifths of the total; while the Uncia mines alone produce about 30% of the total Bolivian tin output. Three-fourths of the production comes from the department of Potosi.

The bismuth ores are associated with the tin ores, but are not so widely distributed. Important amounts of bismuthinite are found in certain of the Uncia veins, but the chief producing mines are those of the Aramayo Francke Co., Ltd., at Tasna and Chorolque, and the Carmen mine at Huayni Potosi (north of La Paz), worked by the Huet brothers. The latter mine is particularly noteworthy on account of the abundant occurrence of native bismuth. Otherwise the prevailing bismuth mineral is the sulphide of bismuth, bismuthinite.

The antimony ores are also found in the same general region as the tin ores, but as a rule not in the same veins. The veins are usually narrow, but the filling consists almost entirely of stibnite with very little gangue; so that it is comparatively easy to sort out a high-grade material. In the "boom" of the past year the principal centers of production were the Chuquiutu district, near Uncia, the country about Porco and that around and to the south of Atocha.

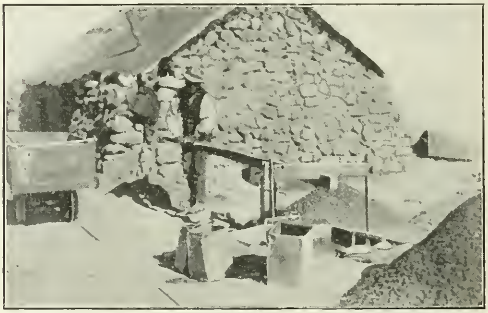
Tungsten ores are likewise widely distributed through the tin region and have been produced at many points. At present the chief producing regions are the Quimza Cruz district, northwest of Cochabamba, and the region between Uyuni and Chorolque in which Sala Sala is the most important center.

This review of the distribution of the mineral deposits of Bolivia shows that from the standpoint of present productivity the department of Potosi is the most important and that it produces over half of each of the metals considered with the exception of gold and copper, for which that position is held by the department of La Paz.

Mining Conditions in Bolivia

The greatest difficulties encountered in mining in Bolivia are high transportation costs, lack of fuel and scarcity of labor; in which respects it does not differ from other West Coast countries of South America.

While transportation problems are not easy in Bolivia, they are by no means so difficult as in Peru, and the mining industry is far better served by railroads in the former country than in the latter. Bolivia is fortunate in having its mineralized country paralleled by the great high plateau along and across which the construction of railroads is comparatively easy. The completion of the Antofagasta & Bolivia R.R. to Oruro over 25 years ago and the extension of the Southern Railway of Peru via Lake Titicaca to La Paz 15 years ago made it unnecessary to pack everything to and from the coast on animals. It seems remarkable that the former road was not extended to Viacha to connect with the latter until as late as 1908. This extension gave La Paz, the virtual capital[2] of the country, two outlets to the sea by modern transportation. The completion of the Arica-La Paz line in May, 1913, gave a third and more direct outlet. There is now consequently a line running the entire length of the *altiplanicie* along its eastern edge, from which branch lines are being built into the mineral belt to the east of it. At Oruro is the partly completed line to Cochabamba that has already opened up the Berengela district and made more accessible to rail transportation a number of other tin-producing districts of that region. From Machacamarca, the next station south of Oruro, Simon I. Patiño is constructing a private railroad to his mines at Huanuni and Uncia. It is now in operation beyond Huanuni and when completed will also put the Llallagua mines on the railroad. The branch line from Rio Mulato to Potosi has now been in operation four years, and its course lies only three miles north of the old mining town of Porco, in which district it has made possible a revival of mining. The line has a length of 108 mi. and is the second highest railroad in the world, reaching an elevation of 15,814 ft., or only 51 ft. lower than the highest point on the Morococha branch of the Central Railroad of Peru. At Uyuni the Compañia Huanchaca de Bolivia has a line 25 mi. long to its mines at Pulacayo, and a line is under construction to La Quiaca on the Argentine border to connect with the Argentine railroads. It is now in operation as far as Atocha, a distance of 51 mi. out of a total of nearly 200 mi. This line runs through a mineralized area that was of considerable importance formerly, and the introduction of modern transportation facilities will no doubt again make it an important contributor to the mineral production of the country. The completion of this line will also provide a second transcontinental railroad in South America, that will have an advantage over the present line (between Buenos Aires and Valparaiso) of being able to operate throughout the year. The previously mentioned Arica-La Paz line has solved the transporta-


MARITATA, OR HAND JIG, USED AT BOLIVIAN MINE

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[2] The City of Sucre is the nominal capital, but the congress meets at La Paz and the president resides there.—Editor.

tion problem for the Corocoro district. There are now 1,000 mi. of railroad in operation in Bolivia. There are still many ore deposits lying dormant in the country, owing to lack of transportation facilities, but compared with conditions that existed only a few years ago and that still exist in other South American countries, mine operators in Bolivia have much for which to be thankful.

With increased transportation facilities the fuel situation is not nearly so acute as it was. Accustomed as we are to an abundance of coal and wood, it is difficult to realize what a problem this has been. The most important native fuel is the *taquia*, the droppings of the llamas. Incredible quantities are used both as domestic fuel and to run mining machinery and smelters. One of the companies at Corocoro alone consumes annually 10,000 tons of *taquia*, having a value of $1 per ton. Locally *yareta* is found in sufficient quantity to be of importance as a fuel. It is a plant that grows in large clusters of woody, resinous fibers adhering to the rocks at high altitudes and has the appearance of large clumps of moss. In addition, at a few points there are sufficiently large accumulations of peat to make it an available fuel. Fuels other than these must be imported, and if their price is not to be prohibitive at the points of consumption, relatively cheap transportation must be provided. The rapid extension of the railroads of Bolivia in recent years has made it possible to use increasing quantities of imported fuel, and especially oil. Diesel engines are being introduced very extensively, as they furnish the easiest solution of the power problem at present.

The labor question in Bolivia is a difficult one. The high plateau lies at an elevation of over 12,000 ft., and the mines are in the hills and mountains that rise above it up to elevations of as much as 18,000 ft. Most of the mines lie between 14,000 and 16,000 ft. At such elevations it is impossible to use imported labor, as it cannot endure the strain of continuous manual exertion, and it is necessary to depend on the native Indian stock. The supply of this is limited, and consequently in the regions where there has been the greatest development of mining operations difficulty is experienced in obtaining sufficient labor. The Indians are a primitive people, and their methods of work are equally primitive, with the result that their efficiency is not high. The obvious and probably the only method to meet the growing demand for labor attendant on the increasing development of the country is to increase the efficiency of the labor available. A more enlightened and altruistic attitude on the part of the Spanish inhabitants of the country might also be effective in considerably augmenting their numbers. Efforts along the lines of social, moral and sanitary uplift, instead of the purely materialistic policy of exploitation of these people, might yield such results and prove more profitable in the long run. The present status of the Andean Indians was described in some detail in a previous article[3] and need not be discussed again.

TRAVEL AND LIVING CONDITIONS

Travel in Bolivia cannot in any sense be called a pleasure from the standpoint of comfort and conveniences in comparison with our own standards. On the other hand, conditions are far from unendurable, and anyone who has a real purpose in traveling in Bolivia need not hesitate to do so. The *nocturnos*, or through trains, have modern sleeping cars and a really good dining-car service furnishing for 3 bolivianos (about $1 gold) table d'hote meals) that are better than the meals one can get at any hotel in the country. The most uncomfortable feature of the trains is that they are not heated. During the day, when the sun is shining, the cars are quite comfortable, but early in the morning and in the evening it is very cold in the coaches, and on the *nocturnos* the water often freezes to such an extent that one cannot wash in the morning. The railroad fares range from about 2½ to 5c. per mi., and 50 kg. of baggage is carried free. On the principal lines there are about three trains a week and on the branch lines usually not more than one. As soon as one is called upon to leave the lines of railroad transportation, though he can in a few instances depend upon stage lines, for the most part he must travel on muleback. Owing to the lack of forage and grain, mules are expensive and often it is impossible to secure animals at all.

There is no first-class hotel in the entire country. Even in La Paz, the *de facto* capital and principal city, the best hotel makes no effort to furnish a hot bath after 6 p.m., and what is called hot water before that hour is merely water that does not feel cold to the touch. A source of considerable discomfort is the lack of heating apparatus so that only rooms on the sunny side of the house are warm during the day and no room is comfortable to sit in at night. We were repeatedly driven to bed immediately after supper in order to get warm. Fresh milk and fresh butter are almost unknown. In the northern part of the country, at La Paz and Oruro, one can get Peruvian butter shipped in from Arequipa; elsewhere canned Danish butter is used. The meats are not particularly good and are nearly always spoiled for some *yanquis* by the liberal flavoring with *aji*, a variety of pepper. One can nearly always get good bread, so that even under the worst conditions he can satisfy his hunger. In La Paz one pays about $2.50 per day for room and meals, and in the rest of the country from $1.50 to $2.

Taking into consideration the resources of the land, its stage of development and the amount of travel, one must in all fairness say that railroad and hotel accommodations are all that one can reasonably demand. Except for the lack of heat, the houses of the better classes are comfortable and their food supply varied and good, so that if called upon to remain at a given place any length of time, one can make oneself comfortable.

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[3] "Eng. and Min. Journ.," Vol. 101, May 13, 1916, p. 849.

New South Wales Tin Production*

The value of the tin production of New South Wales in 1915 was £266,780, compared with £267,130 in 1914. Of this amount the various dredging plants produced 1,164 tons valued at £116,549, a decrease of 11 tons and £2,618 in value from the record of the previous year. This brings the total stream tin recovered by the dredges since 1900 up to 16,375 tons valued at £1,748,712.

The output in the Emmaville division was 1,0[illegible] [illegible] valued at £105,101; in the Tingha division, 662 [illegible] valued at £61,076; in the Wilson's Downfall division, 1[illegible] tons valued at £13,303; in the Glen Innes division, [illegible] tons valued at £10,043; in the Torrington division [illegible] valued at £5,510; on the Fi[illegible]an field, [illegible] trates valued at £53,771

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*Excerpt from Annual Report of the De[illegible] New South Wales, [illegible]

The Kimberlite of Brazil*

Some correspondence from the United States has reached this office concerning my report of Aug. 8, on "The Diamond Fields of Brazil" (appearing in *Commerce Reports*, No. 212, of Sept. 9, 1916) in which mention was made of the presence in this country of the eruptive masses commonly known as "pipes" of kimberlite, or diamond matrix.

The subject is of intense interest, naturally enough, to geologists as well as to diamond miners generally, and a report upon as much of its history as is known at present may be interesting.

Brazilian diamond mining, as mentioned in my report above cited, has traditionally been placer mining. There may have existed here the vague dream that all placer miners indulge in, in all countries, of finding the mother lode "farther up," but these never appeared to attract attention until the arrival in this country, in 1909, of Samuel Draper, the geologist, well known as the discoverer of the "Premier" mine in South Africa and an acknowledged expert among geologists on diamond prospects.

It should be remembered that the first orderly attempts at systematizing the geological work of Brazil date back to the early 70's when, the country still being under the empire, Messrs. Branner, Hartt and Derby first visited it and described certain portions of it. Of these three geologists only Dr. Orville E. Derby remained in Brazil, becoming first, geologist to the state of São Paulo, and then later, through the efforts of the famous Baron de Rio Branco, being attached to the Geological Section of the Federal Government's Department of Agriculture and Industry.

It was to the late Dr. Derby that his friend and colleague, Draper, first addressed himself when, in 1909, he had completed certain examinations of the Aguas Sujas mine at Baggagem, in the state of Minas Geraes. It is a placer mine—an ancient conglomerate lying high above the present river levels—and Mr. Draper believed that he had found there traces of a broken-down "pipe" of kimberlite.

Dr. Derby was busied with other things at the time, and not until 1913 did he begin seriously to direct his attention to the matter, when Mr. Draper reopened the question with him and a petrographer in the service of the Brazilian government, a German named Everard Riemann, at Tiros, a village in the state of Minas Geraes on a branch of the São Francisco River, in the Serra de Matta da Corda, where he believed again to have found evidence of kimberlite.

In 1914 Dr. Derby, who was at the head of the geological work of Brazil, sent Riemann, the petrographer, and Horace Williams, a geologist, together on an expedition to Tiros and beyond to investigate. They returned, bringing with them good, but still not quite conclusive evidence, substantiating and adding to Mr. Draper's prognostications.

In 1915 Mr. Riemann went on a mission, alone, to Tiros and beyond that point. He reported, it is said, the discovery of at least five "pipes" of kimberlite. Toward the close of the year 1915 Dr. Derby made an official report to the Brazilian government of these conditions, which I believe was printed in the *Imparcial* newspaper, of Rio de Janeiro. At that time, Mr. Draper has stated to me that Dr. Derby—whose kindliness and fairness to all his associates had become proverbial here—also sent him a letter acknowledging that to him was due full credit for the discoveries. I am in hope that by another mail I may have obtained for transmission to the department a copy of the letter in question, which has been promised me.

The Brazilian government, as stated in my report of Aug. 8, has given serious consideration to this matter and is awaiting the reports of a geologist and a petrographer who are studying conditions at present.

Two months ago Mr. Draper returned to Brazil and will now, I am told, continue his investigations of this subject. Their result, as may naturally be supposed with a man of his acknowledged ability, will be awaited with intense interest here.

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*Communication from Alfred L. Moreau Gottschalk, consul general at Rio de Janeiro, Brazil, to the U. S. Department of Commerce, Oct. 24, 1916.

Analyses and Assays of Rocks

The question is frequently asked of the United States Geological Survey, according to a statement in the Bulletin, November, 1916, "What is the difference between an assay, an analysis, and an expert examination of a specimen of rock or mineral—such a specimen as may be sent to the Geological Survey by anyone who has found or thinks he has found a valuable mineral?" Most of the Survey's correspondents ask for assays of their specimens, others ask for analyses, and few appear to distinguish between the two. The Geological Survey can make neither an assay nor an analysis for private parties; it can, however, make a visual inspection of a specimen, or it can make a simple chemical test to determine whether the specimen contains a commercial amount of some valuable mineral, such as potash. Of the specimens submitted to the Survey 99% are found to be commercially valueless. Such an inspection, or test, however, is widely different from an analysis. A complete analysis of a rock that is composed of many different minerals may require the more or less continual attention of a chemist for a month or six weeks, and such work is done by the Survey only in connection with its own scientific investigations. An assay, on the other hand, is usually a fire test made to determine the exact metal content of an ore specimen. The Geological Survey makes no assays for private parties.

The Survey has recently reprinted its Bulletin 422, by W. F. Hillebrand, entitled "The Analysis of Silicate and Carbonate Rocks." This is a revision of Bulletin 305, which was so highly valued in Germany that it was there translated and republished. It contains a detailed description of the analytical methods employed in the laboratory of the United States Geological Survey and represents the experience gained in the analysis of more than a thousand igneous rocks alone. These analyses have been carried to a degree of completeness previously unknown, by methods that have been carefully tested and proved, some of them devised in the Survey.

A copy of Bulletin No. 422 may be obtained on application to the Director of the Geological Survey, Washington, D. C.

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Molybdenite Occurs in Rhodesia in several places, but so far has been found nowhere in commercial quantities. Recently, however, a deposit which is believed to be of considerable size has been discovered near the Umfuli River. It is now being explored.

The Bituminous-Shale Industry in Northwestern Colorado

By G. R. De Beque*

SYNOPSIS—The oil-shale area is about 20x50 mi. in extent. Deposits are being exploited and transportation equipment being installed. A sample of shale showed yield of 51.8 gal. of oil and 30.9 lb. of ammonium sulphate per ton of rock. Recent tests indicate the possibility of producing at a low cost oils high in cresols and phenols, suitable for use in flotation processes.

An examination of the bituminous shales, or oil shales, of northwestern Colorado was conducted by the United States Geological Survey in 1913. The result of the examination, necessarily of a preliminary character, served to show that the Colorado shales are much more extensive in area and thickness and richer in oil content than the bituminous shales of Scotland and France, which have been worked continuously for the last 60 or 70 years. More detailed experiments have been conducted recently by private individuals with the result that a number of valuable byproducts have been discovered through the fractionating of the distillate derived from the shale. Among the various products so far found are a number of aniline dyes, ichthyol (a valuable drug), ammonium sulphate, paraffin wax, flotation oils, phenol and gasoline; besides various materials which are found in the residue after distillation and which are utilized in the manufacture of insulating and roofing material and paints.

The Colorado oil-shale area extends westward from Rifle for a distance of 50 mi. and northward from De Beque for 20 mi. The town of De Beque, which is on the Denver & Rio Grande R.R., is on the south-central edge of the oil-shale zone, and it is in the territory contiguous to this place that the industry is being developed. In recent geologic time the surface of the area in this particular section was a high plain extending from the plateau on the north to Battlement Mesa on the south. Through this plateau Grand River has cut a valley to a depth of 3,600 ft., and the shale beds are exposed along a range of hills that rise to the north above the river valley. The igneous basement in western Colorado is covered by a series of formations, several thousand feet thick, which belong to the Paleozoic, Mesozoic and Cenozoic ages. The rocks of the Tertiary period were among the last to be deposited, and these are classified, in part, as the Bridger, Green River and Wasatch formations. The oil-bearing shales that outcrop in this section belong to the Green River formation and are the only ones that have received attention.

The Green River formation is characterized by the even bedding of the strata, by the presence of bitumen in some of the shale and by the calcareous character of the sandstone and oölite. Fish scales are common in this formation, and well-preserved insects and fossil turtles have been found. The bituminous shales occur in lenticular beds from a few inches to 80 ft. thick. A continuous exposure of several thousand feet generally reveals no marked variability in thickness.

ERODED MESA, CHARACTERISTIC OF NORTHWESTERN COLORADO, WITH OIL-SHALE OUTCROPPING NEAR SUMMIT OF MOUNTAIN

The shale, which has been pronounced as wurtzelite—a hydrocarbon similar to albertite—has a specific gravity of 1.60, is light to dark brown in color, has a velvety luster and, when scratched, gives a light-brown streak. It is very tough, being split along the bedding planes with [illegible] and strongly resists breaking across stratification. A sliver, when ignited, burns with a sooty smoke and gives an odor of burning petroleum. When large pieces are ignited in a pile, they soften and become plastic. In the richer shale there is an irregularity of lamination which gives it a peculiar curly structure, and the name of "curly shale" has been applied to this particular class of material because of its appearance.

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*De Beque, Mesa County, Colo.

Chemical and microscopical examinations of the shale show an intimate mixture of calcite and fine-grained quartz embedded in a mass of vegetable débris consisting of cells, spores, wood and pollen grains. A partial analysis of the oil-shale gives the following result: Volatile 36.14%, sulphur 0.94%, nitrogen 0.59%, ash (mineral matter) 61.85% and water 0.48%. This shale contains 51.8 gal. of oil and 30.9 lb. of ammonium sulphate per ton of rock. The oil has a specific gravity of 0.91642. It is dark brown to black in color and has a pungent odor.

One of the large shale beds is being opened on Kimball Creek, 30 mi. from De Beque. This deposit outcrops near the summit of the range at an altitude of 8,000 ft. It is approximately 80 ft. in thickness and is covered with an overburden of about 60 ft. of rock and dirt. The intention of the operators is to remove the overburden and extract the shale rock in open quarries. The pillar-and-stall method of mining will probably be employed in working the lower shale beds in cases where they are more than 4 ft. thick. Deposits under 4 ft. in thickness will be worked by the longwall system. The company is constructing an aërial tramway to convey the shale to the foot of the mountain, a distance of about 1/4 mi., where it will be loaded into motor trucks and transported to the railroad at De Beque; from which point it will be shipped to Eastern chemical works for treatment.

OUTCROP SHOWING "CURLY SHALE," NEAR DE BEQUE, COLO.

OIL SHALE OUTCROP NEAR SUMMIT OF RANGE ON KIMBALL CREEK, NEAR DE BEQUE, COLO.

The exploitation of the immense oil-shale deposits of Colorado opens a new field of industry in the United States, and that business promises to become one of great importance in the near future. As experimental work advances, additional byproducts of value undoubtedly will be discovered. Tests are being conducted at De Beque with a view to producing oils high in cresols and phenols, so that Western mining companies may be supplied with flotation oils at low costs. Such oils have already been produced locally, in quantities sufficient for laboratory experiments, and the intention is to enlarge the plant to meet market requirements.

Chronology of Flotation

By William Motherwell[*]

The chronology of flotation patents has been fully dealt with in T. J. Hoover's book and credit given to the different inventors. This article is intended to deal only with the commercial application of flotation—successful and otherwise. It is, of course, difficult for anyone to make a complete list of working-scale plants all over the world, especially as so much secrecy has been observed, so that there are probably many omissions. Any criticism or amendments will be cheerfully received, to the end that a true record of the work done in different countries may be obtained.

As the Murex magnetic is not strictly a flotation process, I have not included plants using that system. The Cattermole has been included, as it was partly a granulation and partly a flotation process. Incidentally, it is interesting to note that the Elmore, Potter, Delprat, Minerals Separation, de Bavay, Murex, Horwood, Lyster, Owen, Bradford and Callow processes, like the MacArthur-Forrest cyanide process, were made commercially successful by Britishers, mostly Australians, and the Macquisten flotation process was invented by a Scotchman and first applied commercially in the United States by a Scotch mining company, the Glasgow & Western.

First Application of Flotation

Hoover estimates that up to the end of 1913, 11,000,000 tons of material had been treated by flotation at Broken Hill alone. It is said that feathers dipped in pitch were used to recover gold as long ago as 400 B. C., but whether used on a commercial scale history does not relate, and perhaps this was not exactly a "flotation process." According to the Hoover book the Everson process was tried on a fairly large scale (whatever that may be) at Baker City, Ore., in 1889, and also near Denver in the same year.

It is stated in a letter in the *Journal* of Apr. 14, 1906, that flotation was successfully used in treating the telluride ores of Boulder County, Colo., about 20 years before that date, by Albion M. Rouse. The process seems to have resembled the Potter process in that acid and not oil was used. I think this will be news to most of the present-day Cripple Creek metallurgists who are struggling with the problem.

In the *Journal* of Aug. 12, 1905, an interesting fact is mentioned which is probably not generally known. The reference is given in the bibliography to Hoover's book, but I do not think it is mentioned in the book itself. This is a statement that the old Elmore thick-oil process had been experimented with for the recovery of diamonds at the Premier mine in the Transvaal and proved so successful that a plant with a capacity of 800 tons per day would be built. Can anyone say whether it was successful? This, of course, is a different process from the grease tables used at Kimberley.

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[*] Metallurgist, Salt Lake City, Utah

It will be seen that I have only brought the list down to the end of 1914. The number of companies that did not wake up until 1915 is so large that I am afraid the editor could not spare the space to specify them.

Name and Location of Mine	Daily Tonnage	Metals in Ore or Tailings	Process
1896			
Glasdir mine, near Dolgelly, Merioneth, Wales	?	Au, Ag, Cu	Robson & Crowder
1898			
Glasdir mine, near Dolgelly, Merioneth, Wales	?	Au, Ag, Cu	Old Elmore
Date Unknown*			
Boston Cons. Co., Utah, U.S.A		Cu	Old Elmore
Cape Copper Co., Namaqualand		Cu	Old Elmore
Namaqua Copper Co., Namaqualand		Cu	Old Elmore
Mammoth Mining Co., Utah, U.S.A.			Old Elmore
1901			
Detroit Copper Co. (?) Morenci, Ariz., U.S.A.	80	Cu	Old Elmore
Sygun mine, Wales	100	Cu	Old Elmore
St. David's mine, near Dolgelly, Merioneth, Wales		Au, Cu	Old Elmore
Tywarnhaile mine (date uncertain) Cornwall, England		Cu	Old Elmore
1902			
Santa Barbara mine, Yauli, Peru	100	Ag, Zn	Van Meter & Boss
Alpinina mill, Yauli, Peru	100	Ag, Zn	Van Meter & Boss
1903			
Broken Hill Proprietary, Broken Hill, N.S.W., Australia	500	Pb, Zn, Ag	Delprat
Broken Hill Block 14, Broken Hill, N.S.W., Australia	?	Ph, Zn, Ag	Potter
1904			
Le Roi mine, British Columbia, Canada	?	Cu	Old Elmore
Lake View Consols, Kalgoorlie, Western Australia		Au	Old Elmore
1905			
Sulphide Corporation, Broken Hill, N.S.W., Australia	100	Pb, Zn, Ag	Cattermole
Sulphide Corporation, Broken Hill (old mill), Australia	300	Pb, Zn, Ag	Minerals Separation
Zinc Corporation, Broken Hill, N. S. W., Australia	300	Pb, Zn, Ag	Potter
De Bavay Treatment Co., Broken Hill (1st mill), Australia	10 to 400	Pb, Zn, Ag	Original de Bavay
1906			
Sulphide Corporation, Broken Hill, N.S.W. (new mill), Australia	500	Pb, Zn, Ag	Minerals Separation
Adelaide Reduction Works, Golconda, Nevada, U.S.A	125	Cu	Macquisten
(?) Marion, Kentucky, U.S.A.	?	?	Sanders
Kelly mine Magdalena, New Mexico, U.S.A.	100	?	Sanders
1907			
Zinc Corporation, Broken Hill, N.S.W. (2nd mill), Australia	300	Zn, Pb, Ag	Minerals Separation
Minerals Separation, Ltd., Broken Hill, N.S.W., Australia	900	Zn, Pb, Ag	Minerals Separatio
At Block 10 mine, Broken Hill, Australia	?	Zn, Pb, Ag	Gillies
At Block 10 mine, Broken Hill, N.S.W., Australia	?	Zn, Pb, Ag	Minerals Separation
Pinnacles mine, near Broken Hill, Australia	?	Zn, Pb, Ag	Elmore Vacuum
Sulphide Corporation and Minerals Separation, Broken Hill, N.S.W. (Slime), Australia	100	Zn, Pb, Ag	Minerals Separation
Dolcoath mine, Cornwall, England	40	Cu, Sn	Elmore Vacuum
Ore Concentration Syndicate, Broken Hill, N.S.W., Australia	40	Zn, Pb, Ag	Elmore Vacuum
Tywarnhaile mine, Cornwall, England	40	Cu	Elmore Vacuum
Date Unknown			
Ramsley mine, Devonshire, England	40	Cu	Elmore Vacuum
Avino mine, Durango, Mexico			Elmore Vacuum
Caucasus Copper mine, Dzansul, Russia		Cu	Elmore Vacuum
Telemarken mine, Norway	120	Cu	Elmore Vacuum
Saxberget mine, Sweden		Zn, Pb, Ag	Elmore Vacuum
Garpensberg mine, Sweden	80	Cu	Elmore Vacuum
Traag mine, Norway	40	Pb, Zn	Elmore Vacuum
Hadeland mine, Norway	100	Zn	Elmore Vacuum
Edmundian mine, Rhodesia	80	Cu	Elmore Vacuum
Glasdir mine, Dolgelly, Wales	40	Cu, Ag, Au	Elmore Vacuum
1908			
Zinc Corporation, Broken Hill, N.S.W., (third mill) Australia	700	Zn, Pb, Ag	Elmore Vacuum
Pinnacles mine, Broken Hill, N.S.W. (third mill), Australia	160	Zn, Pb, Ag	Minerals Separation
Cobar Gold mines, Cobar, N.S.W., Australia	120	Au, Cu	Elmore Vacuum
New Ravenswood Gold mine, Queensland, Australia		Au, Cu, Zn, Pb	Elmore Vacuum
Saxberget mine, Sweden		Zn, Pb, Ag	Minerals Separation
John Moffatt, Wolfram, Queensland, Australia		Mo	Wood (?)
1909			
San Francisco del Oro, Chihuahua, Mexico	100	Au, Ag, Pb, Zn	(?)
1910			
British Broken Hill mine, Broken Hill, Australia	400	Zn, Pb, Ag	Elmore Vacuum
British Broken Hill, Broken Hill, N.S.W., Australia		Zn, Pb, Ag	Minerals Separation
Gt. Fitzroy mine, Rockhampton, Queensland, Australia	250	Au, Cu	Minerals Separation
New Einasleigh Copper mine, Queensland, Australia	120	Cu	Elmore Vacuum
Sulitjelma Copper mine, Norway	600	Cu	Elmore Vacuum
Amalgamated Zinc (de Bavay), Broken Hill, Australia	1,600	Zn, Pb, Ag	Improved de Bavay
Lancefield Gold mine, Laverton, Western Australia	?	Au	Minerals Separation
1911			
Federal Mining & Smelting Co., Mullan, Idaho, U.S.A.	150	Pb, Zn	Macquisten
Butte & Superior, Butte, Mont., U.S.A	500	Zn, Ag	Hyde
Zinc Corporation, Broken Hill, N.S.W., Australia	1,000	Zn, Pb, Ag	Minerals Separation
Orijarvi mine, Finland	?	Cu, Zn, Ag	Minerals Separation
1912			
Kyloe Copper mine, N.S.W., Australia	60	Cu	Minerals Separation
Braden Copper mine, Sewell, Chile		Cu	Minerals Separation
Etheridge Gold mines, Forsayth, Queensland, Australia	80	Au, Ag, Pb	Minerals Separation
Junction North mine, Broken Hill, N.S.W., Australia	600	Zn, Pb, Ag	Minerals Separation
Chesney Copper mine, Cobar, N.S.W., Australia	400	Cu	Minerals Separation
Kamioka mine, Hida, Japan	?	Zn, Pb, Ag	Potter with oil
Britannia mine, Howe Sound, B.C. Canada	500	Cu	Minerals Separation
Inspiration Copper Co., Miami, Ariz. (first test mill)	50	Cu	Minerals Separation
1913			
Caucasus Copper Co., Dzansul, Russia	?	Cu	Minerals Separation
Falcon mine, Rhodesia	?	Au, Cu	Minerals Separation
Silver Peak mine, Yerranderie, N.S.W., Australia	80	Ag, Pb	Minerals Separation
Cuba Copper Co., Santiago (test mill) Cuba	50	Cu	Minerals Separation
Hewitt mine, Silverton, B. C., Canada	?	Ag, Pb, Zn	Minerals Separation
Standard mine, British Columbia, Canada	?	Ag, Pb	Minerals Separation
Wallaroo Copper mine, South Australia	400	Cu	Minerals Separation
Lloyd Copper mine, Burraga, N.S.W., Australia	?	Cu	Minerals Separation
Mt. Morgan Gold mine, Queensland (test mill) Australia	100	Au, Cu	Minerals Separation
National Copper Co., Mullan, Idaho, U.S.A	500	Cu	Callow
Atlas Mine, Ouray, Colo., U.S.A		Au, &c	Minerals Separation
Zinc Corporation, Broken Hill, N.S.W., Australia	80	Zn, Pb, Ag	Horwood
Zinc Corporation, Broken Hill, N.S.W., Australia		Zn, Pb, Ag	Lyster
Timber Butte Mill, Butte, Mont., U.S.A		Zn, Pb, Ag	Minerals Separation
Seoul Mining Co., Suan, Whang Hai, Chosen		Au, &c	Minerals Separation
Miami Copper Co., Miami, Ariz., U.S.A	50	Cu	Canby
Ozark Smelting & Mining Co., New Mexico, U.S.A.	?	Zn, Pb, Cu	Ozark
1914			
Mt. Morgan Gold Mining Co., Australia	500	Au, Cu	Minerals Separation
Mountain Copper Co., Shasta County, California, U.S.A	250	Cu	Minerals Separation
Engels Copper Co., Plumas County, California, U.S.A.	200	Cu	Minerals Separation
Old Dominion Mine, Globe, Ariz., U.S.A	300	Cu	Minerals Separation
Inspiration Cons. C. Co., Miami, Ariz., (second test mill), U.S.A	600	Cu	Callow, Cole Minerals Separation, Towne & Flynn, Inspiration
Cuba Copper Co., near Santiago, Cuba	600	Cu	Minerals Separation
Miami Copper Co., Miami, Ariz., U.S.A		Cu	Callow
Consolidated Arizona Smelting Co., Humboldt, U.S.A	200	Au, Ag, Cu	Minerals Separation
Magma Copper mine, Superior, Ariz., U.S.A		Cu	Callow
Detroit Copper Co., Morenci, Ariz., U.S.A	50	Cu	Canby
Copper Queen Consolidated, Bisbee, Ariz., U.S.A	?	Cu	Rork
Arizona Copper Co., Morenci, Ariz., U.S.A	50	Cu	Towne & Flynn
Burro Mountain Copper Co., Tyrone, N.M., U.S.A	50	Cu	Minerals Separation
Burro Mountain Copper Co., Tyrone, N.M., U.S.A	50	Cu	Towne & Flynn
American Zinc, Lead and Smelting Co., Mascot, Tenn	500	Zn	Mechan. Agitator
St. Joseph Lead Co., and Doe Run Lead Co. (3 plants), Missouri, U.S.A		Pb	Mechan. Agitat[illegible]
Federal Lead Co., Flat River, Mo., U.S.A.		Pb	Mechan. Agit[illegible]
Desloge Lead Co., Flat River, Mo., U.S.A.		Pb	Mechan. Agit[illegible]
St. Louis Lead Co., Flat River, Mo., U.S.A		Pb	Mechan. [illegible]
Teziutlan Copper Co., Puebla, Mexico	500	Cu	Towne & Fl[illegible]
Moctezuma Copper Co., Nacozari, Sonora, Mexico	30	Cu	Towne & Fl[illegible]
Utah Copper Co., Garfield, Utah, U.S.A		Cu	[illegible]
Sulphide Corporation, Broken Hill, N.S.W., Australia		Zn, Pb, Ag	[illegible]
Broken Hill Proprietary, Broken Hill, N.S.W., Australia		Zn, Pb, Ag	[illegible]
San Francisco del Oro, Parral, Chihuahua, Mexico		Zn, Pb, Ag	W[illegible]

Cananea Consolidated Copper Co., Sonora, Mexico..	50	Cu	Towne & Flynn
Federal Mining and Smelting Co., Idaho, U.S.A.. . . .		Pb, Zn, Ag	Callow
Gold King mine, San Juan, Colo., U S A .		Au, Ag, Pb	Minerals Separation

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Report of the Director of the U. S. Geological Survey

Washington Correspondence

Demand for scientific research never before has been so keen, its purposes so definite or its results so satisfactory. That this is the opinion of George Otis Smith, Director of the United States Geological Survey, is made very plain in his annual report, which was recently presented to Congress.

"Science is regarded as a necessity rather than a luxury," says Dr. Smith. "This coming of science into its own as a large factor in the industrial life of the nation necessarily is followed by a certain reaction of business upon science. The utility of science has become more universally the test of its value."

One of the features of the fiscal year ending June 30, 1916, which is under review in the annual report, is the fact that mineral development is outstripping the facilities of the geologic branch of the Survey. Calls on it for service made by the public have increased greatly and never before were so varied. Despite the fact that there are 188 geologists of various grades in the service of the Survey, work of the most pressing importance, very necessary to the public good, cannot be done, as the geological force is working overtime nearly every day as it is.

Director Smith gives prominence in his report to the efforts being made by the Survey to get before the public at the earliest possible moment the results of work in the field and the significance of statistical and other data which are gathered by the bureau. That accuracy has not suffered by giving such data to the public while it is still news, rather than after it has become history, is pointed out in the report. Announcement Jan. 1, 1915, of the probable output of iron ore in 1914 missed the final figures by only 239 tons. Likewise the statement giving the marketed output of other minerals was estimated very closely, and in practically every case the final figures did not change results by more than 1%. Hundreds of letters have been received by the Survey indicating that the mineral industries have benefited greatly from this policy of releasing information as soon as it reaches the Washington office. There is now no doubt that much of the value of the statistical reports was being lost under the old policy of making the information public only after final figures had been obtained.

In his report Director Smith calls attention to the delay and expense occasioned by 2% of producers who fail to fill out and return the blanks sent them. In running down the production from this 2%, more time is lost than in collecting figures from the other 98%. The cost of gathering this information is also increased greatly by this failure to respond promptly.

In discussing the determined search for potash which is being made by the Survey under the disadvantages of inadequate appropriations, Director Smith points out that from the first it has been recognized that the chances of immediate success are small. This is due to the fact that the area to be explored is large, the funds available are small and to the fact that the surface indications that may help in determining the most promising places for drilling are only of the most general nature. In view of the great demand for an adequate supply of cheap potash in this country—and if potash is to be obtained at a low cost it must come from deposits in the earth—Director Smith believes that systematic drilling in the "Red Beds" of the Southwest and in other places where there is geological evidence that potash may have been precipitated must be continued.

What is characterized by Dr. Smith as "a notable contribution to geologic literature in its broadest relations" is the report of Grove Karl Gilbert on "Hydraulic-Mining Débris in the Sierra Nevada," which will be published by the Survey during the coming year.

Director Smith's report is a condensed analysis of the work done by the Survey during the year. Even the brief treatment given the principal activities of the bureau furnishes material for 173 printed pages.

*

New Graphite Discovery

The curtailment of the supply of raw materials has been a serious problem to the American manufacturer, but from the standpoint of our future commercial welfare this shortage has proved a blessing in disguise. The high prices have led to the development of chemical and other processes to meet the shortage, while intensive prospecting has brought to light many commercial deposits of minerals.

The bulk of the supply of graphite used in this country has been obtained from the Island of Ceylon, off the southern coast of India, but this supply has been seriously curtailed by the lack of shipping facilities. The New York State Department of Labor points out that search for this mineral has recently brought to light the largest known deposit of high-grade ore on this continent. It is between Lake George and Lake Champlain in the vicinity of Black Mountain. The famous mine opened by the Joseph Dixon Crucible Co., in 1878, is in this section and in the same geological horizon. This mine is still being operated, but the new find is said to be several times as large as the Dixon deposit. The vein outcrops for nearly a mile with a thickness of 50 ft. The graphite content indicates a variation of 6 to 10% of the large flake variety desired by the manufacturers of crucibles, while a 6-ft. layer in the deposit assays over 15% of the same high-grade graphite.

For the purpose of milling the ore a 100-ton mill unit has been erected, which will be added to next year when mine operations will have been developed sufficiently to furnish an increased supply of ore.

The property is owned by Hooper Brothers, with headquarters at Whitehall, N. Y. Their father, William Hooper, was the pioneer of the graphite industry in this county, having erected the first concentrating plant for the treatment of graphite ore in Ticonderoga during war times.

The owners, George H. and Frank C. Hooper, who have specialized in graphite mining and graphite separation, have in this an ideal deposit as regards size, richness and situation. Their power plant, when erected, will be below the mine on the bank of South Bay, connected with Lake Champlain and the Barge Canal.

Some Observations on Sampling

By Irving Herr*

SYNOPSIS—Mill runs often do not come up to the results expected from sampling. Various examples of a spotted deposit show that the error may be as great as 49% even though due care was exercised while sampling. At best sampling is only a means of approximation.

For a number of years, while superintendent of one of the silver-gold mines of the Guanajuato district in Mexico, I was confronted with the fact that the results of our mine sampling were not always dependable. It was usually found that when mining of any particular portion of the developed orebody began, the grade of the broken ore was lower than that expected and shown to exist according to the sampling record.

As the development of the mine progressed by the usual drifts, raises, winzes, etc., these headings were sampled by the mine engineer. The method usually followed was that of taking cuts across the roof of the drifts at regular intervals, usually one meter apart. This frequently alternated with sampling of the face of the headings, in which case two and sometimes three cuts taken across the face or across the width of ore exposed in the face constituted a sample.

When the ore thus blocked out came to be mined, the value of the broken ore was considerably less than that calculated from the sampling records. This was particularly noticeable in the case of one large stope which for a number of months formed the main ore supply for the mill. When ore breaking began in this stope, the grade of the broken ore was so much lower than that expected from the previous sampling of the block that all the calculations of the management on probable mill returns were upset and a situation of some delicacy arose between the mine engineer who did the sampling, the mine foreman in charge of breaking the ore and the management.

Mill Runs Always Lower Than Sampling Results

For a while it was believed that either high-grading was being carried on in a very extensive manner or else the mine foreman was allowing a much greater width of ground to be broken than was warranted by the sampling and thus permitting the ore to be diluted with waste from the foot and hanging wall. Special attention was directed toward the elimination of these defects, and as often as possible the bottom of the stope was carefully sampled over its entire area by the engineer. This stope continued to be a disappointment throughout its life, and the grade of the broken ore continued lower than that shown by the stope sampling. The ore was in the main low-grade, but with numerous bunches and stringers of high-grade scattered through it. I have discussed this matter with the superintendents of other Guanajuato mines and have found their experience to be similar. One said that he always deducted about 20% from his mine samples in order to check the mill heads.

I believe this has probably been the experience of a number of mine managers, especially those who are mining orebodies in which the mineralization is uneven; where high-grade masses, stringers, or bunches are disseminated through a main body of low grade ore, which is frequently the case in Guanajuato.

Such differences between values anticipated from sampling and values actually contained in the broken ore may be attributed to careless sampling or poor judgment on the part of the engineer in charge of the sampling, or to the subsequent breaking of greater widths in stoping than were sampled and the consequent dilution of the ore by inclusions of waste rock from foot or hanging wall. The main question is not how these differences occur, but how they may be avoided, and in studying the subject I have been impressed with the fact that it is often difficult to correctly sample such ore and that perhaps the engineer is sometimes blamed for carelessness when he was using every precaution and exercising care to the best of his ability. If errors occur, they will be rather on account of bad judgment where correct judgment is difficult to attain. Such errors are apt to balance themselves in the long run, and if the sampling extends over a sufficient area, the average of all the samples should be very nearly correct. But I believe that in a limited area the error may be unbalanced.

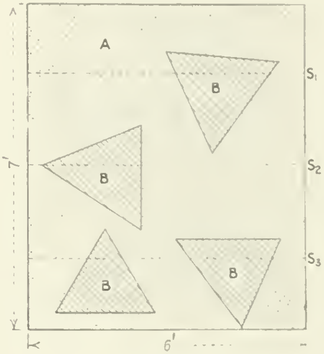

FIG. 1

Area of face	42 sq. ft.
Area high grade ($100)	9.37 sq. ft.
Area low grade ($10)	32.63 sq. ft.
Average valeu of face = $30.08	
Total length sample cut	18 ft.
Total length high-grade cut	7 ft.
Total length low-grade cut	11 ft.
Average value by sample, $15.	
Error = $14.92 = 49.6%.	

Fig. 1 is a theoretical case showing the face of a drift on a vertical vein whose width is that of the drift. The drift is 6 ft. wide and 7 ft. high. The vein filling consists of uniform low-grade ore *A* in which are four irregular-shaped bunches of high-grade ore *B*. The low-grade assays $10 per ton, while the high-grade assays $100 per ton. Three sample cuts are made along the lines S_1, S_2, S_3. The area of the high-grade ore exposed in this face is such that the average value over the entire face is $30.08 (see calculation under Fig. 1), while the average value according to the sample is $15, an error in sampling of $14.92, or 49.6%.

The Question of Representative Sampling

A little study of this figure shows why the sample is so unrepresentative, but it is my opinion that many engineers in the course of the day's work might sample a face similar to this and believe they had taken a fair sample. Moreover, to calculate in this instance where the sample cuts should have been taken in order to obtain a correct sample would be difficult. This case seems to [illegible] that the only true sample of a face of this character is one where the entire area of the face is cut down—obviously quite impracticable. The next most dependable sample would be one of the muck broken down by a round of holes covering the entire face. A careful sample of the muck should be more reliable than any ordinary cut sample. I think, as a general rule, where both muck samples and cut samples are taken, more reliance is likely to be placed, unjustly, on the cut sample.

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*Mining engineer, Cambridge, Mass.

Fig. 2 is another example illustrating the same idea. Here the shaded portion is high-grade ore running $100 per ton, while the light area A is ore of $10 grade. In this case the actual average value of the face is $47.10 while the sample gives $51.25, an error of $4.15, or 8.8%. From a casual inspection of Fig. 2 the sampling looks quite fair and representative. The ultimate degree of accuracy obtained in sampling along a drift in this manner depends upon the law of averages; some samples will be too high, others too low. There is a probability that the sampler will oversample rather than undersample. The psychological process by which this comes about is somewhat as follows:

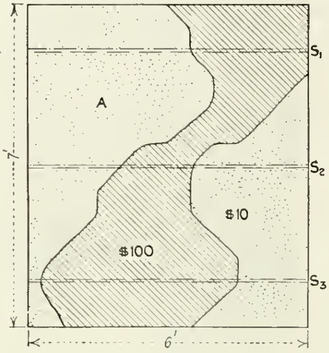

FIG. 2

Total area of face........... 42 sq.ft.
Area of high-grade ore ..... 17.3 sq.ft.
Area of low-grade ore ...... 24.7 sq.ft.
Average grade of ore in face, $47.10.
Total length of sample cut..... 18 ft.
Length of high-grade cut ..... 8.25 ft.
Length of low-grade cut ...... 9.75 ft.
Average grade by sample, $51.25.
Error + $4.15 = 8.8%.

The sampler knows that he is liable to err on the high side and must take precautions against it. In most cases the barren or low-grade ore is harder and more difficult to cut than the richer portion. In his zeal not to slight the low-grade, considerable time and muscle are expended in cutting this part of the sample. In fact, by the time he has broken off what is really a fair proportion of it, he has expended so much time and force that he unconsciously believes he must have taken too much. In an effort to be fair he will probably add a little more of the better ore and salt the sample.

All hands, including the engineer, about a mine are glad when there is good ore on hand. If the development faces are running well, the whole atmosphere around the property is more cheerful. The tension slackens a bit, and good fellowship increases. The mine foreman coming off shift drops into the office and in an unobtrusive manner glances over the assay sheet for the day. If the faces of his headings are sampling well up, he closes the book with a grin.

Is it much to be wondered at, then, that the mine sampler, while aiming to be careful and conservative in his work, also wants to do the fair thing by the ore and unconsciously believes that his very precautions against too high results may cause his samples to run lower than they should and is influenced thereby? Apart from all this is the case where the sampler actually is careless, and then in the majority of cases his samples will be too high because it is easier to break the good ore and because pieces of soft friable high-grade will slough off the face into the sample while the harder ore is being cut.

Examples of Errors in Sampling

Fig. 3 represents an underhand stope *a-d*. This is supposed to consist of uniform low-grade ore *A* with occasional masses of higher-grade ore *B* scattered through it. Let this stope as it is mined down be sampled along the lines S_1, S_2, S_3 and S_4. Let $100 per ton be the grade of the masses of high-grade, and $10 per ton be the uniform grade of the balance of the ore. If the stope is 2 units wide, 6 units long and 6.5 units in depth, while the volume of each of the high-grade bodies is 1, then the average value of the ore in the stope is $14.62. But the sampling along the lines S_1-S_4 gives a total area of sample of 48 square units, of which 4 are high-grade ore. The average, then, according to the sampling is $17.50; an error of $2.88, or 19.7%. Had the small masses of high-grade ore been increased by the small volumes *C*, as shown in Fig. 4, and the sampling lines remained the same, the sampling results would have been correct, for in the latter case the volume of high-grade ore is increased to 6.5 cubic units without increasing the area of high-grade in the samples, and the following necessary ratio is found to exist:

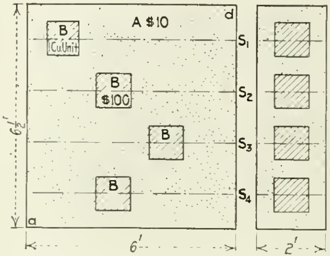

FIG. 3

Volume of stope = 6.5 × 6 × 2
= 78 cu.units
Volume of high-grade = 4 cu.units
Volume of low-grade = 74 cu.units
Average value of ore in stope, $14.62.
Area of samples 6 × 2 × 4
= 48 sq.units
Area of high-grade sampled 4 sq.units
Area of low-grade sampled. 44 sq.units
Average value by samples, $17.50.
Error + $2.88 = 19.7%.

$$\frac{\text{Area of high-grade sampled}}{\text{total area of samples}} = \frac{\text{volume of high-grade}}{\text{total volume of orebody}}$$

The conclusion that I draw from this is that in dealing with orebodies that are not homogeneous in character and where the ore contains irregular masses of distinctly higher grade ore, it is difficult to get reliable samples by taking cuts over the surface of the body. The reason that the ore represents a volume, while the sampling represents a surface only; one a figure of three dimensions, the other of only two. In order to sample correctly such a body, the proportion previously indicated must hold true, and this is obviously difficult of attainment. The more frequently cuts are taken, the better they represent the actual value of the ore.

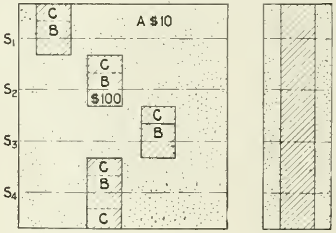

FIG. 4

Volume of stope = 78 cu.units
Volume of high-grade B + C.
6.5 cu.units
Volume of low-grade..... 71.5 cu.units
Average value of ore in stope, $17.50.

Another example of a stope in which the broken ore would consistently show lower values than the sampling is one in which, beginning at the top with a certain grade of ore, the grade continually decreases as the stope is worked down. In this case, if the sampling of the floor where the stope is begun shows a certain value, the first lot of ore broken will give lower returns than the sampling because it is a mixture of the higher-grade ore from the plane of the samples and lower-grade from the bottom of the cut removed from the stope.

⁂

South African Mineral Production in 1915

The annual report of the Department of Mines and Industries for 1915 contains the following information relative to the production of the several minerals given for 1914 and 1915:

Product	1914	1915
Gold, oz	8,396,068	9,096,410
Silver, oz	890,781	966,176
Diamonds, carats	2,801,016	103,385
Coal, tons	8,477,923	8,281,324
Coke, tons	6,493	7,279
Tar, gal	2,225	26,050
Copper, tons	29,325	28,969
Tin, tons	3,429	3,441
Asbestos, tons	1,190	2,138
Graphite, tons	34	41
Magnesite, tons	572	627
Antimony, tons		89
Lead, tons	136	180
Zinc, tons		352
Corundum, tons	12	68
Nickel, tons		2
Mica, tons		2
Iron pyrites, tons		545
Kaolin, tons		20
Talc, tons		44
Salt (including byproducts), tons	40,290	45,104
Soda, tons	2,593	6,303
Lime, tons	66,095	68,989
Flint, tons	425	453
Gypsum, tons	1,791	2,838

The total value of these products in 1914 was £45,366,224, while the 1915 production was valued at £43,531,009. The greatest single increase was in gold, in which £2,974,865 was recorded. The chief decrease was in diamonds, where £5,087,384 was recorded.

A report on the asbestos industry is included, as the interest in asbestos has increased as shown by the substantial increase in output.

A total of 299,673 men were employed in the mining and metallurgical industry during 1915. Of these 29,604 were white, 4,311 Asiatic and 265,758 natives.

In gold mining the tendency has been to employ a higher stamp duty and work a slightly lower-grade ore. On the Witwatersrand a duty of 9.335 tons per stamp was employed, while in the Transvaal 9.156 was used. Waste to the extent of 9.36% was sorted out. The average value of ore worked was 26.319s. ($6.40) per ton and working costs were 17s. 6d. ($4.26), leaving a profit per ton of 8s. 9d. ($2.14).

⁂

Operating Electric Steel Furnaces

A writer in a recent issue of *L'Echo des Mines et de la Métallurgie* suggests the installation of electric furnaces in towns, in order to utilize the electric units lying idle at the power station during slack time, says *Iron and Coal Trades Review*, Nov. 10, 1916. He saw the first installation of this kind about eight years ago in a suburb of Turin. There were two small Stassano furnaces of 100 hp. each, and two of 1,000 hp. each, both taking their current direct from the town supply.

In France the idea is making headway. Just outside Limoges a Keller furnace has been installed capable of smelting down 30 tons of iron turnings and other cheap scrap per day, and producing 25 tons of high-priced cast metal, in conjunction with dephosphoration or without it, or turning out ordinary cast iron of high quality when the current is obtainable at a low rate. The furnace occupies a very small space in the tramway depot and requires little attendance owing to the provision of ample labor-saving appliances. The current in this case is transmitted from a hydraulic power station to Limoges at 30,000 volts, where it is transformed down to 10,000 and then again to 110 volts to suit the voltage of the furnace. The consumption of current is about 700 to 800 kw.-hr. per metric ton of metal produced. The first heat would, it is presumed, have to start about midnight, or soon after the peak load is passed at the power station.

⁂

New South Wales Copper Output*

The copper production of New South Wales for 1915 was valued at £231,137, a decrease of £40,234 from that of 1914 and the smallest return recorded since 1896.

Of this production, the mines of the Cobar district supplied the largest part, with a value of £134,212; compared with £116,160 for the previous year. The Cadia Copper plant produced 500 tons of copper matte valued at £16,011, or a decrease of £24,848 from the 1914 record. The Grafton mine at Cangai shows a slight increase over 1914, the yield being 161.32 tons of matte valued at £6,488. The Mouramba Copper Mines, Ltd., at Nymagee smelted 18,500 tons of ore and obtained 663 tons of copper valued at £37,780. At the works of the Electrolytic Refining and Smelting Co. of Australia, Ltd., the production included 20,733 tons of copper, the greater portion of which was obtained from imported blister copper.

⁂

Lead-Coated Steel Sheets

The Ledcote Co. of Canada, Ltd., Amherst, N. S., is making steel sheets coated with lead electrolytically deposited, which is offered for constructional ironwork. These lead-covered sheets are a substitute for galvanized sheets.

The Ledcote Co. informs us that it uses the ordinary electrolytic process of lead depositing. It has, however, developed a solution that enables it to deposit lead on iron, wood or plaster to any thickness without flaking or peeling. This has not previously been possible, the thickness capable of being deposited without peeling being so small as to make it of little value commercially. The new process has overcome this difficulty. The company controls this process for the United States and Canada.

⁂

Aluminum Exports from Switzerland to Germany in 1915, according to Swiss reports, were 12,000 to 14,000 tons, according to "Iron Age" Nov 9, 1916. Before the war Germany obtained aluminum from Switzerland, France and Canada. The Aluminum Industrie A. G. is now the largest source of the German aluminum supply, with the largest plant at Chippis, in Valais, at the junction of the Rhone and the Navizance.

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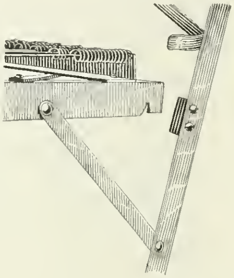
*Excerpt from Annual Report of the Department of Mines, New South Wales, for the year 1915.

Details of Practical Mining

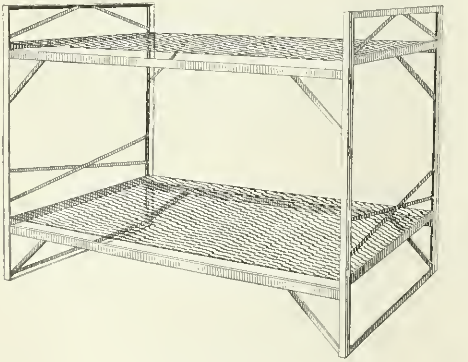
Sanitary Steel Bunks

A new feature in the construction of steel bunks is the device here shown (from *Excavating Engineer* for October, 1916), which illustrates a boltless locking device, on the Tiger steel bunk. The corner of the bunk, shown in detail, is a view taken from the side. The angle side rail is notched near the end of the rail. This engages with a flange riveted to the angle which forms the upright of the frame. A swinging lug, which is shown immediately above these two parts, is brought down to rest on the upper surface of the side angle, thus making firm joint between the slotted part of the angle and the flange on the upright piece. It is a perfectly rigid piece and requires no tools to complete the operation, which consists in simply slipping the angle side rail over the flange, and hammering the lug into place. This device is offered for the convenience of those who require a sanitary portable bunk. The Tiger steel bunk, when completely set up, presents the appearance here illustrated.



KNOCKDOWN FEATURE OF BUNK

The steel bunk has made a place for itself in modern camp equipment. It is much more sanitary and durable than the old-style wooden bunk or wooden cot. The wire-link fabric, with the helical springs, makes a comfortable bed, and in these times, when the question of securing satisfactory labor is so important, a good bed under sanitary conditions has much to do with assuring a satisfactory final result.



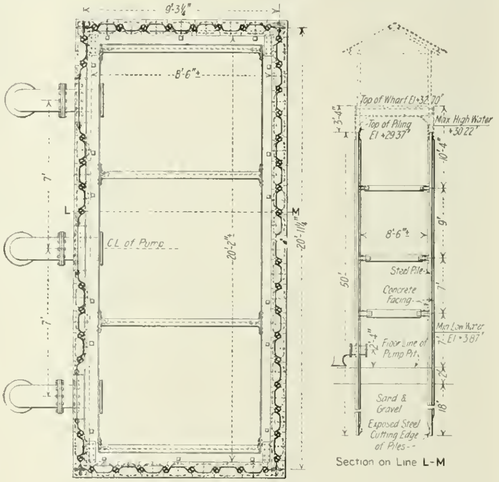
A SANITARY BUNK

Tiger steel bunks are made by Haggard & Marcusson Co., 1113 West 37th St., Chicago, Ill.

Pumphouse Construction Under Severe Tidal Conditions

By Charles S. Boardman*

The Alaska Treadwell Gold Mining Co., at Treadwell, Alaska, found early in the year 1914 that it was necessary to construct a new intake and pumping plant. This new central pumping plant, situated at its dock face in the tidewaters of the Gastineau Channel, was to be built on sand and gravel foundation over which there was but a few feet of water at extreme low tide. The pump station, 8 ft. by 19 ft. 6 in. inside dimensions, was to be constructed 30 ft. in height above a concrete base or floor to protect pumps, shaft, etc., from the action of the tide, which has a range at this point of about 26 ft. It was to contain three horizontal centrifugal pumps, having a capacity of 2,800 gal. per min., working under a head of 125 ft. These pumps were to be electrically driven and set on the floor of the pumphouse 5 ft. above high tide. They were required to furnish circulating water for condensing purposes, and suction pipes were to extend outside of the pumphouse below mean low tide.



PLAN AND ELEVATION OF PUMPHOUSE FOUNDATIONS

After considerable study on the possible methods of construction for a pumphouse in such an exposed situation and subjected to such a high range of tide, it was decided to attempt the use of steel sheet piling. Accordingly an order was placed with the Lackawanna Steel Co., of Buffalo, N. Y., on plans drawn for its protected steel sheet piling.

To accomplish this, 65 tons 14x$\frac{3}{8}$-in. arch-web steel sheet piling was ordered.

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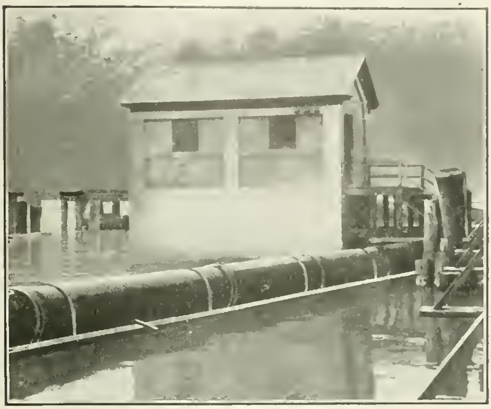
*Engineer, Lackawanna Steel Co., Buffalo, N. Y.

This piling was all fabricated before shipment, the necessary reinforcing rods, special piling, etc., being shipped from Buffalo. In carrying out the construction at Treadwell, the only departure from the original plans was that the concrete was placed on the sheet piling after it was driven into place, instead of premolding it as it was first contemplated. The method of procedure in this construction was to set up vertically around a driving form the entire 46 piles, comprising the caisson, as shown in the accompanying illustrations. When thus set up the piling was driven a short distance, driving on one or two bars at a time, continuing this driving around the perimeter of the caisson until all the piles were driven to their final position.


VIEW OF COMPLETED PUMPHOUSE

DRIVING THE SHEET-PILE FOUNDATION

From the plans it will be seen that while this is a small pumphouse, the details of the piling and structural steel are rather complex. The piling used was of sufficient section to establish the strength of this pumphouse wall vertically between the three sets of structural-steel braces and concrete floors, and to enable them to resist the extreme water pressures at high tide.

The 18 ft. of penetration of sheet piling below the reinforced-concrete floor enabled the pumphouse to retain its vertical position, and prevented any sliding of the structure. Details for the junction of the piling walls and the three suction pipes through them, were successfully carried out by fabricating three wide sheet piles each with a plate ½ in. by 2 ft. 6½ in., 50 ft. in length, as a web, reinforcing this web with an angle and bolting the 12-in. cast-iron nipples to the web of the piling at these three openings. This structure has proved, upon completion, to be substantial, strong and entirely watertight, meeting in every way the conditions required. The designs for the pumps, motors, etc., were prepared by C. C. Moore & Co., San Francisco. The design for the pumphouse structure was passed upon by them, and the construction itself was carried out under the general direction of P. R. Bradley.

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Salt Water Causes Crack in Concrete in Philippines

The cracking of reinforced-concrete structures is markedly prevalent in the Philippine Islands, according to a report by J. L. Harrison, District Engineer, Iloilo (in the "Bulletin" of the Bureau of Public Works, October, 1916), abstracted by *Engineering News*, Nov. 30, 1916. The accumulation of evidence of this trouble became so serious about two years ago that it was decided by the authorities to make some studies into the cause. They proceeded first on the assumption that the rusting was wholly chemical—stimulated by appreciable quantities of some determinable material; and a number of samples of concrete taken from structures in trouble were subjected to chemical analysis.

The samples submitted showed one foreign substance—chlorine—and that indicated the presence of salt. At first not much attention was paid to this, as it was known that it was largely used in the United States to prevent freezing of concrete during setting; but it was soon realized that the climatic conditions in the Philippine Islands are so different from those in the United States that the effect of the salt could not be neglected. The collection of analyzed samples has gone on for something over two years and not a single structure showing rusted steel has been found free from salt. The percentage of this salt has varied considerably—from that high enough to show that beach sand and sea water must have been used in making the concrete, to a figure low enough to indicate that either brackish water was used or that salt water was used to wet down fresh-water concrete after the forms had been taken off. A typical sample (from the Constabulary Headquarters building, Iloilo) showed 0.07% chlorine. This was computed to be equivalent to 1.11% salt in the water, assuming 12.5 lb. of water used per cubic foot of concrete. This is considered fairly salt water.

The presence of 0.10% chlorine in the iron rust indicated too small a percentage of ferric chloride to explain all the indications of rusting to be observed; but it was realized that ferric chloride is not stable and that it readily oxidizes to ferric oxide, releasing the chlorine for further attack. High temperature and moisture are the only conditions necessary for the indefinite continuation of the process, and both of these conditions prevail throughout the Philippine Islands.

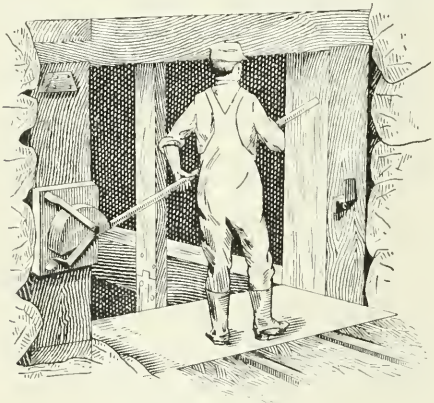
Not every structure in which salt water has been used, or in which salt is found, goes to pieces in this way. There are several such buildings in good condition. However, the concrete in them is unusually dense, and it is thought that their success in withstanding the influence of the salt is due to the density of the concrete.

Engineers in the Philippines have been accordingly advised that all use of salt water in concrete structures is dangerous and that the use of beach sand and beach gravel should be permitted only after thorough washing with fresh water.

Simple Shaft Gate at Junction Mine, Warren, Ariz.

At the Junction shaft of the Calumet & Arizona Mining Co., Warren, Ariz., a shaft gate is used that is simple and cheap and has an inherent tendency to stay shut when it should be shut and to stay open when it should be open.

The gate consists of a piece of 1½- or 2-in. pipe on one end of which is a semi-circular section of cast iron pivoted as shown. When the gate is closed, the weight of the pipe has a greater moment-arm than the counterweight and it naturally stays closed. When the gate is lifted about two-thirds of the way up, the center of gravity changes so that the counterweight tends to keep on rotating and after the pipe passes the vertical the moment of both pipe and counterweight act together to hold the pipe against the stop *A*. A plate *B* is used on the center post to give a bearing, and the iron straps *C* support the bearing pin and provide a guide for the counterweight so that the far end of the gate never misses the clip *D* and falls down. It is a clever gate.



A SIMPLE SHAFT GATE

How To Waterproof Drawings

A few methods for waterproofing drawings were noted by F. W. Salmon, in *Engineering News,* Nov. 30, 1916, all of which are useful and satisfactory.

A. Give the drawing several light coats of white shellac dissolved in a grain alcohol, letting each coat dry before the next is applied. Orange shellac and even wood alcohol may be used; but I much prefer the "white" or bleached shellac, and I object to the wood alcohol because of its injurious effect on the eyes.

B. Give the drawings several light coats of "Zapan" varnish, which, I understand, is made of scrap trimmings of clear sheet celluloid dissolved in acetone and is produced by several Eastern chemical factories and firms manufacturing celluloid articles.

C. When a heavier protective covering is desired than A or B will provide, the drawing may be made wet with the thin celluloid varnish and pressed down evenly on a sheet of thin sheet celluloid, then allowed to dry. This process gives a beautiful clear mounting with 0.01 in. of celluloid on the face.

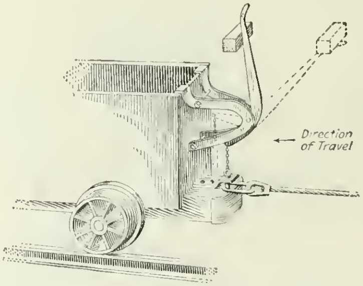
D. Drawings may be made waterproof with paraffin wax, which is applied hot (melted) with a flat bristle brush. The drawing is then put between two sheets of blotting paper, and a hot (electric) sad-iron is passed over the upper blotter, thus causing the paraffin to be distributed more evenly and the surplus to be absorbed by the blotting paper. The blotters must be removed before they cool. If the wax is thick and white over any part of the drawing or print, sponge it off with benzine.

E. Drawings may be paraffined by dissolving the paraffin wax in benzine and then thoroughly painting the drawing with this liquid or passing the drawing through a bath and hanging it up to dry.

Some of the solvents mentioned are very inflammable and even explosive, so all open lights should be kept away from them. Sometimes they affect certain people injuriously; accordingly, such work should be done only in a well-ventilated room, with a fan to keep fresh air moving.

Handy Rope-Detaching Device

At one mine a man was dispensed with and a dangerous job eliminated by having a tool made to uncouple the rope at the foot of an incline, says R. Z. Virgin, in *Coal Age*, Nov. 11, 1916. The device is fastened to the rear end of the trip. It pulls the pin, detaches the rope, and the trip runs onto the siding.



DEVICE AUTOMATICALLY RELEASES ROPE AT FOOT OF PLANE

The overhead knocker is placed at the point where the rope is to be attached to the loaded trips to make the return journey up the incline.

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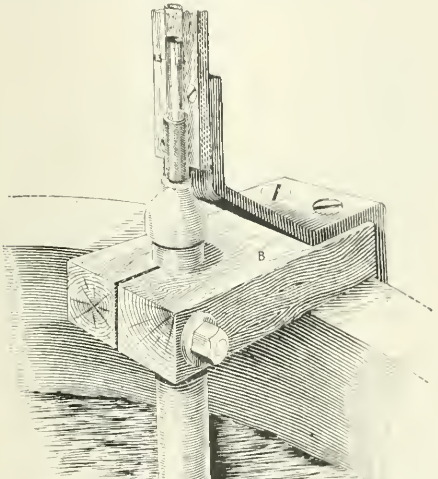
American Lithographic Stone—The only American company producing lithographic limestone in commercial quantities is the Kentucky Lithograph Stone Co. of Brandenburg, Ky. This company's quarries are producing a stone rivaling in quality the Baravian product which was used in America almost exclusively up to the outbreak of the European war. One of the recently developed industries requiring quantities of stone is the manufacture of colored posters for moving picture plays, a business which has attained large proportions.

Details of Milling and Smelting

A Simple Pulp Indicator

By C. W. Dowsett*

An appliance designed to show at all times the specific gravity of pulp under agitation in a Pachuca tank has been tried out with successful results. It is shown in the accompanying illustration. *A* is a 1-in. iron pipe of such length that its lower end can be submerged 10 ft. in the pulp while the upper end is about 6 in. above the surface. The pipe is suspended from the wooden clamp *B*, which rests on the top of the tank. At the lower end of the pipe a 2-in. to 1-in. reducer is attached, and to this, by means of a nipple, a flange is screwed, across the opening of which a piece of cotton filter cloth is stretched. Another flange is then bolted on to hold the cloth. A clamp *C* is fixed in such a position that its horn, as shown in the sketch, is exactly 10 ft. above the surface of the filter.



PULP-DILUTION INDICATOR

The air lift of the tank is shut off for a few seconds, and when the surface movement has subsided, the pipe is adjusted in the clamp *B* until the top of the horn on *C* is just on a level with the pulp surface. The pipe at the top is now reduced to ¼ in. by means of a plug and nipple. With a short piece of rubber tubing the nipple is connected to a length of glass tubing supported vertically on a board, the lower end of which rests on *B*.

The zero point is on the pipe level with the horn on *C*. At a point, say, 2 ft. above *C* there is marked on the board a line designated at 1.2; a point 1 ft. above that will be 1.3, and so on. The distances between these points is marked off in intervals of $\frac{1}{10}$ ft. If required, these latter may be further subdivided.

Now, assuming that the pulp in the Pachuca tank has a specific gravity of 1.15, the clear solution in the glass tube will be forced up to a point 1.5 ft. above the zero mark; or in other words, a 10-ft. column of pulp at 1.15 specific gravity will exactly support a 11.5-ft. column of water or solution at a gravity of 1.

It is essential that all joints in the apparatus be perfectly tight, for should slimes leak in at any part of the pipe near the bottom, the specific gravity of the column in the pipe would rise above 1 and a reading lower than the true figure would be recorded. Should there be a leak at the top of the pipe at the junction, say, of the iron pipe with the glass tube, a low reading would be recorded, for the filter might not be able to pass solution quickly enough to maintain equilibrium.

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*Mill superintendent, Dome Mines, Ltd., South Porcupine, Ont.

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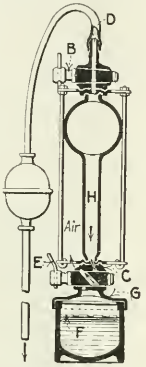
New Electric Process for Brass and Copper Alloys

G. H. Clamer, of the Ajax Metal Co., Philadelphia, has patented a process (U. S. Pat. 1,198,618, Sept. 19, 1916) for making brass and copper alloys. As noted in *Iron Age*, Nov. 30, 1916, melted copper of the correct "pitch" is drawn off into an electric furnace. Zinc and other alloying metals are then added. Economy is claimed for this procedure because large quantities of copper are melted and brought to the proper "pitch" before entering the electric furnace; because alloying is done therein, and because the casting is accomplished at the proper temperature. The ease of regulation of the atmosphere to neutral or reducing and the simplicity with which the temperature can be controlled are claimed as important factors. Little or no zinc is reported as lost by volatilization. Large slabs may be cast, which is [illegible] a saving.

Mining & Metallurgical Machinery

A Mechanical Analyzer for Carbon Dioxide

The need of a compact, accurate and quick analyzer for carbon dioxide has been met by the Bacharach Industrial Instrument Co., Pittsburgh, Penn., which has perfected the appliance here described. By its use 17 to 20 determinations may be made per hour by an inexperienced man within an accuracy of 2%. A solution of KOH in water is used as a reagent, and several hundred determinations can be made with one change. The instrument consists of a measuring tube *H* (in the illustration), a glass jar *F* containing the KOH solution and the metal connecting body *C*. Valves at *B* and *E* regulate the flow of the liquids. A sample of the air to be tested is taken, and the percentage of CO_2 is read directly from the calibrations on *F*, after the valves have been closed and the CO_2 subjected to the action of the KOH solution. This is accomplished by the entrance of water to replace the absorbed CO_2. The apparatus is most serviceable both as to design and construction.



APPARATUS FOR CO_2 DETERMINATION

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Denver Dreadnaught Drill

The Dreadnaught drill is the machine credited with breaking all tunnel-driving records when by its use the Rogers Pass Tunnel, at Glacier, B. C., was driven 678 ft. per month, or nearly 22 ft. per day. It is claimed for the drill that it combines a maximum of drilling power with a minimum of weight, and it is adaptable to any type of excavation from drifting and stoping to raising and sinking. Mounted, its weight is 140 lb., but when equipped with a spring handle and used as a hand drill, the weight is 83 lb. It is fitted with chucks to use either 1⅛-in. or 1¼-in. steel. Hollow steel is used, delivering either water or compressed air to eject the rock cuttings. The drill is valveless and uses compressed air expansively. Rotation, as seen in the illustration, is accomplished entirely in the front head and is positive and powerful. All of the chuck end may be removed without taking down the drill.

Lubrication is automatic, the lubricating chamber requiring refilling only two or three times per shift. By means of the mounting, the drill proper may be quickly removed from the feed shell and slide by the removal of the two nuts that clamp the drill in the yoke immediately behind the front head.

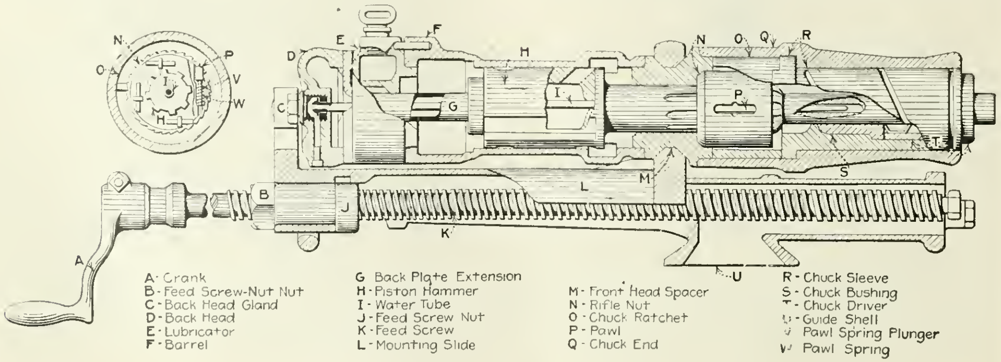
The manufacturers, the Denver Rock Drill Manufacturing Co., of Denver, Colo., have just issued Bulletin D-60 describing this drill in detail.

⁂

Clark Compressed-Air Meter

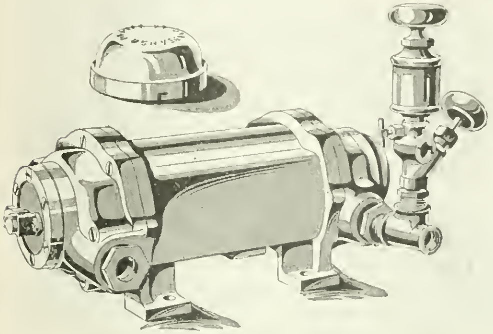
The amount of compressed air consumed by rock drills and coal-cutting machines is usually a rather vaguely known quantity around mines. Every miner believes each type of drill requires just about so many cubic feet of free air per minute, but this belief is likely to be based largely upon claims set forth by the manufacturers of the drills and cutters. It is in the power house that doubts are entertained regarding these figures of air consumption, but here the superintendent is so far away from the consuming units that any excess over the calculated demands is usually accounted for as leakage in the lines.

For a long time unsuccessful attempts have been made to construct a serviceable, portable device whereby the air actually passing through a pneumatic machine could be measured, but recently the Denver Rock Drill Manufacturing Co. placed upon the market a meter that answers all the requirements of such a machine while



SECTIONAL VIEW DREADNAUGHT DRILL, SHOWING PARTS avoiding the defects in previous types. The accompanying illustration shows a complete meter whose compactness is evident. It is made in one size only—capable of accurately measuring any quantity of free air up to 200 cu.ft. per min., this being a quantity sufficient to operate almost any type of machine around a mine. If it is required to measure a greater quantity of air, two or more of these meters may be placed in parallel.

This meter is intended to be placed close to the machine whose air consumption is being tested, and to which it is attached in series by suitable short connections in such a manner that the air passes through the meter before entering the drill. It is a positive displacement meter, that is, no air can get through it without actually occupying the cylinder space. Air enters the meter through the connection at the right end, exhausting at the left end and passing on to the drill. In its passage it forces a piston full stroke in alternate directions so that the quantity of air passing per minute will be the volume of the cylinder multiplied by the strokes. The strokes are automatically recorded by a simple counter on the left-hand end, the cover being shown removed in the illustration. Knowing the number of reciprocations and noting the gage pressure as well as temperature of the air, simple calculations quickly give the cubic feet of free air per minute.


CLARK COMPRESSED-AIR METER

This meter will appeal to operators of properties in which air is furnished to numerous groups of lessees and to company employees where it is desirable to ascertain how the power is being distributed. Another field of usefulness will also be found for it in detecting open lines and leaky pipes.

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Portable Railroad to Atbasar Mine, Siberia

Transportation constitutes such an important factor in most mining operations that any new phase of this subject is of interest. The Atbasar mines of the Spassky copper company in Siberia are about 250 mi. from the Trans-Siberian Ry. A new smelting plant and other equipment were to be transported to Atbasar, and it was finally decided to use for this purpose a "portable railway," somewhat similar in principle to the modern track-laying machine. This portable railway has nearly reached Atbasar and in fact would have been there by now had it not been for delays consequent upon the war. Some remarks made in this connection by Chairman Arthur Fell at the recent annual meeting in London are interesting. He said: "The portable railway is about 10 mi. in length, and the amount of goods, trucks and the engines on it weigh several thousand tons. The railway is relaid in sections in front of the train, and by this means the plant is being transported across the Steppes to Atbasar. According to the latest advices the relay rail transport had reached within 10 mi. of the Atbasar mine, and it should have arrived there by August or September. Owing, however, to the men being called up for military service and the fear of the Khargiz that they would also be requisitioned, all the men who were engaged on this railway disappeared. Some of the labor was got back again with great difficulty and work restarted, but they again disappeared, and I am sorry to report that there is now no prospect of the plant reaching Atbasar this year. I mention this to show you the difficulties of the situation under which we are working the Atbasar mine at 250 mi. from the nearest railway, and the Spassky mine at 500 mi. from the railway."

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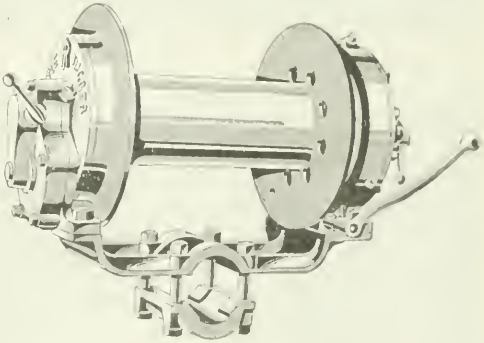
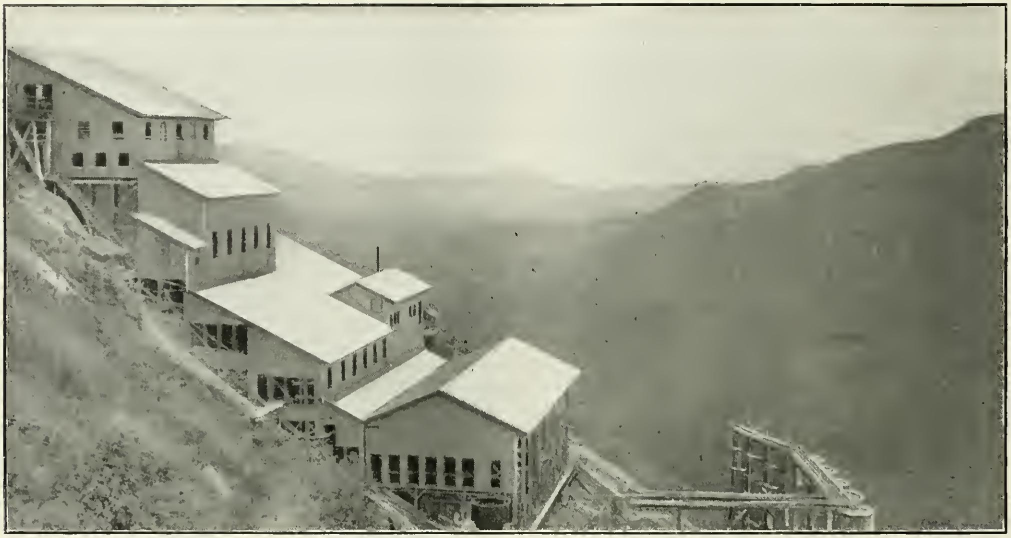
A New Model Hoist

For the use of those who prefer manila rope to wire rope for light hoisting and hauling, the Ingersoll-Rand Co., 11 Broadway, New York, is making a new model Little Tugger hoist. The square piston, reversible driving engine, automatic lubrication, inclosed gearing, drum-release clutch and worm-operated band brake are essentially the same as in the previous model described on page 971, *Engineering and Mining Journal*, Dec. 11, 1915. The main differences are in the diameter and length of the drum, the width of the flanges and, necessarily, the main frame and over-all dimensions.

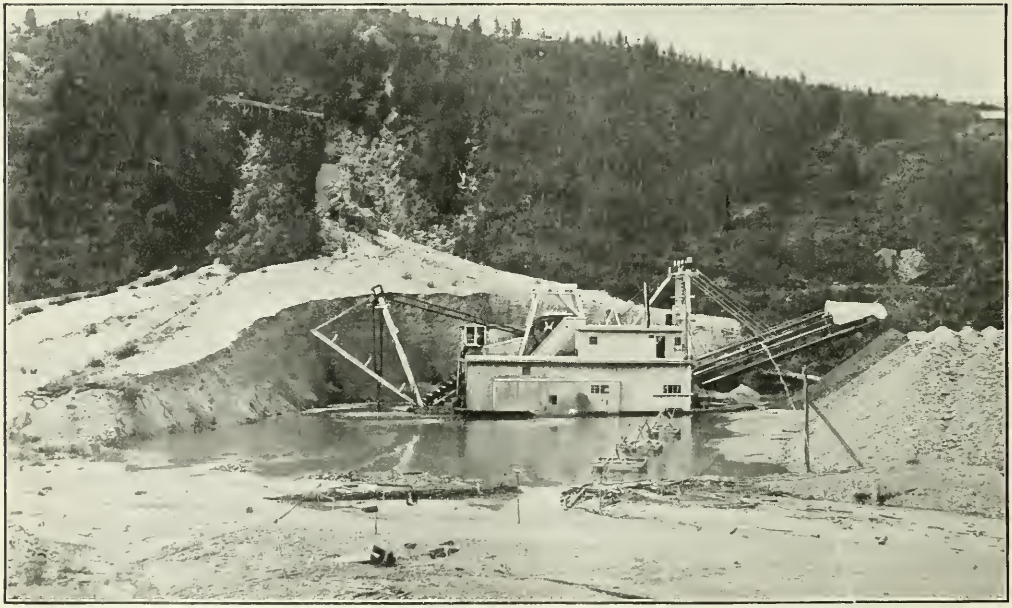

A NEW MODEL "LITTLE TUGGER" HOIST"

This new hoist has a drum 7 in. diameter by 17 in. long, with 5-in. flanges. This accommodates 500 ft. of $\frac{7}{8}$-in. manila rope. The maximum capacity of this hoist is 600 lb. The weight of the hoist itself is 358 lb. It is $21\frac{1}{2}$ in. long, $31\frac{1}{4}$ in. wide and 23 in. high. The hoist is built for both compressed-air and steam operation. The standard clamp fits a $4\frac{1}{2}$-in. diameter column or pipe, but by removing the clamp the hoist can be readily bolted directly to any convenient support—timber, flooring, etc. Although designed primarily for underground work, it is recommended for general hoisting, hauling and handling in mines, tunnels, quarries and industrial plants.

Photographs from the Field



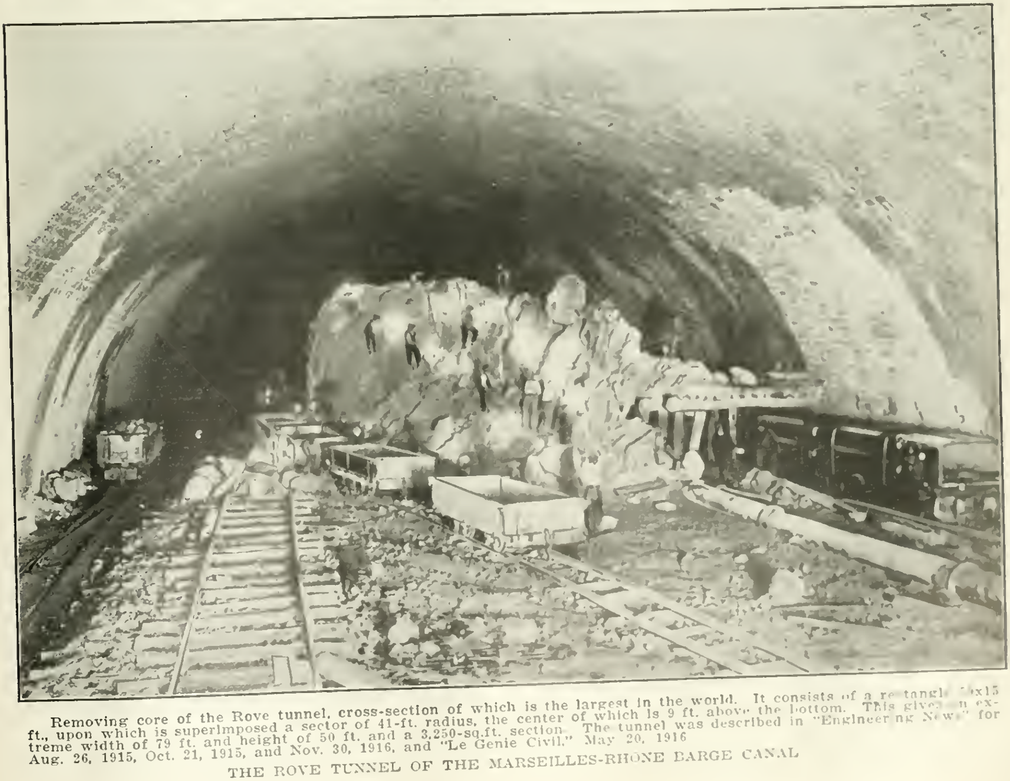
MILL OF NEW YORK & HONDURAS ROSARIO MINING CO., AT SAN JUANCITO, HONDURAS



DREDGING A HIGH BANK OF TAILINGS ON BONANZA CREEK, YUKON TERRITORY, CANADA

The Yukon Gold Co.'s No. 2 dredge, near Dawson, Y. T., digging through a high bank of tailings deposited by early miners on one of the Bonanza Creek claims—38 Below on Bonanza. Part of the sluice used by the earlier miners may be noted farther up on the hillside.

Marseilles harbor looking toward the portal of the Rove tunnel. When completed this will form a protected water route between Marseilles and the Rhone River



Removing core of the Rove tunnel, cross-section of which is the largest in the world. It consists of a rectangle [illegible]x15 ft., upon which is superimposed a sector of 41-ft. radius, the center of which is 9 ft. above the bottom. This gives an extreme width of 79 ft. and height of 50 ft. and a 3,250-sq.ft. section. The tunnel was described in "Engineering News" for Aug. 26, 1915, Oct. 21, 1915, and Nov. 30, 1916, and "Le Genie Civil," May 20, 1916

THE ROVE TUNNEL OF THE MARSEILLES-RHONE BARGE CANAL

Correspondence and Discussion

Limestone Precipitation of Weak Copper Solutions

In the *Journal* of Nov. 11 you publish a letter written by E. Gybbon Spilsbury referring to some remarks that I made at the recent meeting of the American Institute of Mining Engineers about precipitating copper from weak copper solutions by limestone.

It seems to me that Mr. Spilsbury misunderstood my remarks, as I did not refer to precipitation by burnt limestone. As a matter of fact, I consider precipitation of copper from solutions by burnt limestone and the subsequent utilization of the precipitate a very difficult and almost hopeless problem, and Mr. Spilsbury is certainly to be congratulated upon having solved this problem under special conditions.

Precipitation by crude—that is, unburnt—limestone is not a reaction that can be carried out as easily in the laboratory as precipitation by lime, but on a larger scale it presents advantages due to the more granular nature of the resulting precipitate, which, in my opinion, are great enough to justify the practical application of the process.

While we were working here at Inspiration on this problem, Dr. L. D. Ricketts told me that he had accomplished the precipitation of copper solutions by limestone after heating such solutions. W. D. Thornton told me also, I believe, that he had had occasion to use precipitation by limestone.

While, therefore, the principle involved is not new, it is not, to my knowledge, carried out anywhere on a practical scale except, of course, by nature, which has used it for millions of years. RUDOLF GAHL.

Miami, Ariz., Nov. 22, 1916.

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Lead-Smelting Practice

Replying to A. S. Dwight's criticism of my notes on the St. Louis hearth, I want to say that I did not fail to read his article carefully, and that the remarkable low matte- and slag-fall applies equally to the hand hearth and the mechanical hearth. The amount of gray slag upon which the matte- and slag-fall depends remains the same whether worked by hand or mechanically.

The increased direct lead recovery on the mechanical hearth is entirely due to a reduction in the flue dust and fume produced. The mechanical hearth, by nearly trebling the tonnage with the same labor, places it on a most economical basis for treating lead concentrates containing 70% and over in metal.

Mr. Dwight says that it hardly seems just to compare the slag-fall in the two processes. As a matter of experience, figures prove that on any grades 60 to 68% Pb for the Dwight & Lloyd and 70% for the mechanical hearth, the slag-fall per ton of concentrates is 1,500 lb. to 500 lb. for the mechanical hearth, and the matte-fall 500 lb. to 50 lb. respectively. This is accounted for by the fact that one ton of 70% concentrates on the mechanical hearth produces 584 lb. of gray slag, which in turn produces 500 lb. of blast-furnace slag containing 26 lb. MgO = 5% MgO.

The Dwight & Lloyd mixture must be reduced to 45% Pb, thereby increasing the slag-fall and reducing the percentage of MgO lower than is necessary. Blast-furnace slags with 5 to 6% MgO are daily made from gray slags, while the slag from sintered Dwight & Lloyd material analyzes from 3 to 4% MgO. The double roast will partly overcome this big difference in slag- and matte-fall, but still leaves a comfortable balance in favor of the mechanical hearth.

Mr. Dwight dwells on the slag-fall only—saying nothing about the more important item of matte-fall. The low matte-fall is one of the decided advantages of the mechanical hearth, as the re-treatment of mattes in almost endless cycles locks up lead in byproducts and materially increases the cost.

Leaving the Joplin and Oklahoma high-grade concentrates (75 to 80% Pb) out of consideration, the percentage of high-grade concentrates (70% and over) in southeast Missouri is not so small as Mr. Dwight indicates.

Notwithstanding the large production of flotation concentrates, applicable only to Dwight & Lloyd, Huntington & Heberlein and other sintering processes, the tendency to produce 70% and over concentrates is increasing in this district and represents nearly three-quarters in weight of the entire output.

It has occurred to me that the mechanical hearth should have a place in the silver-lead districts of Idaho and British Columbia on all concentrates 70% and over in lead. While it is true that no tonnage of this grade is made at present, there is no reason why the grade should not be increased to a considerable percentage of the output, rendering the mechanical hearth applicable to a certain amount of concentrates from these important lead districts. HERMAN GARLICHS.

St. Louis, Nov. 22, 1916.

I do not like to appear to dodge a fair discussion of the relative merits of the Newnam mechanical Scotch hearth and the Dwight & Lloyd process as applied to the preliminary treatment of Missouri lead concentrates preceding smelting in the blast furnace; but the fact is, I do not wish to follow up the subject exactly along the lines of discussion laid down by Mr. Garlichs, and I must therefore ask him to pardon me if I decline to make a categorical reply to the points brought up in his letter of Nov. 22.

My review of "Lead Smelting Practice in the United States" in the *Journal* of Oct. 7, 1916, was intended to be purely academic and as nearly impartial in spirit as I could make it, all controversial elements being omitted. If I was compelled to refer frequently to the Dwight & Lloyd process, it was because it enters largely into present practice, but I hope I did not put undue emphasis upon it. On the other hand, my reference to the Newnam mechanical hearth and its future was intended to be distinctly complimentary and friendly. It has made a good start in the metallurgical world and will no doubt find its proper place in due time. I, for one, wish it all good luck.

Under these circumstances I do not wish to have the entire spirit of my original article altered by being forced to take part in a controversial discussion or by seeming to criticize and belittle a process that I had previously praised. I cannot agree with all of Mr. Garlichs' figures; in fact, I am quite sure that some of them will require revision, but there are no doubt other metallurgists familiar with the facts who can supply them with better taste than I can at this time.

As a matter of fact, I really cannot see that there is any occasion for a controversy over the merits of the two processes in this connection, for Mr. Garlichs admits that in treating Missouri concentrates there is a point of economic division between them, which point is found at about 70% lead. I have accepted his figure as probably correct and have used it in my paper. Each process, therefore, has its own special province in the preliminary treatment of the concentrates before the final smelting, and I cannot see that there is any use in comparing the slag fall or matte fall in two separate cases where the original material undergoing treatment is different and the final smelting is done by separate metallurgists, each using a different slag type, and where it is admitted that each is being treated in the most economical way.

Any data that Mr. Garlichs wishes to publish about the Newnam hearth will, I am sure, be welcomed by metallurgists, and I, for one, shall be glad to contribute to the discussion, but I confess that I would prefer to find myself discussing *his* paper on this particular subject, rather than having such a discussion tacked on my own paper, in which I distinctly tried to avoid making comparisons. ARTHUR S. DWIGHT.

New York, Dec. 4, 1916.

The discussion of Scotch-hearth practice by Herman Garlichs and Arthur S. Dwight, in the *Journal* of Nov. 25, is interesting to me because it brings out in Mr. Dwight's conclusions the limitations of the hearth to 65 or 70% concentrates of not so fine a mesh as flotation material.

Following this discussion, and the saving of the life of the Scotch-hearth practice by the research along the lines of mechanical stoking carried out by the St Louis Smelting and Refining Co., at Collinsville, Ill., first by the Moses movable hearth and mechanical stirrer or stoker, and later by the Newnam stationary hearth, using the stoker and data developed by Moses, it may be of interest to note the recommendations I made at the time the Moses experiments were in process, when I saw that future conditions of treatment involved large proportions of fine lead concentrates running about 50% Pb. I was then acting as research metallurgist for the National Lead Co., conducting tests at the Collinsville plant.

The imperfect action of Dwight & Lloyd roasters on the sulphur of PbS and the inability to treat very fine lead concentrates containing 50% Pb by the hearth reaction, and the successful results I obtained in forming small hard contact briquettes—1 in. or less in cross-section—of lead flue dust, with any fluxes *ad libitum*, led me to suggest a contact reaction for the hearth action. This would undoubtedly precipitate 70 to 80% of the lead, even in concentrates carrying as low as 50% Pb; combine the sulphur with iron from which the hearth action would easily oxidize and remove it; reduce the necessity of a bagroom in large proportion, as the PbS and PbO sublimation would exist only in small degree as compared to the present action; and lastly yield a so-called "gray slag" suitable for blast-furnace smelting.

The only difference would be that the slag would run high in iron-oxide compounds, thus obviating the necessity of adding the flux at the blast furnace. Lime would not be desirable in the hearth mixture, as it is even more tenacious of sulphur than PbS and thus would defeat the desulphurizing act desired.

If the hearth men will adopt this contact-briquette idea, they will handle the fine low-grade lead concentrates more easily and rapidly than they now handle 70% concentrates and with greater yield of metal and less "fume." I agree with Mr. Dwight that the mechanical hearth saved the life of the practice and feel that the use of a contact-briquette reaction, followed by the desulphurizing in the same hearth act, will preserve the hearth practice when 70% concentrates are no longer obtainable. The hearth will thus become a reducing furnace to approach the blast furnace.

The method proposed involves forming a hard-pressed briquette using 50- to 200-mesh concentrates or slimes or flue dust, mixing in iron oxide or scale adequate to form FeS and about 10% pulverized coke as fuel, with 5 to 6% pitch binder. Use a special type of roller press giving 5,000-lb. pressure per square inch. Bake the briquette at 100° to 500° C. and charge as hearth feed. The cost of briquetting was about $1 per ton, including binder. The resulting efficiency would save that amount, but added to this is the ability to handle any concentrate, irrespective of grade or fineness.

The matte fall of the blast furnace can be easily controlled by varying the iron-oxide proportion in the briquette, which practically would be less than the amount theoretically necessary to desulphurize PbS. The perfection of the contact-briquette reaction and their superior action under heat are well known to zinc men in retort tests. Why the St. Louis Smelting and Refining Co. did not avail themselves of the facts I never knew, but conditions will perhaps soon force the issue.

Essex, Mass., Nov. 29, 1916. PARKER C. CHOATE

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Oil-Fired Boilers vs. Hydro-electric Power

In the *Journal* of Oct. 28, 1916, page 787, is described three types of oil-fired boiler installations in Arizona. The average efficiency of these three installations is 80%, but no cost of producing power is given. The Edison power plant at Long Beach, Calif., has shown for that locality that oil-fired boilers produce power at a lower cost than hydro-electric means. This argues well for oil-fired power plants, but I would like to see some cost data for a plant using hydro-electric and oil-fired power plants interchangeably. A plant permitting the [illegible] operation of these two methods of power generation would require a cheap and constant supply of oil fuel and streams capable of hydro-electric development. California should contain localities of this type.

New York, Dec. 1, 1916. F. W. [illegible]

Jerome Mining District Geology*

SYNOPSIS—The ore-bearing Yavapai schist is deeply buried beneath sedimentary strata and lava except for a great belt exposed by erosion along the extent of the great Main Fault. The orebodies of the district are great pipes of which horizontal sections have their main axes within the plane of schistosity. They are characterized by great bodies of gossan capping the ore whether outcropping on the surface where erosion has exposed the schist, or deeply buried by sedimentaries. Since such outcrops could easily be detected within the belt of exposed schist, it is contended that prospecting within the area capped by sedimentaries and lava, which may hide gossan caps, is fully as apt to result successfully.

No general geological study of the Jerome mining district has ever been published. The United States Geological Survey has so far devoted no attention to this section. Since recent mining developments in the district have been so important and have attracted so much attention in the mining world, the following report is issued in the hope that it will prove timely and useful to many operators beginning new work in the vicinity. It is written with the object of aiding the local miner and prospector rather than of benefiting the trained geologist.

Historical Geology of Jerome District

The oldest underlying rock at Jerome is a schist which forms the body of the mountain range. It extends south and westerly into the Bradshaw Mountains, where the United States Geological Survey has examined it and named it the Yavapai schist. As seen on the geological map, Fig. 1, to the north of Jerome this schist underlies all the limestones, sandstones, shales and others that are so prominent in the landscape, and it is found again in the bottom of the Colorado Cañon. The only extensive area where this schist outcrops on the surface is seen on the map extending from just north of the famous United Verde mine in a southeasterly direction, bounded on the northeast by what has been called the Main Fault.

For illustrative purposes the sequence of geological events is outlined in the sketches of Fig. 3.

The Yavapai schist is the result of intense folding and altering of what were at one time flat-lying lava beds and sediments, illustrated by *A*, Fig. 3. In ancient geological time (Algonkian) these lava beds were folded in very tight and almost vertical folds, whose axes took a general northwest-southeast direction at Jerome (illustrated by *B*, Fig. 3).

This intensely folded schist was invaded from below by large diorite dikes and stocks that forced their way up most easily along the planes and cracks which the folding had produced in the beds, as illustrated at *C*, Fig. 3. As a consequence these diorite intrusions also have a northwest-southeast trend.

This mass of folded beds and diorite dikes was then subjected to great pressure and chemical action, probably through being buried once or more under great masses of younger rocks and subsequently uncovered by their erosion. During this period chemical changes, heavy shearing, etc., altered the beds to schist. Into the slips and minor faults caused by this shattering, smaller acid dikes of quartz, porphyry and trachyte were intruded as shown at *D*, Fig. 3, and following the planes of schistosity, also took a northwest-southeast direction.

It was probably at the time of the intrusion of the diorite that mineralization took place, since the siliceous dikes are younger and frequently cut the orebodies.

The period of time during which events so far related took place was pre-Cambrian and more definitely placed as Algonkian.

During the succeeding Cambrian age the schists, eroded to a nearly level surface, were inundated by sea water. Sandy sediments were deposited over the schist to a thickness varying up to a maximum of 90 ft., which formed the coarse red sandstone which is now found nearly everywhere adjacent to the schist. This Cambrian sandstone is named the Tonto sandstone.

During the following Devonian and Carboniferous ages, great beds of limestone were deposited conformably on top of the sandstone, which in places reach a maximum thickness of 850 ft. The Carboniferous limestone was capped by some 300 ft. of sandstone, likewise of Carboniferous age. The condition of the rock strata at this time is illustrated by *E*, Fig. 3.

At the end of Carboniferous time, the country south of Mingus Mountain (Fig. 1) was lifted by earth movements gradually clear of water and the beds bent and eroded as shown at *F*, Fig. 3.

During the comparatively recent time (Tertiary) eruptions of lava, probably from the direction of Flagstaff, covered the whole country about Jerome, as shown at *G*, Fig. 3. Lava was deposited in successive eruptions and hence varies in variety and composition. The thickness of these lavas today, in places, is a maximum of 700 ft.

The last important geological event was the great faulting, shown at *H*, Fig. 3, which, like the intrusions of diorite and acid dikes, took place in a general northwest-southeasterly direction along the planes of schistosity. Subsequent erosion of the surface shown at *I*, Fig. 3, left it in the shape found by the miner today.

Rock Characteristics and Outcrops

The Yavapai schist, as shown in Fig. 1, forms most of the eastern part of a wide belt extending from Jerome to the Copper Chief mine. One of the best schist exposures can be seen near Jerome, just below the Arkansas and Arizona mine, where it crosses the gulch in which the Haynes mine is situated. The schistosity, or lamination, here strikes about N 10° W with a dip of 70° from the horizontal toward the east. This dip and strike persists near Jerome, but in the Black Hills property and at the Copper Chief mine, the strike is almost east-west, owing probably to original folding and crumpling in that direction, and to local granite intrusions.

The schist is a rock of very fine texture, frequently resembling a shale. Its color varies from light to dark greenish gray with a bluish tinge. It almost always has a schistose, or slaty, structure.

The diorite is found showing all gradations from a coarsely to a finely crystalline structure, depending upon conditions of cooling after intrusion. Where sufficiently coarse, it has a mottled greenish appearance, but where its texture is fine and it has acquired a slaty structure through subjection to shearing, it so closely resembles the schist that it is practically impossible for the miner to tell them apart by eye alone.

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*Abstract from "Geological Reconnaissance of Jerome District," a report by F. A. Provot, mining engineer, United Verde Extension Mining Co., Jerome, Ariz.

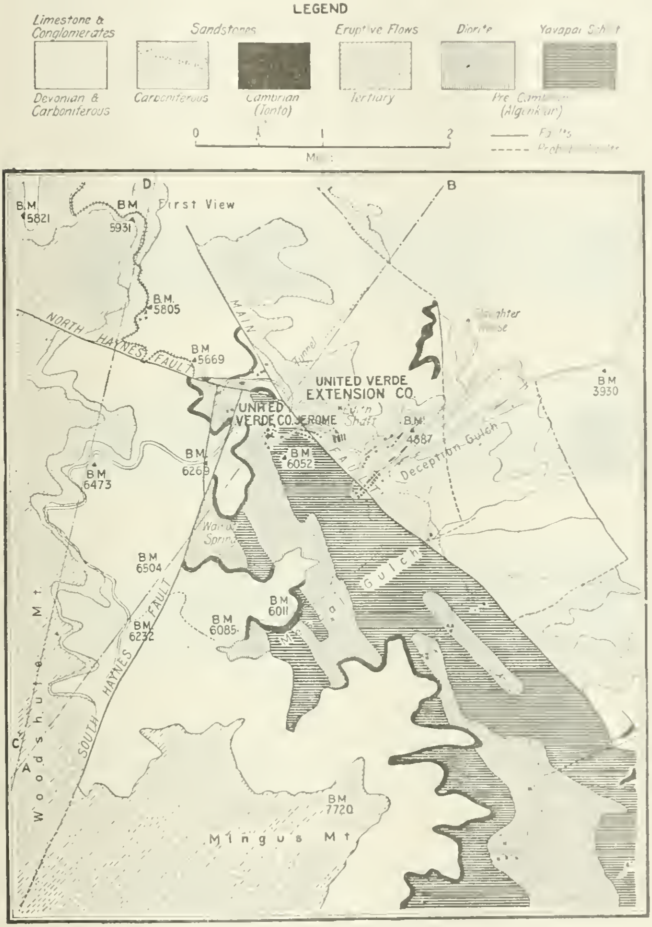
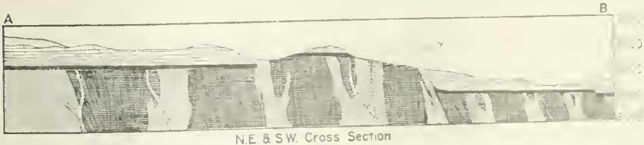
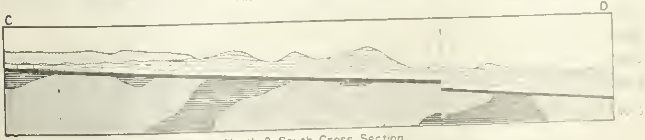


FIG. 1. GEOLOGICAL MAP OF JEROME MINING DISTRICT



N.E. & S.W. Cross Section



North & South Cross Section

FIG. 2. GEOLOGICAL SECTIONS ALONG LINES A-B AND C-D OF FIG. 1

Great dikes of diorite measured in miles run northwest and southeast along the general strike of the planes of schistosity. The diorite outcrops shown on the map, Fig. 1, are merely sketched in to give an idea of their mode of occurrence. Their accurate outlines can be determined over a wide area only by a thorough and expensive geological survey. A great diorite dike can be seen in the west wall of the big opencut on the surface of the United Verde mine, and it probably runs, with numerous parallel dikes, southeasterly through the range. It can be seen again in the upper part of Mescal Gulch and once more in the Brookshire property and Equator mine. Many other dikes are also found in the schist underlying the limestones on the down-throw side (north) of the great Main Fault. The acid dikes, called watercourses by the miners, are best seen in underground workings. They are frequently associated with orebodies, often cutting the latter, and have had great influence in causing secondary enrichments in the chalcopyrite and pyrite chimneys. The acid dikes are usually grayish rocks, speckled with snow-white feldspars much altered and kaolinized, especially in the vicinity of orebodies. They are not of great width, usually measured in feet, and generally have the same general trend as the diorites and schist. The Tonto sandstone, colored dark wine-red, lies almost everywhere on top of the schist and diorite, almost flat except where faulted. Beginning directly above the old smeltery of the United Verde Copper Co., it can be traced, as shown on the map, Fig. 1, with only one or two breaks, down the east side of the range past the Copper Chief mine. It is absent in the upper part of Mescal Gulch and for a distance south of the Pittsburg & Jerome mine. To the east of Jerome only two exposures are known to the writer: one by the lower ore bins of the United Verde Extension Co., at an altitude of about 4,350 ft., and another just below the Copper Chief mine, at about the same altitude. This great difference in elevation between its position on the west side and that on the east side of Jerome (about 1,600 ft.) gives with considerable accuracy the throw of the great fault to which the name of the Main Fault has been given. By careful study of the position of this structure, the miner can usually foretell the thickness of overlying lava and limestone through which he will have to sink a shaft before reaching the underlying ore-bearing schist. The other overlying strata of limestone, sandstone conglomerates and lava have no particular interest to the miner. No secondary deposits of ore of any importance have as yet been found in them, and there is little likelihood of any being so found as the strata were laid down long after the ore was in place.

A study of the three large known orebodies of the district—namely the United Verde, the United Verde Extension and the Copper Chief—shows that the crest of the orebody, whether exposed on the surface as at the United Verde or covered by limestones, as at the United Verde Extension, was constituted by a large quartz and gossan outcrop. In each case the original mineral, through oxidation, has left on the schist surface very large and unmistakeable indications of the great orebodies found below. At the United Verde Extension mine these siliceous croppings happened to be covered by Cambrian sandstone and limestones, below which they oxidized. Were these strata removed, however, similar croppings to those at the Copper Chief and United Verde mines would be exposed.

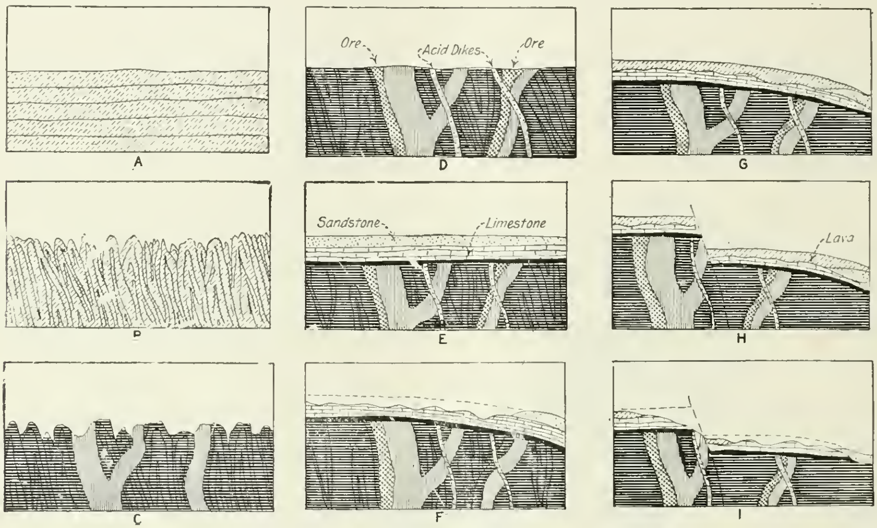


FIG. 3. SEQUENCE OF GEOLOGICAL EVENTS SHOWN GRAPHICALLY

All the large orebodies occur typically as enormous pipes or chimneys of lenticular cross-section measured in hundreds of feet. Their form can best be vizualized by comparing them to flattened cigarettes standing almost vertically. A cross-section of an orebody always has its longer axis paralleling the planes of schistosity of schist or diorite in which it is found, and the dip of the ore also follows this schistosity. Cracks in the nature of veins often extend from the ore pipes in a northwest and southeast direction.

The primary ores were chalcopyrite, bornite, and pyrite in a siliceous gangue, with such a preponderance of the first two minerals as to make these orebodies probably the highest-grade large copper-sulphide mines of the world.

Oxidation in the upper levels has extended to a depth of from 150 to 400 ft. and here has produced a zone of enormously enriched ore, the enrichment being caused by secondary chalcocite or copper glance. This zone of great enrichment reaches in places a thickness of 200 ft. Below it the original primary ores are found still of very high tenor, and these primary ores show even to great depth numerous zones of relative barrenness and enrichment.

Below the surface capping, or gossan, previously described, the oxidized zone consists of siliceous sands containing certain values in gold and silver that in some of the mines are of considerable economic importance. Certain associated minerals have occasionally formed concentrations in the oxidized zones so that occasionally bunches of secondary lead ores, manganese and other rarer metals are found. These are of little importance.

The ore seems to be a replacement of both diorite and schist, perhaps brought about by the solutions that accompanied the intrusion of diorite, and at or near its contact with the schist. Nothing positive is known on this point. Perhaps a study by the Government may throw some light on the origin and manner of ore deposition. Without further data speculation on the subject is idle.

District Faulting and Principal Faults

Two periods of faulting are recognized in the district, which are separated by ages of geologic time.

The first faulting, occuring during pre-Cambrian time, faulted the schists, diorites and inclosed orebodies, but not the overlying sedimentary strata and lavas. These old faults were of relatively small displacement, rarely having a throw of over 100 ft. Their course is usually east and west or north and south, and they no doubt provided pathways for some of the acid dikes.

The important faulting took place during comparatively modern time—post-Tertiary—and caused tremendous displacement, the throw at one place having been accurately determined as 1,600 ft. These faults occurred after all the strata were laid down and cut them all.

The principal fault has been called the Main Fault, and is locally known as the "lower contact." As shown by the map, Fig. 1, this extends beyond First View to the north and beyond the Copper Chief mine to the south. While its strike varies slightly, it approximates N 40° W for its whole course. Its throw at Jerome is 1,600 ft., and all the country to the east has dropped for that distance. The dip of the fault seems to vary considerably. At Jerome it is probably 65° below the horizonal, and it seems to get steeper with depth.

On the surface this fault is easily traced by following the line of contact between the lavas and limestones with the schist belt. Underground the fault shows as a badly shattered zone from 80 to 200 ft. wide.

Two other large faults have been named by the writer, the South Haynes Fault and the North Haynes Fault. The former fault is seen on the map, Fig. 1, extending from the summit between Mingus and Woodshute Mountains to an intersection with the North Haynes Fault. All the country to the west of the fault has dropped about 350 ft. in two steps.

The North Haynes Fault runs almost east and west through Haynes Gulch, starting at the Main Fault, south of the United Verde "glory hole," then passing just below the railway station and continuing up the first gulch just north of the Haynes shaft. The country north of this fault has dropped from 300 to 400 ft. below the country to the south.

Summary for Practical Mining

The orebearing complex underlies the sedimentaries, and therefore the ground under the limestones and lavas is good prospecting country—perhaps better than where the schist has no capping, for the limestone may hide gossan croppings that would otherwise show on the surface. Seeking for the cropping of an orebody under hundreds of feet of limestone is, of course, rather blind prospecting, but the history of the United Verde Extension find under such circumstances will no doubt stimulate prospecting.

For the operator and underground man the important fact to bear in mind about the schist is that the strike of shistosity planes at Jerome is about N 10° to 20° W. and the dip about 70° to the east from the horizontal. All prospecting should therefore be done as much as possible by running long drifts along the strike of the schists, and numerous crosscuts run from them at right angles. Acid dikes encountered underground should be followed, as they have been found in practice to lead to orebodies.

Chronology of Mining for November, 1916

Nov. 1—All Australian coal mines at Newcastle and Maitland idle on account of strike, about 12,000 employees being affected.

Nov. 2—Anaconda bought Lexington mine at Butte, Mont., and other claims of Atlantic Mines Co. in northern section of district.—End of labor strike, begun Sept. 19, at Mother Lode mines in Amador County, California, the miners returning to work on the old basis.

Nov. 6—Nevada-Douglas Copper Co. started its main leaching plant at Ludwig, Nev.

Nov. 13—Carranza extended forfeiture date for idle Mexican mines 60 days to Jan. 11, 1917.

Nov. 15—Exploration Co., Ltd., reduced capital from £750,000 to £375,000 on account of depreciation of its Mexican investments.—Arizona Copper Co. resumed operation after 11 days' idleness due to strike resulting from discharge of Mexican employee for sleeping while on duty.

Nov. 17—Suit filed in New York Supreme Court by 15 fire-insurance companies to prevent collection of damages by Tennessee Copper Co. for destruction of its Fox Hill trinitrotoluol plant.

Nov. 23—Tentative agreement for consolidation of the McIntyre, McIntyre Extension and Jupiter properties in Porcupine district Ontario, adopted by directorates at joint meeting in Toronto.

Nov. 26—Yuba No. 16 all-steel dredge launched near Hammonton, Calif.

Nov. 28—Transfer of management of Tennessee Copper Co. to Tennessee Copper and Chemical Corporation, with Adolph Lewisohn and associates in control.—Judge Bourquin, of Federal District Court at Butte, Mont., denied petition of Minerals Separation, Ltd., for injunction to restrain Butte & Superior Mining Co. from paying dividends and Butte & Superior was released from its $75,000 bond previously ordered for possible patent infringement.

Foreign Trade in Copper

Exports of copper from the United States in October are reported by the Department of Commerce as follows, in pounds:

Ore concentrates, contents	1,174,695
Unrefined, in bars, etc	4,653,542
Refined copper in ingots bars, etc	55,303,187
Old and scrap	329,200
Plates and sheets	971 953
Wire	2 280,505
Total copper	64,713,082

The weight of ore exported in October was 16,800 tons; of concentrates, 725 tons.

Imports of copper into the United States in October are reported by the Department of Commerce, as follows, in pounds:

Ore concentrates, contents	12,373,571
Matte contents	713,919
Unrefined, in bars, pigs, etc	14,731,276
Refined in bars, plates, etc	5 782,771
Old, etc., for remanufacture	939,792
Composition metal, copper chief value	36,596
Total copper	34,577 965

Actual tonnage of copper-bearing material imported in October was 15,172 tons ore, 13,279 tons concentrates, and 789 tons matte.

May Withdraw Oil-Shale Lands

Secretary Lane recently recommended to the President the withdrawal for navy reserves of about 15,000 acres of public land in Colorado and 86,000 acres in Utah, each of which, it is estimated, will yield not less than 500,000,000 bbl. of fuel oil. The lands include a part of the Green River formation, containing shales that yield petroleum when subjected to destructive distillation. Shales of this character in Scotland have long been producing oil and paying dividends on a large investment. The shales in the areas withdrawn will yield from two to four times as much oil as is obtained from the average run of Scotch oil shale. In addition to the heavy residuum, the shale oil will yield 10 to 15% of gasoline by ordinary methods of refining, and as a by-product the shale will produce ammonium sulphate, a valuable fertilizer, in large quantities. The land lies at a [illegible] distance of railroad [illegible] and [illegible], it is believed, be exceedingly valuable as [illegible] naval reserve fuel for the Navy. [illegible] the areas withdrawn there are other lands [illegible] of [illegible] oil shale.

Editorials

Enter the Federal Bank

The recent actions of the Federal Reserve Bank are considered by some thoughtful persons to be momentous, to mark a new development in American finance, and there is good reason to concur with that opinion. Heretofore American finance has been of the happy-go-lucky order. Bankers have acted individually and done as they would. Excesses have been committed, the natural consequences have ensued, business has paid the penalty and when banking has been manifestly sick—and not until then—the doctors, alias the more conservative financiers, have been called in to effect a cure. The policy of the Federal Reserve Board—and in exercising this it is possibly exceeding what was contemplated by its creators—is obviously to prevent illness. That there should now be such a power acting for the collective interest of all the people, without fear or favor of any group, is the new and wonderful thing in our financial history.

The recent warnings of the Federal Reserve Board have been but imperfectly understood, but the ensuing events, which happened with dramatic promptness, did much to clarify them.

The great accumulation of gold in the United States, the inflation arising from it, has been recently more and more the subject of discussion. Alarm over the prospect has been freely expressed. The public was therefore rather startled to hear a few weeks ago that the Federal Reserve Board did not see necessarily in this any ground for alarm. The public generally overlooked the proviso accompanying this assurance, which was to the effect that there was no ground for alarm if the situation were properly handled, and by proper handling was signified the impounding of the gold. The coolness of the Board reflected its plain intimation that it intended to see to it that a good deal of the gold should be impounded, by obtaining legislation, if necessary, requiring the banks to pay in next spring what is not due by present law until next fall.

The next step of the Board was the issuance of a note of warning against the floating of British treasury bills among our bankers. Again this was misunderstood. It did not mean to cast any aspersion upon British credit, nor did it mean that American investors should not subscribe to foreign loans. It meant simply that American banks should not tie up their funds in bills of apparently short-time which might, however, prove easily to be long-time. Rather should surplus funds be kept surely liquid for the commercial uses of this country. The proposed issue of British treasury bills was promptly withdrawn, in spite of the prognostications of some powerful bankers that it would mean a curtailment of foreign buying of our commodities, and the selling of American securities, etc.

The next dramatic events were a poor bank statement last Saturday and a rise in the rate for call money to 15% last Monday. For many months the call money rate had been about 2% and the common theory was that money had been plentiful, was plentiful and would continue to be plentiful. The first part of this theory was correct, the second was incorrect, the third is still veiled in the mystery of the future. In fact the situation has been tightening. We look back upon recent bank statements and see it. But we did not see it when they were current. The Federal Reserve Board is making it its business to see such things and remind us of them. Hence its warning about the British treasury bills.

But why this talk of dearer money? We were all under the impression that the United States had been making more than it knew what to do with. What has become of it? Well, we have tied up large parts of our liquid resources in foreign loans and in the erection of new plants at home. A vast sum of money is absorbed in Wall St. speculation. Present conditions require far more money for carrying on commercial business than ordinarily. We must not delude ourselves with the idea that great profits and high prices spell security. In 1873 prices were very high but there was a panic. In the early part of 1907 prices were high and profits were large. The first signals of danger in 1907 were little spasms of tight money, disappearing and recurring, each time a little worse. Commonly these are dismissed as trifling "flurries," just as the man who is getting sick ignores premonitory headaches. Last July there was some tightening of money. It recurs about five months later. This does not mean that we are going to be sick, but the Federal Reserve Board warns us that we may be if we do not take care of ourselves.

This Is Not a Wild Cat

The *Engineering and Mining Journal* does not advertise mining stocks or promotions, but we have broken our rule, and are not only advertising a mining promotion, but are doing it in our editorial pages. Moreover, the "interests"—these particular "interests"—have got us. We are ready to do anything they want us to do. We are not ashamed of it. "Belgian Kiddies, Ltd." is organized under the laws of humanity. The promoters do not say anything about the stock quadrupling in value during the next month or two, and they state specifically that it will never pay any dividends. As to the latter, we are not so sure as they are. We think it will pay big dividends in friendliness and in the satisfaction that every subscriber will feel from having done a good deed.

"Belgian Kiddies, Ltd.," is being promoted by American mining engineers as a testimonial to Hoover and his great work in relieving the Belgians. There has been a lot of talk about doing something to show Hoover what we think of him, and how we appreciate the honor that he has done to the mining engineering profession. But Hoover does not need medals, loving cups, or diplomas. He has got more of them than he can remember. We had been a good deal at a loss to know what to do for Hoover until he, himself, unconsciously indicated it.

Hoover wrote over a few days ago that the Belgium Commission needed a lot more money in order to feed the Belgian children especially. His medical experts had reported that there was an alarming increase among them of tubercular tendency, etc., owing to insufficient nutrition. If the Belgian race is to be perpetuated it is necessary that the children shall have at least one square meal per day and for a long time. This news inspired the idea of giving Hoover a Christmas present, which we knew he would accept, for he would accept it only as a trustee, and would turn it over to the cause nearest his heart. What the mining engineers are going to do is, we hope, only a beginning.

The Belgian Commission has so far expended about $227,000,000 in support of the Belgian people with an administrative cost that is ridiculously low. There never was any charity in the history of the world run on such business principles. That was due to Hoover.

For supporting the Belgian people, the American people are regarded by the Belgians as their great benefactors. That also is owing to Hoover, who in the eyes of the Belgians constitutes the American people. In fact, the United States has contributed only about 4% of the money that has gone to the Belgians. Consequently, we have been sailing under false pretences, have been four-flushing, etc. We owe it now to Hoover to make good. In making good it is appropriate that the mining engineers should lead the way, for Hoover has done more than anybody else to advertise them by showing what a leading mining engineer really is.

We urge our readers to send in their contributions. This is not a case of partisanship, or of any exhibition of feelings pro-ally, or pro-German. It is simply a case of relieving suffering humanity, and especially the helpless part of it. Just incidentally, we shall please Hoover.

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A Christmas Appreciation

This has been a prosperous year for the mining industry, perhaps the most profitable it has ever experienced. The high price of the metals has been a stimulus to record production and a comfort to shareholders. But to the operating staff 1916 has been a strenuous year: feverish production has been demanded; labor has been more scarce and independent than ever before, and delivery of machinery and supplies equally difficult.

The members of the operating staff have given unstintingly of their energies and have strained every resource in keeping the output up to the maximum. They have had their eyes constantly focused on production and have not given much thought to next year or to the period when all the refinements of practice will be required in order to bring costs within the limits that will be set when metal prices again become normal. The staff members—from shiftboss to superintendent—have been working at high pressure during this extraordinary period, and under the most trying operating conditions have produced record outputs in nearly every instance. Has it been appreciated?

We believe that every manager is deeply grateful to his staff for the loyal service that has been given both in and out of regular hours. But do the members of his staff know this? To be sure, there have been bonuses but these have been well earned and lack the personal element necessary in the expression of individual appreciation of the directing head for this loyal coöperation. How, then, is the manager to show his appreciation?

May we suggest that a subscription to the *Engineering and Mining Journal* would be the ideal Christmas gift for this purpose. It will not be broken, loaned, or [illegible] during the first succeeding week, as are most other gifts, but will be to each recipient a weekly reminder throughout the year of the thoughtfulness and appreciation of the directing head of his company, and as such will receive careful reading. Instead of having to take chances on a hasty perusal of the office or club copy, the recipient will have the *Journal* at his home or room, where he can look it through at leisure and benefit by the opportunity to read with care the many valuable contributions to technical literature that appear in it during the year. This will be of advantage not only to himself, but likewise to his company, because many suggestions are constantly appearing as to different ways of doing things that might be applicable to local operations and help to solve that ultimate problem of reducing costs which is awaiting all company heads following this period of war prices. We can call to mind nothing that would stimulate more thinking on the part of the operating staff or would be more appreciated than a personal copy of the *Journal* that the recipient can clip or file as best suits his purpose.

Any manager or superintendent who may desire to express his appreciation of the work of any members of his staff in this way can do so by simply mailing our subscription department a check and the list of names to which he desires the *Journal* to be sent.

The remaining issues of December will be mailed to each, together with a special Christmas card (or letter) announcing that the *Journal* is to be sent to him during 1917 with the complements of the manager or superintendent of his company.

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The United States maintains a Bureau of Foreign and Domestic Commerce and is going to the expense of sending representatives to far-off lands of South America, Australia, China and Russia to find opportunities for foreign trade and investment, but already-established investments in Mexico may go to pot because Mr. Bryan blandly declared these foreign investors to have been mere adventurers and their capital and property entitled to no protection. What is to be done with this new foreign trade when we get it? Is it also to be cast overboard? It is safe to say that we would not now need to bother about America's foreign investments had it been foreseen that the time would ever arrive when American property would not be protected by its Government to the full extent to which it was entitled.

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Some real measures are being taken to increase the spelter production of Great Britain, and three important additions to plant there are now going up. A small [illegible] is nearing completion in Italy. The new plant at Ekibastus, Siberia, is reported to have gone into operation. Steps are being taken to increase the production at Port Pirie, in Australia. In the meanwhile the Japanese are making great strides in spelter production. Their output in 1916 is expected to be about [illegible] tons, against about 17,000 in 1915. In 1915 Japan for the first time became an exporter of spelter, shipping [illegible] tons. The record of all these countries in spelter production is, however, rather petty in comparison with that of the United States, which has doubled its output—already large—in less than two years.

$120,000

Preferred Stock, Health Giving and Life Saving

Belgian Kiddies, Ltd.

(A Corporation to be organized under the laws of Humanity)

10,000 shares of a demand value of $12 each

Registrar—None* Trustees—Hoover, Honnold & Co.

*"Let not thy left hand"

We offer, subject to no over-subscription or prior allotment, $120,000 preferred stock, and as much more as we can get rid of, in Belgian Kiddies, Ltd., concerning which we are in receipt of full reports from H. C. Hoover, W. L. Honnold, Edgar Rickard, and other well known mining engineers, which we summarize as follows:

I. The object of this stock issue is to provide one meal per day for ten thousand Belgian children for the year 1917. Each share sold means 365 square meals for one child.

II. Our business is constantly growing and no estimate can be made of the requirements for 1918.

III. Security of the principal is absolutely assured by the personal management of H.C. Hoover and associates.

IV. That no cash dividends will ever be paid is absolutely guaranteed.

V. The stock is probably only part paid and is fully assessable.

VI. The stock is preferred as to holders, the subscribers being preferably taken from the members of the mining and metallurgical professions, and their wives and sisters.

VII. The demand value of the shares shall be $12, preferably payable in advance, but installments will be welcome if more convenient to the subscriber.

The legality of this issue has been passed upon by no one, but the committee can convince any one of its necessity.

Applications for stock, should be mailed at once as we desire to sell the allotment before Christmas.

Address Subscriptions to

BELGIAN KIDDIES, Ltd., *Room* 2124, **120 Broadway, New York City**

Belgian Kiddies, Ltd.

The promoters of this movement have issued the subjoined explanatory letter. Checks (or money orders) should be made payable to Herbert C. Hoover, Chairman, Room 2124, No. 120 Broadway, New York.

Dear Sir:

An informal committee of mining engineers from all over the United States, are undertaking to give our friend Herbert C. Hoover a Christmas present, by taking off his shoulders part of the burden which he and his associates have been carying for the last two years and a half.

During this time, the United States has received a great deal of gratitude from the Belgian people which it has not deserved. To the Commission for Relief in Belgium all praise is due for their work. The C. R. B.—as it is known—has distributed in Belgium goods costing about $227,000,000, of which the United States has contributed $10,000,000, or about 4.3% of the total; and much of this has come from a few large foundations. The commission has purchased in the United States goods to the amount of $125,000,000. We have not even paid a fair commission thereon. Reduced to a per-capita basis, we have given 8 cents apiece. Canada has given 18 cents per capita, New Zealand $2.34 and little Tasmania $6.25 a head. Yet the United States gets most of the credit. We have been obtaining gratitude under false pretenses.

This is naturally discouraging to us who know and appreciate the work of American engineers in Belgium. These men have been keeping alive a population of nine million on one meal a day. This is not enough for children. (Would you like it for yours?) At present one million children are failing in health, and the C. R .B. has asked us Americans to assume the proper feeding of these children as our little share of the big job.

To do this right, the C. R. B. has started to give the children a nourishing noon-day meal, and they have not the money to carry it on. This costs only one dollar per month per child (three cents a day). This seems incredible but as the overhead expenses of the C. R. B. are only $\frac{3}{4}$ of 1% of the gross cost you will understand that this is real engineering efficiency.

As engineers we want to show our appreciation and so we have organized an informal syndicate to float a new venture. We would like to cable Hoover before Christmas that we will take a block of "Belgian Kiddies" off his hands. Don't you want to come in with us on this?

Sincerely yours,

BASSETT, W. H.
BRADSHAW, FREDERICK
BROWNE, ROSS E.
BROWNE, DAVID H.
BRUNTON, D. W.

CARNAHAN, R. B.
CATLIN, R. M.
CHANNING, J. PARKE
CLARK, A. C.
CLYMER, F. H.

DOUGLAS, WALTER
DORR, J. V. N.
DRINKER, H. S.
DU PONT, T. C.

EASTON, S. A.

GOODALE, C. W.
GREENWAY, J. C.

HIXON, H. G.
HOLDEN, R. J.
HOLLIS, C. B.
HUNT, R. W.
HULST, G. P.

INGALLS, W. R.
JENNINGS, HENNEN
JACKLING, D. C.

KELLY, WILLIAM
KIRBY, E. B.

LAKENAN, C. B.
LYON, D. A.

MAC CARTHY, J. F
MAC DOWELL, C. H.
MAC FARLANE, D.
MAC NAUGHTON, JAMES
MATHEWSON, E. P.
MEMMINGER, C. G.
MERRILL, C. W.
MILLS, C. E.
MOORE, P.. N
MUDD, S. W.

NORRIS, R. V.

PARMELEE, H. C.

RAND, C. F.
RALSTON, J. C.
RICHARDS, F. B.
RICHARDS, R. H.
RICKARD, T. A.
RICKETTS, L. D.
RIORDAN, D. M.
ROBERTS, MILNOR
ROBINS, T.

SAUNDERS, W. L.
SMITH, E. A. C.
SMITH, F. M.
STEARNS, T. B.
SULLY, J. M.

VAN HISE, C. R.

WEBSTER, WM. R
WHITE, I. C.
WHITLEY, C. W.
WINCHELL, H. V.

YEATMAN, POPE

BY THE WAY

The *Evening Post* is authority for the story, which is sufficiently plausible, that one large copper company, whose mine is on a mountain, cannot bring its coal up for its plants. The only thing to do is to have the power transmitted by electricity. As the engineering problem has been worked out, the power is to be brought up the mountain through heavy copper conductors raised high from the ground on steel supports. But the copper company not only finds it next to impossible to get the steel for the supports, but is having difficulty in getting the copper wire. It applied to a large copper-wire house to see if it could buy the wire, and the wire house replied that it could not—unless the copper company furnished it the copper. The copper company is now doing this, and it has been compelled to take its copper from its own deliveries in order to do it.

⁂

The Morenci Miner's Union has a new idea in settling strikes. It seems to blend the elements of Christian Science and mediation into a happy harmony, the principles of which when applied to labor disputes bring peace and provide jubilation alike to both the victor and the vanquished. The basic tenet of the new scheme is to the effect that if one tells himself and everybody else with sufficient emphasis that one's opponent has conceded the point, then the point is conceded. On the morning of Nov. 15 the employees of the Arizona Copper Co., who had been on strike because, among other things, the company refused to pay a Mexican for the time he had been laid off, returned to the mine and informed the bosses that, as they had been granted everything they had asked for and Juan had the *dinero* in his pocket, they were ready to go to work, so to work they went. A few days later, Joseph Myers, of the Department of Labor, who sat in the last deal of mediation, sent a letter to the *Clifton Mining Journal* stating that neither the company nor he nor anybody else had paid any Mexican anything for any lost time whatsoever. So the matter stands, and the Arizona Copper Co.'s output is normal. Whether the union or other interested parties secretly paid Juan is not interesting.

⁂

A Yaqui Indian of about 6 ft. 4 in. vertical dimensions came up from Sonora and got a job in a Morenci mine. So patent was his innocence of everything pertaining to mining, the foreman felt that to let him go underground alone would be nothing short of a crime against humanity. So he personally conducted the savage to the stope. He showed the Indian the chute and a pile of ore and explained to him that, as his education in mineralogy apparently had been neglected, the sorting of ore would not come within the scope of his present activities, which same would be merely to transfer the "metal" to the chute. Thus saying, he handed the Yaqui a shovel and pointed to a wheelbarrow. This caused an investigation. The new employee examined thoroughly in turn the chute, ore pile, wheelbarrow and shovel. After a few minutes' work of this inquisitive character, he arrived at the conclusion that there was some relation between the wheelbarrow and shovel and the carrying of the ore to the chute. Accepting this as a working basis, he made a few passes at the ore with the shovel, finally landing a lump in the barrow. After which he finished filling the *carucho* with tolerable efficiency. But then came the rub. How to get the ore out of the wheelbarrow and into the chute was too much for the primitive mind. He made a second round of investigation, but to no effect. He was about to give it up when there came from the direction of the foreman a roar, which, although it has no printable equivalent in the English language, if liberally translated, meant, in addition to a great many things of a personal nature, that it was entirely appropriate for ore to be passing into the chute at that particular hour. "Si, *Senor, muy bien*." Slamming his sombrero to the floor, the Yaqui went down and embraced the wheelbarrow, lifted it and contents to his full stature, walked across the stope and deposited it bottom side up crosswise of the chute. "*Alli esta!*" Needless to say, therefore the Indian won the prize, a few months later, at a single-jack drilling contest.

⁂

November Mining Dividends

Dividends disbursed in November, 1916, by 28 United States mining companies making public reports amounted to $12,111,586, as compared with $6,032,264 paid by 27 companies in November, 1915. Iron, metallurgical and holding companies allied to mining paid $7,887,789, as compared with $7,393,113 a year ago. Canadian and Mexican companies paid $1,911,798, as compared with $1,057,607 in November, 1915.

United States Mining Companies	Situation	Per Share	Total
Am. Zinc, Lead & Sm., pfd., l.z	U. S.	$1.50	$144,840
Anaconda, c.	Mont.	2.00	4,662,500
Arizona Copper, preference	Ariz.		53,840
Boss Gold Min., g.s	Nev.	.02	8,240
Bunker Hill & Sullivan, l.s	Ida.	.50	163,500
Bunker Hill Con., g	Calif.	.02	5,000
Caledonia, l.s.c	Ida.	.03	78,150
Champion, c	Mich.	6.40	640,000
Chief Cons., s.g.l	Utah	.05	44,148
Cresson Cons., g	Colo.	.10	122,000
Derry Ranch Gold Dredge	Colo.	10.00	10,000
Ducktown, Sulphur, Cop., c	Tenn.	.33	65,934
Golden Cycle, g.	Colo.	.02	30,000
Hecla, l.s	Ida.	.15	150,000
Homestake, g	S. D.	.65	163,254
Intermountain, c	Mont.	.005	8,250
Mass Con., c	Mich.	1.00	100,000
Miami, c	Ariz.	1.50	1,120,671
Nevada Wonder, g.s	Nev.	.10	140,839
New Jersey Zinc	U. S.	9.00	3,150,000
Pacific G. M. & M., g	Utah	.01	4,000
Pacific Mines Corpn.	Calif.	.01	6,420
Shannon, c	Ariz.	.50	150,000
United Verde, c	Ariz.	1.50	450,000
United Verde Ex., c	Ariz.	.50	525,000
Wilbert, l.s	Utah	.01	10,000
Yellow Aster	Calif.	.05	5,000
Yellow Pine	Nev.	.10	100,000

Iron, Metallurgical and Holding Companies	Situation	Per Share	Total
Cambria Steel	U. S.	$0.62½	$562,500
Crucible Steel, pfd	U. S.	2.00	500,000
Gulf States Steel, 2d pfd	U. S.	1.50	46,681
Internat. Nickel, pfd	U. S.	1.50	133,689
St. Mary's Min. Land	Mich.	2.00	320,000
U. S. Steel Corpn., pfd	U. S.	1.75	6,304,919
White Knob, pfd	Idaho	.10	20,000

Canadian and Mexican Companies	Situation	Per Share	Total
Amparo, g.s	Mex.	$0.05	$1[illegible]0,000
Coniagas, s	Ont.	.25	200,000
Granby Cons.	B. C.	2.[illegible]0	299,970
Greene-Cananea	Mex.	2.[illegible]0	[illegible]76,828
Hollinger, g	Ont.	.05	240,000
Standard Silver Lead, s.l	B. C.	.02	[illegible]0,000
Temiskaming	Ont.	.03	75,[illegible]

The dividend of the Boss Gold Mining Co. was its first and the Shannon payment was the first [illegible].

The Atlantic Mines Co., whose property was sold to the Anaconda Copper Mining Co., paid on Nov. 2[illegible], a [illegible] liquidation of $12.50 per share.

The totals for the first eleven months of the year are as follows: Mining companies, $15[illegible], as against $61,012,688 in 1915; iron, metallurgical and holding companies, $102,884,452, as against $7[illegible] in 1915; Canadian, Central American and Mexican companies, $[illegible]251,679, as against $8,499,315.

Personals

J. D. Spen has removed to Jerome, Ariz., from Oatman.

E. G. Spilsbury has returned from a professional visit to Cuba.

Albert G. Wolf has gone to Cripple Creek on professional business.

Heath Steele has returned to New York from an examination trip in the West.

Adolph Lewisohn has been elected president of the Tennessee Copper Co., succeeding Utley Wedge.

William D. Blackmer, of Los Angeles, has been appointed manager for Northern Ore Co., Edwards, N. Y.

E. Maltby Shipp has returned to New York from an examination of marble properties near Proctor, Vt.

Ralph N. Moore, now with the Morococha Mining Co., Morococha, Peru, will return to Mexico City in December.

R. W. Petre, of Baltimore, is engaged in professional work in the Spottsylvania zinc and lead district of Virginia.

George B. Holderer has recently been appointed superintendent of the Northern Pyrites Co., at Northpines, Ont., Can.

C. T. Griswold, of the Associated Geological Engineers has transferred his activities from Wyoming to Oklahoma.

F. L. Stack, mine captain for the Morococha Mining Co., Morococha, Peru, expects to go to Mexico City early in December.

M. L. Fuller, managing engineer of the engineering division of the Associated Geological Engineers visited the New York office recently.

D. R. Thomas has resigned as superintendent for Moose Mountain, Ltd., to accept the management of the Davidson mine, at South Porcupine, Ont

R. W. Marston will assume the duties of acting manager for the Northport Smelting and Refining Co., Northport, Wash., in place of Samuel James, who died recently.

Leo M. Banks has been appointed assistant manager of the Braden copper mines in Chile. He left to assume his new position Dec. 2, sailing from New Orleans.

Justiee Grugan resigned on Dec. 1 his post as manager for the Northern Ore Co., Edwards, N. Y. He will establish offices as consulting engineer at Room 621, 30 Church St, New York.

G. Komorowski, representing the Girod electric furnace, recently arrived at New York from France His headquarters are at the offices of C. W. Leavitt & Co., 30 Church St., American agents for the furnace.

Arthur V. Farr, who for the last three years has been advertising manager for the S K F Ball Bearing Co, Hartford, Conn., has accepted the position of sales manager for the Hess Steel Corporatiou, of Baltimore, Md.

S. S. Sorensen, general manager of the Braden Copper Co., is paying a visit to this country. Pope Yeatman gave a dinner in his honor at Delmonico's, on Nov. 23, at which 16 well-known mining and metallurgical engineers were present.

J. D. Galloway, assistant mineralogist for the province of British Columbia, has returned to Victoria from a five months' trip through the Hazelton district and contiguous areas to the south, which he traversed for the purpose of making a geological reconnaissance.

Michael H. Sullivan, assistant superintendent of the Consolidated Mining and Smelting Co., at Trail, B. C., has resigned to take the position of superintendent of the smeltery and refinery of the Bunker Hill & Sullivan Mining and Concentrating Co, at Kellogg, Idaho.

James Bartlett, Inspector of Mines for the Cobalt and Porcupine districts, in northern Ontario, has been granted a commission in the Tunneling Section of the Canadian Engineers and is at present in training for overseas service at the Engineer Training Depot, St Johns, Que.

Dr. Nicholas P. Melinkoff, of Petrograd, accompanied by officers of the Northern Pacific and Butte, Anaconda & Pacific railways, paid a visit to the Washoe smelting works at Anaconda on Nov. 23. Doctor Melinkoff is chief engineer of the cabinet of the Czar and is on a tour of inspection in this country.

J. H. Gillis, who was in charge of the drafting work for the new zinc plant at the Great Falls works of the Anaconda company, has left for Toronto, where he will enter the services of the British America Nickel Corporation, joining E. P. Mathewson, formerly manager of the Washoe Reduction Works, at Anaconda.

William Sloan has been appointed Minister of Mines in the newly formed Ministry of British Columbia. He came originally from Wingham, Ont., and went to the Yukon in the early days of the gold rush. He is a practical mining man and for four years represented the British Columbia constituency at Comox-Atlin, in the Canadian Parliament

Obituary

William Linney, age 55, veteran employee of the Bunker Hill & Sullivan Mining and Concentrating Co., killed himself on Nov. 23, at Kellogg, Idaho, by shooting himself in the head. He had been ill for several months with tuberculosis, and was not expected to recover. He came here 29 years ago, and is survived by his widow and six children, Edward, William, Fred, Roy and Clara, all of Kellogg, and Mrs. Stella Newell of Smith's Ferry.

Joseph N. Webb died at Johannesburg, South Africa, in the week of Oct. 2, 1916, at the age of 75 years. Mr. Webb was born at Wynberg, Cape Province, in 1841, and as an incorporated accountant attained to many responsible positions. He was a Director of the National Bank of the Free State, a Director of the Rose Deep and other Rand mining companies, besides being auditor for many mining companies. In his early days Mr. Webb received the Royal Humane Society's medal for saving life on the East London bar. He was one of the oldest members of the Johannesburg Stock Exchange.

John R. Patienee, well-known mining man of the state and one of the first shift bosses in the Highland Boy mine, at Bingham, died on Nov. 23, of pneumonia at his home in Salt Lake City. He was 51 years of age. Mr. Patience came to Utah about 22 years ago from Montana. He was employed for some time by Thomas Weir following the opening of the Highland Boy mine, later moving to Tintic, where he leased at the Ajax and other properties. He was well known in these districts and in Utah mining circles. During the past several years Mr. Patience has been engaged in inspecting samples for mines in this vicinity. Born in England, Mr. Patience came to America when 14 years of age. He is survived by his widow.

Samuel James, 62 years old, manager of the Northport smelting plant, died Saturday, Nov. 25, at Northport, Wash., of apoplexy.

Mr. James went to Denver in 1889 and became superintendent of the Globe smelting works. He remained in this position for two years and then went to Murray, Utah, where he was placed in charge of the Mingo Smeltery. He returned to Colorado in 1901 and for two years was manager of the Arkansas Valley plant at Leadville. From Leadville he went to Salida, where he took charge of the Ohio & Colorado plant. He remained there for four years and went to Matehuala, Mexico. He remained in Mexico until a year ago, when he went to Northport to manage the lead-smelting plant there.

Mr. James was a native of Boston and was graduated from the Massachusetts Institute of Technology in 1876. He was recognized throughout the West as a foremost expert of metallurgy. His adopted daughter is Mrs. J. E. Wardecke, of Denver.

William Cooper Cuntz, manager for the Goldschmidt Thermit Co., died on Nov. 2, 1916, at Auburndale, Mass. Mr. Cuntz was born in Hoboken, N. J., in 1871. His maternal grandfather, after whom he was named, was William Cooper, a well-known naturalist and one of the founders of the New York Academy of Science. Mr. Cuntz was educated at the Hoboken Academy, and at Stevens Institute of Technology, graduating from the latter in 1892, with the degree of Mechanical Engineer. He then became connected with the Pennsylvania Steel Co., of Steelton, Penn, first with the Bridge and Construction Department, which he represented as Resident Engineer in Boston, Mass., and as European Resident Engineer in London, England. In 1910 he was appointed by President Taft a delegate to the International Railway Congress, at Berne, Switzerland. In the same year he severed his connection with the Pennsylvania Steel Co. to become a director and the general manager of the Goldschmidt Thermit Co., of New York.

Frederick James Hamilton Merrill, State Geologist of New York from 1899 to 1904, died from a stroke of paralysis on Nov. 20, 1916, in Los Angeles. Since going to California, in 1904, Mr Merrill had been engaged in private practice as a mining geologist For three years he had been field assistant in the California State Mining Bureau.

He was born in New York on Apr. 30, 1861, and was graduated from the Columbia School of Mines in 1885, receiving the degree of Ph.D. five years later From his graduation until 1889 he was assistant in the Geological Survey of New Jersey. In 1890 he entered the service of New York as assistant director of the State Museum, becoming director four years later and holding the position 10 years.

At the World's Fair at Chicago in 1893 he was director of the state's scientific exhibit, performing the same duty later at Buffalo and St. Louis. He was a Fellow of the American Association for the Advancement of Science, the Geological Society of America and the Academy of Sciences and a member of the American Institute of Mining Engineers, and the Mining and Metallurgical Society of America

In 1887 he married Winifred Edgerton, who survives him with four children, Louise, Hamilton, Winifred and Edgerton

Societies

National Association of Stationary Engineers will be entertained on Dec. 12, at Coplay, Penn., with a series of three industrial motion-picture films illustrating the manufacture of iron pipe by the National Tube Co. These pictures were taken under the direction of the National Tube Co., Pittsburgh, Penn., and show all stages of pipe manufacture, from ore mining to finished pipe.

National Association of Brass Manufacturers will hold its 30th annual meeting at the Hotel Astor, New York, on Dec. 13 and 14. The unusual trade conditions now existing tend to make this meeting one of the most interesting and important in the history of the organization. All brass manufacturers, whether members or not, are invited to attend and confer with their fellow manufacturers as to the wise course to pursue in view of the erratic course of the metal market. On the evening of the second day's session there will be a banquet and dinner, and the following have been appointed a committee to make the necessary arrangements: A. S. Hills, chairman, Haydenville, Mass.; C. C. Hale, New Haven, Conn.; C. H. Downs, Springfield, Mass. Further information as to details can be had by addressing William M. Webster, commissioner, 1818 City Hall Square Building, Chicago.

New Patents

United States patent specifications listed below may be obtained from "The Engineering and Mining Journal" at 25c. each. British patents are supplied at 40c. each.

Calorimeter — Continuous Gas Calorimeter. Frank Gottlob Breyer, Palmerton, Penn., assignor to the New Jersey Zinc Co., New York, N. Y. (U. S. No. 1,205,704; Nov. 21, 1916.)

Electric-Arc Furnace. Clas Walther Harry von Eckermann, Ljusne, and Ivar Rennerfelt, Djursholm, Sweden. (U. S. No. 1,206,057; Nov. 28, 1916.)

Furnace-Lining Material and Process for Preparing Same. Charles J. Barr, Birmingham, Ala, assignor to Allen S. Davison Co., Pittsburgh, Penn. (U. S. No. 1,206,771; Nov. 28, 1916.)

Ingot Stripping—Method and Apparatus for Stripping Ingots. Edwin E. Slick, Westmont Borough, Penn. (U. S. No. 1,206,150; Nov. 28, 1916.)

Ingots—Method of Making Ingots. James E. York, New York. (U. S. No. 1,206,188; Nov. 28, 1916.)

Mine Car. Edwin E. Slick, Westmont Borough, Penn. (U. S No. 1,206,042; Nov. 28, 1916)

Ore Car. William C. Carr, Buffalo, N. Y. (U. S No. 1,206,091; Nov. 28, 1916.)

Pump—Displacement Pump. Elmer A. Watts, Springfield, and Irwin L. Dunn, Marietta, Ohio. (U. S. No. 1,206,065; Nov. 28, 1916.)

Sintering—Ignition Furnace for Sintering Machines. Frederick W. Yost, New York, N. Y., and Bethune G. Klugh, Cleveland, Ohio, assignors to American Ore Reclamation Co, New York. (U. S. No. 1,206,397; Nov. 28, 1916.)

Tunneling Machine. Samuel Hoar, Virginia, Minn. (U. S. No. 1,206,437; Nov. 28, 1916.)

Assessments

Company	Delinq.	Sale	Amt.
Atlantic, Ida	Dec. 9	Jan. 9	$0 001
Beaver Copper, Utah	Dec. 11	Dec. 30	0 005
Buffalo, Ida	Nov. 15	Dec. 12	0 005
Carbonate Keystone, Utah	Dec. 14	Jan. 2	0.01
Century Gold, Utah	Dec. 10	Jan. 10	0.01
Challenge, Nev	Nov. 29	Dec. 20	0.05
Christmas, Utah	Nov. 20	Dec. 16	0 005
Con. Virginia, Nev	Dec. 8	Dec 29	0 05
Eagle Mtn., Ida	Dec. 22	....	0.001
East Hercules Ext., Ida	Jan. 2	Feb. 2	0 0005
Ely-Gibraltar, Nev.	Dec. 15	Jan. 10	0 0025
Emerald, Utah	Dec. 15	Jan. 13	0 001
Eureka, Ida	Dec. 9	Jan. 9	0 001
Exchequer, Nev	Dec. 5	Dec. 27	0 03
Federal Ely, Nev.	Dec. 2	Dec. 20	0.005
Four Timbers, Ida	Dec. 2	Jan. 2	0 002
Hector, Ida	Dec. 22	Jan. 16	0 005
Idaho-Nevada, Idaho	Nov. 15	Dec. 16	0.002
Idora, Ida.	Nov. 24	Dec. 23	0.005
Imlay, Nev	Dec. 19	Jan. 9	0 01
Iron King, Ida	Dec. 9	Jan. 9	0.001
Lion Gold, Utah	Nov. 13	Dec. 5	0 0025
Mayflower, Ida	Dec. 23	Jan. 25	0 005
Mexican G. & S., Nev	Nov 25	Dec. 18	0 10
National Lead, Ida	Nov 25	Dec. 26	0 001
Nevada Zinc, Nev	Nov. 26	Dec. 16	0 01
New Hope, Ida	Oct. 11	Dec. 11	0 002
North Franklin, Ida	Dec 30	Jan. 22	0 005
O K Extension, Utah	Dec 21	Jan. 10	0 0025
Paloma, Utah	Dec. 12	Dec. 28	0 015
Pittsburgh Cons, Utah	Nov 17	Dec. 8	0 0175
Rarus M. & S, Utah	Dec. 16	Jan. 4	0 00075
Reindeer Queen, Ida	Dec 16	Jan. 22	0 005
Silver Moon, Ida	Nov. 25	Dec. 23	0 005
Silver Pick, Nev	Dec. 2	Jan. 8	0 02
Tarbox, Mont	Dec. 22	Jan. 13	0.005
Tiberius, Ida	Dec. 21	Jan. 12	0 00075
Wallace M., M & R, Ida	Dec. 8	Jan. 8	0 0025

The publication of this table will be discontinued after Dec. 30, 1916.

Editorial Correspondence

SAN FRANCISCO—Nov. 29

Metal Production in California in 1915, according to Bulletin 71 issued by the State Mining Bureau, amounted to $96,663,369. A total of 19 metallic and nonmetallic minerals was contributed by 56 of the 58 counties in the state. There was a total increase over 1911 of $3,348,596; the largest gains were in the copper and gold output. Quicksilver and zinc increased in a greater ratio than usual and there were increases also in borax, lead, platinum, potash and natural gas. Petroleum decreased approximately 12,000,000 bbl. and $3,983,272 in value. The bulletin attributes the decrease in petroleum to overproduction in previous years, the closing of the South American trade due to the war and threatened litigation by the Federal Government.

Hull of Yuba No. 16 Dredge was launched at Hammonton on Nov. 26. This is of same size and design as Yuba No. 15 except that it is equipped with two tailing stackers and is a little heavier in total weight than Yuba 15, which is approximately 2,300 tons. The first steel was laid in construction on Sept. 20, making a total of 37 elapsed days. The purpose of two stackers instead of one is to place the tailing on either side of the channel of Yuba River, in conformity to agreement with the Government for the reclamation of this part of the river channel. Rainy, cold weather prevented as large a crowd at the launching as was present at the launching of No. 15. There were, however, about 200 people; among them were W. P. Hammon, president, and Newton Cleaveland, manager of the Yuba Construction Co. and of various operating companies, and J. H. Miles, superintendent of the Alaska Mines Corporation. The dredge went into the water smoothly and without a hitch in the launching. It will be equipped with 16-cu.ft. buckets designed to dig 80 ft. below water line and is one of the largest gold dredges in the world. The dredge will be operated by the Yuba Consolidated Gold Fields, George Carr, manager. It was designed and built by the Yuba Construction Co. and constructed under the superintendence of Paul E. Morse.

BUTTE—Nov. 30

Butte & Superior Wins another point in the flotation litigation by the decision of Judge George M. Bourquin, of the Federal District Court on Nov. 28. This denied the petition of Minerals Separation, Ltd., asking for an injunction to restrain the Butte & Superior company from declaring dividends and distributing its profits to the stockholders in this manner. The court also discharged the Butte & Superior company from the order issued Nov. 13, 1913, requiring it to post a bond in the sum of $75,000 to secure a possible judgment for infringement of patent on the flotation process it uses, and requiring monthly reports of the results of the process at its mill. The decision is a victory for the Butte & Superior company so far as this phase of the controversy is concerned and permits the company to proceed with its plans for the enlargement of the mill. Attorneys for Minerals Separation have filed the necessary notices of appeal but it is probable that the decision of the United States Supreme Court, which is expected daily, will dispose of all the points involved in this and similar suits against other companies over the patent question.

Wages Again Advanced by Butte mining companies added to the Thanksgiving feeling in this district. The companies on Nov. 29 posted notices at their properties to the effect that beginning Dec. 1, miners will receive $4.75 per day as long as the average monthly selling price of copper remains 27½c. per lb. or more. Employees at the Washoe and Great Falls smelteries of the Anaconda company will also receive the 25c. increase. All office employees of the Anaconda company receiving $300 a month or less will have their salaries increased 5%. This is the third time this year that the mining companies in Butte have voluntarily raised the wages of their employees. It is indeed a justified cause for thanksgiving in Butte that the relations between capital and labor at Montana's great mining center are so cordial and sympathetic and that the good will borne by the employers toward their employees takes a form so tangible. The mining industry is thriving as it never did before and it is just that the workers should have a share in the increased profits from the metals they are helping to produce. It is not only Butte, however, that is benefited by this prosperity. Silver Bow County and the state as a whole receive a share of the wealth created by the prevailing conditions. On Nov. 29, the Anaconda company paid its taxes in various counties of the state, the checks sent out in receipt for tax claims against the company amounting to $981,551. More than half of this went to Silver Bow County and the City of Butte. Another big check was that of the Butte & Superior company for approximately $325,000. Altogether there is good ground for rejoicing and for thanksgiving in Butte and in Montana as far as material things are concerned. Neither have the higher aims of humanity been lost sight of. The welfare of Butte's young men has been in the minds of thoughtful citizens for some time. The subject took concrete form in the raising of $200,000 within a period of only 10 days for the building in Butte of a Y. M. C. A. building, that will be needed all the more when saloons and other nefarious resorts will have passed out of existence in conformance with the overwhelming vote for prohibition cast at the last election.

Third Section of Electrolytic Zinc Plant, at Great Falls, has been placed in operation with the result of an enlarged market for Butte's zinc ores. The shipments of zinc ores from the Emma, Poulin, Lexington, Alice, Pilot Butte and other Butte mines of the company has been averaging close to 1,050 tons of ore per day for the last month. This will be increased to a daily average of 1,300 tons at once. In addition a contract has been made with the North Butte Mining Co., by which 200 tons of zinc ores daily will be taken from that company or a total of 1,500 tons of zinc ores from the Butte mines. The zinc ores from the North Butte come mainly from the 2,000- and 2,200-ft. levels, where an 11-ft. vein was opened. Arrangements have also been made by the Anaconda company to maintain through the winter the shipments of ore from the Douglas mine in the Coeur d'Alene district of Idaho. Messrs. Shipley and Fox, of Wallace, Idaho, have the transportation contract and it calls for the handling of from 100 to 200 tons of zinc ores per day. These have to be hauled a distance of 9 mi. from the mine to the nearest railroad point; teams, auto trucks and sleds will be utilized. In order to reduce the amount needed to be hauled, the Anaconda company has completed arrangements to install a mill at the mine; also compressor plant, hoist and pumps.

Southern and Western Section of Butte district will see a large amount of exploration work within a short period; this is clearly indicated by the fact that some of Butte's prominent companies, among them the Anaconda, have entered the field with substantial evidence of continuous operation. In past years these sections have been exploited in a more or less haphazard way for the silver ores they contained. When the price of silver fell to its low level and zinc was encountered, which was worthless then, operations were discontinued and the mines were allowed to fill with water, to cave and to become practically abandoned. Since Butte has entered the lists as one of the largest zinc producers in the country, individuals and companies have bestirred themselves not only to prove the existence of almost unlimited amounts of zinc ores within the boundaries of the Butte camp, but have already developed many of the Butte zinc mines to the point of production. Anaconda not only participated in the exploration of the zinc resources in Butte and other localities, but its technical staff, headed by Frederick Laist, made possible the economical treatment of these Western zinc ores in the region in which they occurred. Having placed the Nettie mine, 2 mi. west of the Anaconda Hill and the Emma mine in the southern section of Butte in a condition for continuous operation, the Anaconda company has begun the sinking of a 1000-ft. shaft on the Bonanza claim, one of a recently acquired group of claims adjoining Senator Clark's Trevona and Ancient claims on the west, all situated in the southern district of the Butte camp. This step by the Anaconda company has brought into prominence a large number of mining claims in that locality which have been neglected since the days of the silver boom and which are now spoken of as possibilities to be turned into prominent zinc producers. A little farther east of the Bonanza and the Clark properties is the Ophir group of claims, owned by the Butte-Detroit company, which has planned extensive development work on these claims. The Davis-Daly company may soon start operations at some of its western properties near the Nettie mine of the Anaconda company, having made satisfactory arrangements with the Butte-Detroit company for milling facilities in the latter company's plant at the Ophir mine. Altogether the development of Butte's zinc resources promises to be a rapid one and will prob[illegible] Butte's present fame as a [illegible]

DENVER—Nov. 29

Alma District was given [illegible] attention [illegible] prospective investors and the[illegible] during the last summer as the short [illegible] for such investigation would permit. W[illegible] before many decisive results [illegible]. However, under management of [illegible] L. Davis of Denver, the old M[illegible] of North Star Mountain, near the [illegible] of Montgomery, has been re[illegible] with the making of [illegible] the old Eddy mill, while a new [illegible] tramway is under con[illegible] tainside to connect the two properties. The ore body is along a fissure [illegible], the ore being deposited both in the vein and as a replacement laterally in the country w[illegible]. The main value is gold and the gangue is [illegible]. Pockets carrying small amounts of copper are occasionally found. This mine has been worked at times for many years but the [illegible] has always been so great that only the highest grade ore could be profitably mined, packed down the mountain on burros, hauled in wagons 7 mi. to Alma, shipped by rail to Denver and there smelted. The Magnolia is a close neighbor to the Atlantic and Pacific mines that have had similar history although credited with large production. The mill will be put into operation as soon as the tramway is completed and its flowsheet will include crushing, stamping, amalgamating and cyanide leaching. The ore that will be mined for a considerable time is oxidized.

Leadville Unit of the Leadville branch of the U. S. Smelting Refining and Mining Exploration Co.—has abandoned its intention of letting out portions of its old workings. Recent exploration of these old mines has proved them to be well worth operation on company account. Manager H. S. Lee is making plans to sink the Jamie Lee shaft on Fryer Hill to new depth, this and its neighboring workings being now completely drained by the pumping operations that have been maintained for some months in the Harvard shaft. The Harvard, Tip Top and Jamie Lee mines have newly laid compressed air lines to convey air from the surface plant at the Harvard. Steady shipments of zinc carbonate are now maintained from the Tip Top and similar shipments will soon commence from the Jamie Lee. Thus one of Leadville's 1916 drainage projects has attained fruition. Some delay is being experienced in the other drainage projects due to unusual and unforeseen flows of water. Downtown Mines continues heavy pumping at the Penrose shaft, meanwhile conducting exploration in some of the upper levels. The Layne & Bowler electric sinker at the Greenback shaft is merely holding its own against the flow but it is expected that the adverse condition will soon [illegible]. This shaft was drained readily during former operations and the present handicap cannot be accounted for.

SALT LAKE CITY—Nov. 29

First Steel Rails Ever Made in Utah were shipped from the plant of the Utah Iron and Steel Co. during the week ended Nov. 26. The works at Midvale is making [illegible] and additions at its mill.

Monument to Tony Jacobson, the former mining operator in the Cottonwood camp of Alta, was unveiled in Salt Lake City on Nov. 2[illegible], when [illegible] mining men of Alta gathered at the City cemetery to express their respect for the former operator. George H. Watson was chairman of the committee which had the gift in charge. The shaft of the memorial is made of Cottonwood granite and the base is of Swedish marble.

Further Wage Increase has been announced by the Utah Copper Co.—the fourth since August 1915—to be effective Dec. 1 to employees of the company's mines at Bingham and of the Magna and Arthur mills at Garfield. The increase will be 25c. a day for labor receiving more than [illegible] and 20c. a day for labor receiving less than this sum. All common labor working [illegible] will be increased 20c. and all other working [illegible]. Machine men will receive $4.25 and [illegible] under the new wage scale. The increase [illegible] remain effective as long as copper sells for [illegible] per lb. at New York. It affects about [illegible] men, [illegible] being employed at the mines and the remainder at the mills and [illegible] work. The dates on which [illegible] increases were made are [illegible] 1, 1915, [illegible] 1916, May 1 and Dec. 1. Other B[illegible] companies will probably increase.

Purchase of Ohio Copper Property [illegible] New York [illegible] has been reported [illegible] H[illegible] [illegible] the [illegible] New York [illegible] work and [illegible] already accepted the plan and made deposits of stock in a large amount. It will be recalled that the bondholders bid in the property at foreclosure sale in August, 1916, for $750,000. The property has been operated under lease by the General Exploration Co., of which Alfred Frank was manager.

WALLACE, IDAHO—Nov. 26

Mining Interests of the Northwest are outspoken in condemnation of the selection of Seattle as the site for the new mining-experiment station for the Northwest. Seattle is far removed from mining activity, present and prospective, in the territory to be served by the station. It is true that it is the great supply point for the mining fields of Alaska, but the Government has already provided for experimental work in Alaska by authorizing the establishment of a station at Fairbanks. There is considerable coal mining in the vicinity of Seattle, but hardly sufficient to justify the establishment of an experiment station, and besides it is understood that the experiment stations in the West are primarily intended for the benefit of metal mines. It is openly charged here that political considerations influenced the selection. After the field had been carefully examined, it was announced that Secretary Lane would withhold announcement of the station site until after the election. The selection of Seattle immediately followed, the election returns showing that the State of Washington had "delivered the goods." Having in view solely the advantages to be gained by the mining industry, Coeur d'Alene operators feel that the station should have been placed either in Idaho or Montana, the two great mining states of the Northwest.

ISHPEMING, MICH.—Dec. 2

Sales of Iron Ore for 1917 Delivery were made this week at an advance of $1.50 a ton over the 1916 prices. This is going to give the mining industry in the Lake Superior district a big stimulus. Most of the underground mines are already operating to capacity, but the increased prices will mean the development of many new properties. The prices, which range from $5.05 for Mesabi non-bessemer to $5.95 for Old Range bessemer, are the highest recorded in over 25 years. The prices for Mesabi ores are the highest in the history of that range, which was opened in the early '90s. Although the mining companies will have to pay an additional 50c. a ton to get their ore down the Lakes next season and about 25c. a ton additional costs at the mine, it will leave a net of about 75c. a ton more than they have been receiving. Wages are to be increased 10% by all of the operators on the first of the year. Most of the sales thus far reported have been on bessemer grades, the furnaces evidently preferring the low-phosphorus ores to the high-phosphorus at this time. The other ores will move later, as every ton that the district can produce in 1917 will be needed. It is estimated that close to 75,000,000 tons will go down the Lakes next year, which will be more than 10,000,000 tons in excess of the 1916 shipments. There is some talk that there will be another strike on the Minnesota ranges next spring, and it is believed that the rumors are founded on facts as the I. W. W. agitators are keeping up their work in that field. A vote was taken in the Biwabik district a few days ago and the men voted to go out on strike on Apr. 1, 1917. Some favored walking out on Jan. 1, but the majority decided to wait until navigation opens in the spring. Every effort will be made by the I. W. W. to get some of their men chosen to offices at the village elections to be held in Minnesota in March, but it is believed that a majority of the other workmen will be opposed to them. The operators are getting out all of the ore they possibly can from their underground mines, in order to have plenty in stock by spring.

GOUVERNEUR, N. Y.—Dec. 2

St. Lawrence County, N. Y., has experienced a healthy development of its mining industry, this year. Recently, the sale of the Caledonia hematite mines, a part of the Joseph Wharton estate, is reported to have been made to the American Vanadium Co. They were last worked about six or seven years ago and have a good record for production and grade of ore. The Benson magnetite mines are again in operation; the mill has been converted into a wet plant, using the Gröndal process and the results of its operation will be awaited with considerable interest in view of the favor hitherto shown for the dry process.

JOPLIN—Dec. 3

The Greatest Find in Recent Weeks—excluding strikes in the Oklahoma field—is that of the Little Martha Mining Co. on the old Baltimore tract at Chitwood, Mo. Working through a shaft of the American Zinc, Lead and Smelting Co.'s B. & M. mine, the Little Martha has opened up a big body of ore that is giving a better return than 10%, and the face is so large and regular that 9 men in the ground are keeping the 250-ton mill busy.

Further Curtailment of Electric Power, as the result of another accident at the local electric company's Riverton plant on Nov. 30, tended to keep down production in this district during the week. Following the accident the company notified the mining operators that electric current must not be used except for pumping. This meant a complete shutdown for many large mining plants, including the A. W. C. and Gibson mines at Joplin, the Picher properties at Picher, Okla., and several properties at Webb City. It is estimated that the shutdown affected at least 20% of the district's production. The company hopes to get the damage partly repaired by the middle of the coming week, and permit mills to be operated at night, which is the best service afforded for some weeks. Meantime, the electric company is spending at least $300,000 in extensive improvements that should guarantee an ample supply of current in future. Many operators with electric equipment would change to coal or gas at this time, but they cannot be guaranteed a supply of either. Coal is so scarce that dealers want no new customers, and domestic consumers of gas are agitating to prohibit its use by mining companies during the winter months.

WASHINGTON, D. C.—Dec. 2

Geological Report on Juneau Gold Belt is to be made by the U. S. Geological Survey to meet the demand of increasing development in that district. A detailed report of its geology is being prepared by A. C. Spencer and H. M. Eakin.

Placer Mining Problems are to be given chief attention at the new Fairbanks mining experiment station. The details of the study which is to be made have not been decided upon but will be worked out within the next few weeks. This matter is to be threshed out in Washington between Van. H. Manning, director of the Bureau of Mines, F. G. Cottrell, chief metallurgist, and John A. Davis, who will have charge of the new Alaska station.

Average Age of Employees of the Geological Survey is 37 years, refuting the charges often made that the Government service is dominated by men and women past the prime of life. A service tabulation applying to the Geological Survey shows this bureau to have about 900 employees of the average age above stated. Among the 188 geologists in the service of the Bureau, the average age is 39.5 years. It is said frequently that Government employees are "life-termers." This also is belied by the Geological Survey figures. The average term of service in the Survey since its stablishment in 1879 has been 10 years; among the geologists the average service has been 11.5 years. Five members of the Survey staff have been connected with it ever since its organization.

TORONTO—Dec. 4

Smeltery Smoke is now bothering beekeepers in Ontario. It is claimed by landowners in the neighborhood of Thorold, Ont., that the gases from the smeltery of the Coniagas Reduction Co. in that town are destructive to the honey-producing industry. Actions have been brought in the Supreme Court by nine beekeepers in Thorold Township, who have filed claims against the company varying in amount from $240 to $10,000, on the ground that their colonies of bees were destroyed by the gases.

Better Forest-Fire Protection was urged on Nov. 28 before Hon. G. Howard Fergnson, Ontario Minister of Lands, Forests and Mines, by a large deputation representing the Canadian Forestry Association and the lumbering, mining and commercial interests. In reply, the minister stated that the Government had had the matter under consideration and had decided that the whole system must be reorganized to meet present conditions. A separate branch of the department will be organized to deal entirely with the question of forestry and fire protection. Edmund J. Zavitz has since been appointed chief of the new branch. Legislation will be passed at the coming session of the legislature giving him wide powers of control, an important feature of which will probably be the adoption of the permit system under which settlers will be prevented from starting fires for clearing except as authorized by the fire rangers. It is also understood that town councils may be given extended fire-protection authority with jurisdiction for a certain distance outside the municipality.

The Mining News

ALASKA

JOSEVIG-KENNECOTT COPPER CO. (Kennecott)—New copper flotation; property comprises 22 claims about 7 mi. from Kennecott; reports 13½-ft. vein in one of its tunnels; also chalcocite orebody on Dagne-Marie claim. D. K. McDonald, Spokane, Wash., president

ALASKA-STANDARD COPPER MINING CO. (Landlock)—Another new copper flotation; owns 5 claims adjoining Standard mine on which company has option at price of $500,000. Several tunnels and cableways to wharf at Landlock Bay. M. L. Hewett, of Montana, and W. J. Stoneham, of New York, interested.

ARIZONA

Graham County

GERONIMO MINING (Geronimo)—Copper sulphide reported struck by churn drill No. 1 at 85 ft.

SOUTHLAND COPPER (Pima)—New organization of C. C. Blalock, A. J. Welty, and V. C. Harland; has 27 claims, situated 25 mi. southwest from Pima.

Gila County

IRON CAP COPPER (Copper Hill)—Initial dividend of 2% declared on common stock, also regular semi-annual dividend of 3½% on preferred stock, payable Jan. 1. Crosscut from Iron Cap shaft passed through 36-ft. vein, 2 ft. on the hanging wall containing copper. Another crosscut is to be run at a depth of 800 ft

Mohave County

ARIZONA CROSS-BAR MINING (Oatman)—Sinking 2 shafts; machinery being installed.

OLD WHITE HILL (Kingman)—R. T. Root, owner, plans to resume operations

Pinal County

QUEEN CREEK COPPER (Superior)—Contract let to explore with diamond drills the Windsor and Neary grounds, adjoining Lake Superior & Arizona on south.

RAY CONSOLIDATED (Ray)—Produced in October 7,590,038 lb. of copper, an increase of 1,339,101 lb. over September and the highest output ever made at this property.

RAY HERCULES (Ray)—Contracts let for new concentrator which, it is now reported, will start with capacity of 2,000 tons instead of 1,000 tons, daily, as originally planned.

Santa Cruz County

WANDERING JEW (Alta)—New concentrator, being installed, may be enlarged.

DUQUESNE MINING AND REDUCTION (Duquesne)—Shipped 25 carloads of ore and concentrates in October.

Yavapai County

MIDNIGHT TEST (Prescott)—Old workings reopened to below 300-ft. level; silver ore blocked out; air compressor and four drills ordered.

HOMESTEAD CONSOLIDATED MINES CO. (Walker)—High-grade milling ore, gold, silver, lead and copper, struck on 100-ft. level.

GOLDEN BELT (Turkey)—Lon D. Hall and W. W. Elliott plan construction of mill and cyanide plant; 80,000 tons ore reported blocked out.

CALUMET & ARIZONA (Warren)—This company, which was last week reported to have optioned the News group of 6 claims, is now said to hold options on the Sutter-Larson, Monster, Larrimore and Howe groups, making an area of nearly 600 acres extending from the Green Monster on south to the United Verde Extension on north.

JEROME COPPERFIELDS, INC. (Jerome)—Another Jerome flotation. Property 3 mi. north of United Verde. James Westervelt, trustee, Globe, Ariz.

CALUMET & JEROME (Jerome)—Benjamin Gillies, mining engineer, who recently examined this and other properties in Jerome district for Lewisohn Bros., of 11 Broadway, New York, has been appointed consulting engineer; has recommended construction of tunnel from the Duluth to the Franklin claim; also the sinking of a 1,000-ft. shaft.

Yuma County

EMPIRE-ARIZONA COPPER CO. (Parker)—Shipping 500 tons monthly to American Smelting plant at Hayden, averaging 5½% copper and about $4 in gold. Property comprises 30 claims, 10 mi. north of Parker, developed by 4,000 ft. of underground work including three shafts and two tunnels. Has been shipping siliceous ore from Carnation shaft, but basic ore from Eagles Nest shaft will soon be shipped. Head office in Title Insurance Bldg., Los Angeles; C. E. Finney, vice-president.

CALIFORNIA

Amador County

ORIGINAL AMADOR (Amador City)—On the 850 level, ore of better grade than on the upper levels. Mill capacity increased from 150 tons to 250 tons per 24 hr.

CENTRAL EUREKA (Sutter Creek)—Recent labor strike cost company $1,090, paid to watchmen for guarding property during October. Operation resumed Nov. 6; regular work was suspended Sept. 19. Some repairs made during strike; tailing dam strengthened and increased in capacity. Deepening of shaft recently started; two new levels will be made.

LIGNITE FUEL CO. (Ione)—Lignite deposits, near Carbondale, being prospected by drilling and shaft sinking, to develop material for the briquetting plant.

LINCOLN GOLD MINING CO. (Sutter Creek)—New incorporation capitalized at $250,000 in ten shares, organized by F. D Buck, George W. Dillman, and M. L. Horten. Will reopen old Lincoln-Consolidated mine, adjoining the Wildman-Mahoney.

CONSOLIDATED AMADOR (Sutter Creek)—Water lowered to 950-ft. point, known as the 1,000 station. Unwatering has averaged 10 ft per day, though frequently 20 ft. per day has been made. Timbers 28 in. in diameter are found to be intact and apparently as sound as when installed, 40 years ago. Another pump and large tank are to be placed at the 1,000 station for handling water from the lower levels; an 18-in. concrete floor is being laid for this purpose. The headframe will stand on concrete piers and will be built of steel and heavy timber. Expected that mine will be unwatered by the end of year.

Eldorado County

MT. PLEASANT (Placerville)—Reopening mine in early spring contemplated. Fuel is being hauled in. Control recently reorganized by F. C. Van Schaick, of San Francisco. Property developed by 1,000-ft. shaft and equipped with 10-stamp mill

HOLLY QUARTZ MINING CO (Placerville)—Permit by commissioner of corporations to issue 17,000 shares to C. A. Dysle, 6,250 to Louis Scholler, 1,750 to George E. Corey in exchange for Lemon mining claim, and to sell 5,000 shares at $1 per share. Property has been worked by surface cuts and shallow shafts and tunnel. Expect to deepen shaft to a point below tunnel level.

Nevada County

ALLISON RANCH (Grass Valley)—Expect to have mine unwatered by end December. New hoist being installed; 50 men employed.

OCEAN STAR (Washington)—Reconstruction of 10-stamp mill in progress. Mill recently installed destroyed by fire of alleged incendiary origin.

Plumas County

INTERNATIONAL SMELTING CO. (Portola)—Reported that company will acquire another copper property in connection with the Walker mine. Ralph Nichols, consulting engineer, making examination.

CRESCENT (Crescent Mills)—Old producing mine, in Indian Valley, will be reopened by Philadelphia Exploration Co. Reported that the Great Western Power Co. will extend lines to Crescent Mills and that this and other mines will be electrically operated.

San Bernardino County

AMERICAN TRONA (Trona)—Cable read at meeting in London Nov. 21 stated: "We should produce daily at least 70 tons salts 50% KCl or better (an increase of 20 tons over previous estimates). . . . Up to now about 400 tons have been forwarded."

UNITED TUNGSTEN MINES CO. (Victorville)—Reported that high-grade scheelite has been disclosed at contact of granite and limestone. A 50-ton mill planned. William K. Weaver, Warren Gillelen, J. Wells Smith, H. A Cole, Frank F. Peard and E. M. Coplen, of New York, are interested. D. G. Kidder is manager.

Siskiyou County

McBRIDE RANCH (Callahan)—About 100 tons of chrome ore have been extracted and shipped to Niagara Falls.

MANGANESE CO. (Callahan)—On Grouse Creek has extracted about 100 tons of chrome ore, but no shipments yet made.

DEXTER DREDGING CO. (Callahan)—Development in progress on Mule and Grouse Creeks of quartz properties, owned by Chapman brothers and Ronning.

Sierra County

BEAR CREEK (Alleghany)—Rich quartz struck; mill repaired and crushing begun. Nixon & Smith, owners.

OSCEOLA (Alleghany)—Formerly large producer; bonded to R. G. Gillespie, of Pittsburgh, Penn. Electric power and milling plant being installed.

TWENTY ONE (Alleghany)—Additional 10 stamps being installed, water power being increased, and other preparations under way for largely increased output.

MOUNTAIN MINE (Sierra City)—Early-day producer bonded to C. J. Berry, former Alaskan operator, to be developed at depth. A E. Smith, of San Diego, in charge.

Trinity County

VALDOR DREDGING (Junction City)—Began operation of 7-cu.ft. dredge on Nov. 18; electrically operated.

Tuolumne County

CALIFORNIA GOLD MINING CO (Tuolumne)—Option taken on Chaparral and adjoining properties. Installation of compressor and machine drills contemplated

GARFIELD (Sonora)—New shaft started; will be sunk to 200 ft.; drifting and crosscutting also in progress.

COLORADO

Boulder County

DOSS (Wallstreet)—Recent development has opened considerable ore, assaying from $10 to $20 in gold. Machine drills will be installed.

NIL DESPERANDUM (Boulder)—Small force employed on development. Company contemplates installation of machine drills and compressor

Clear Creek County

ARGO (Idaho Springs)—This Ute Creek property leased by Loomis and Gray, who are cleaning out and retimbering underground workings.

MURRAY MINING CO (Lawson)—Installation of electric hoist under consideration. Connection made with the Princess tunnel through which property will now be developed.

SCEPTER MINES AND MILLS CO. (Georgetown)—New company, incorporated by A. T Monson, J. P. Horshey and G. K. Thomas, to develop properties of American Sisters Mining Co. Contract let to sink shaft an additional 200 ft.

ROY LEASING CO. (Idaho Springs)—Operating the Edgar property through Big Five tunnel. Drift being advanced on vein east of tunnel. About 800 tons of ore per month produced from development.

Lake County

CORTELLINI LEASES, on the Ibex and Garbutt mines (adjoining properties) on Breece Hill, Leadville, are producing about 450 tons per day of low-grade gold ore, with occasional lots of rich material; shipments are about equally divided between the two leases. The C. & G. lease in the Ibex or Little Jonny mine, is extracting ore from a large shoot that has thus far defied limitations by development. An interesting development is the discovery of strong veins in the Ibex property carrying important amounts of copper, steady shipments of 8% ore being made, while regular shipments of high-grade zinc-carbonate also emanate from this property.

DERRY RANCH GOLD DREDGING (Leadville)—This dredge has been handling about 70,000 cu.yd. per month and has paid 70% in dividends, this year. Robert F. Lafferty, general manager.

San Miguel County

SILVER BELL (Ophir)—Crosscutting south from main level to prospect the territory owned south of the Silver Bell workings.

PERINO & CO (Telluride)—Developing the Carruthers property under lease. New mill and tramway recently completed now running, both operated by electric power. Will continue work throughout winter.

Teller County

AILEEN (Victor)—This property on southwest slope of Raven Hill being developed by W. H Roberts, of Victor. Payable ore opened.

DANTE (Victor)—Development resumed by Consolidated Mines and Reduction Co. Small force underground, and surface plant placed in working order.

ISABELLA MINES CO. (Cripple Creek)—Development on Buena Vista vein on 15th level of Lee shaft opened some 6-oz. gold ore. Clark G. Mitchell, superintendent.

GOLD DOLLAR CONSOLIDATED (Cripple Creek)—Being developed by Union Leasing Co., C. G. Jackson, superintendent. Shoot of $30 gold ore opened on Gold Dollar vein.

UNITED GOLD MINES CO (Cripple Creek)—A body of 2-oz. gold ore opened in the Silver Tip property by Hemby & Anderson, lessees, operating through the Wild Horse shaft.

SHOO FLY (Cripple Creek)—Two-ounce gold ore developed by Alexander Hickman & Co., lessees, on first level of Hickman shaft, about 110 ft. below surface. Developing also on second level.

IRONCLAD (Cripple Creek)—New company organized to take over Rex mill on Ironclad Hill. Necessary repairs and alterations made and operations will be resumed early in December

CRESSON CONSOLIDATED (Cripple Creek)—Newly elected directors and officers are: A. E. Carlton, president; Claud Boettcher, vice-president; E. P. Shove, treasurer; Adolph F Zang, secretary; and Irving Snyder, T. B. Burbridge, Spencer Penrose, Charles M. MacNeill, and Leslie G. Carlton. Extra dividend of 15c. a share in addition to regular monthly dividend of 10c. a share, payable Dec. 10.

IDAHO

Shoshone County

GUELPH (Wallace)—Hoist and compressor delivered at mine. The 100-ft. shaft will be deepened to cut the vein. Electric power

GOLD HUNTER (Mullan)—Planning changes in concentrator to provide separate treatment for the ordinary lead ore and that running high in silver

BUNKER HILL & SULLIVAN (Kellogg)—About 250 men employed on construction of new lead smeltery. Stack being erected; also superstructure of furnace and refinery buildings

MARSH (Burke)—New pump ordered and unwatering mine will begin soon. Probably require 60 days or more. Shaft down 900 ft., with numerous drifts and crosscuts. At 100 level, crosscut will be run to explore O'Neil ground, leased from Federal company

BLACK BEAR CONSOLIDATED (Black Bear)—Resumption fund of $50,000 being raised. Western Union mill, near Wallace, leased and will be remodeled; also plans to spend about $20,000 in new mine equipment

HYPOTHEEK (Kingston)—Recent report gives details of ore shipments from June 15, when new mill began operation, to Oct. 31. Five cars of crude ore were shipped and 21 cars of concentrates, net smelter returns, $11,001, operating expenses, $28,367; profit, about $15,000

MICHIGAN

Copper

MASS (Mass)—Increased tonnage to 1,000 tons per day, having obtained more men

INDIANA (Rockland)—Shaft now down 100 ft on the Butler lode. Crosscut will be driven to other lodes.

SUPERIOR (Houghton)—Some good rock recently encountered at the south on the 21st level, valuable enough to warrant further shaft sinking.

ISLE ROYALE (Houghton)—Has raised daily tonnage to about 3,100 tons. New wooden rock house for No. 5 will be completed in February. Much development work is being carried on

MICHIGAN (Rockland)—Three "cuts" (approximately 15 ft.) have been made on the Evergreen lode with success; mass copper encountered, also good amount of stamp rock. The Ogimah lode drift averaging about same as before. From sixth to the fifth level, the raise on the fissure lying above the Butler lode has run into good ore. Diamond drilling in west drift continues

FRANKLIN (Houghton)—New methods adopted to increase tonnage. First being put in commission on 28th level, where rope-haulage system, operated by compressed-air engine, and modified "caving" system of mining, has been put into service. This eliminates expensive timbering, decreases cost of tramming and cost of mining as a whole. Same system will soon be adopted at the 30th and 31st levels. When completed, it is expected that the tonnage will be increased from about 950 tons to 1,300 or 1,400 tons per day

Iron

COLBY (Bessemer)—New shaft is to be sunk. Equipment ordered and work will be started this month.

AMASA-PORTER (Amasa)—Orders received to work mine to capacity. Some new machinery will be added.

KLOMAN (Republic)—To be reopened. Shaft is 180 ft. deep. Water has been removed. Hard ore mine; vein only about 7 ft. wide. Idle over 20 yr. Chicago men have taken the lease

DOBER (Iron River)—Bailing water from mine. Workings permitted to fill with water to fifth level last spring to extinguish burning pyrite. Two bailers working in incline shaft and one in the vertical.

MACKINAW-GARDNER (Gwinn)—Work to be resumed at these shafts in January. They are 1,000 ft. apart; were sunk several hundred feet a few years ago; no drifting ever done. Both have good sized orebodies. Mine buildings erected

CLEVELAND-CLIFFS IRON CO (Ishpeming)—A police force, similar to the one maintained by the Oliver Iron Mining Co. is to be organized. There will be a uniformed officer at every one of the company's properties both night and day. Most of the night watchmen now employed will be made officers.

MISSOURI

Joplin District

DIXIE (Prosperity)—Symmes Mining Co., of Joplin, has restarted mill, and will mine recently discovered orebody northeast of plant.

NORFOLK ZINC CORPORATION (Joplin)—New flotation, 500,000 shares, to erect 300-ton mill on 10-acre tract west of Airedale mine. J. M. Short, president

FIGHTING WOLF (Joplin)—Contemplate another mill on lease at Zincite. Now making three cars of concentrates every two weeks in 150-ton mill. Operations at 65 and 80 ft.

INDEPENDENCE (Joplin)—Has opened second shaft on lease north of Bell Center. Problem of water shortage solved by pumping from Lucky George mine 500 ft. southeast

U. S. PAYMASTER (Joplin)—Constructing 1[illegible]-ton new mill on Llewellyn land, north of Bell Center. Two shafts in ore. Soft ground to be worked at two levels, 120 and 157 ft. [illegible] Case, Huddells, Ark., principal owner

LATOKA (Joplin)—New mill at Oakland in Webb City camp, started by Short L[illegible] Mining Co. on 10-acre lease near [illegible] property. Rich ore in disseminated f[illegible] at 200 ft. Mill capacity 150 tons per [illegible]

STATE LINE (Miami, Okla.)—G[illegible] results in drilling campaign on [illegible] Kansas-Oklahoma line north of [illegible]. Rich ore at 2[illegible] ft.; 15 ft. [illegible] S[illegible] will be started soon. J. A. West, of C[illegible] associates interested in property

U. S. SMELTING (Miami [illegible])—C[illegible] rebuilding of old Ravensw[illegible] at Reeds, Mo., on 60-acre [illegible] B[illegible] mine at Cardin, where 2[illegible] are at 260 ft. Two shafts put down and drifts from both now in ore. T. J. Rightly, of Miami, superintendent.

Northern Arkansas

C. F. MOSBAUGH (Rush)—Opening up promising mine on 135-acre tract short distance from Rush. Mosbaugh has been blind for more than 20 years; operated in Joplin section until last spring.

MONTANA

Beaverhead County

JACK RABBIT (Argenta)—Vein of high-grade copper ore was uncovered at this mine; said to be 14 in. wide, carrying 15% copper, from 20 to 30 oz. in silver and from $1 to $4 in gold. Expect to begin shipping ore within a few weeks.

Jefferson County

ELKHORN QUEEN (Elkhorn)—Steam hoist and boiler being overhauled by John Lynn and associates, who have leased property.

ELKHORN BULWER (Elkhorn)—Crosscut being run on 200-ft. level to cut high-grade copper shoot, on which winze was sunk last spring.

Mineral County

TARBOX (Saltese)—Work of equipping mine nearing completion. Concentrator for handling low-grade ores is to be erected in spring.

Silver Bow County

BUTTE & SUPERIOR (Butte)—November zinc production estimated at 15,000,000 lb. Mill to be extended, following favorable decision in patent litigation.

ANACONDA (Butte)—At the Emma mine, the deep crosscut from the Gagnon workings has reached a point about 800 ft. below the Emma shaft. Both raising and sinking will be prosecuted and stations are to be cut every 200 ft. Estimated that shaft will be completed by May.

TUOLUMNE (Butte)—At company's Spread Delight claim, in the Main Range group in the eastern section, a 20-ft. vein was cut 625 ft. south of Sinbad shaft. Samples have assayed 4% copper with 3 oz. silver. Preparatory work at Colusa Leonard Extension in same district is progressing rapidly; shaft sinking will be started Jan. 1. At company's property, on Anaconda Hill, 140 tons of ore are being produced daily; November output will show an increase of 50% over October.

NEVADA

Elko County

NEW TUSCARORA MINING (Tuscarora)—Company has purchased four Primeaux claims, on which leasers did well until water became excessive. Drainage and development tunnel now in about 325 ft. Practically virgin ground.

Esmeralda County

BLACK BUTTE (Goldfield)—Recent shipment from the Campbell lease gave returns of about $200 per ton.

SILVER PICK EXTENSION (Goldfield)—Recently organized to take over six claims adjoining the Silver Pick on the north and west.

SILVER PICK (Goldfield)—Station cut near 1,100-ft. point in shaft and a west crosscut is being driven to encounter veins disclosed by recent core drilling.

REORGANIZED CRACKER JACK (Goldfield)—Shaft retimbered to 320-ft. level and east crosscut being driven to encounter vein on dip, now out about 175.

JUMBO EXTENSION (Goldfield)—In addition to present lateral-development program, company contemplates core-drilling below bottom levels of mine.

GOLDFIELD CONSOLIDATED (Goldfield)—Final report for October shows net realization $17,045 from treatment of 30,000 tons ore. Total operating costs were $4.88 and net costs $4.78 per ton. Development work amounted to 1,896 ft. and cost $5.665 per ft. Mohawk shaft abandoned, the territory being served by electric haulage to the Combination and Clermont shafts.

Humboldt County

HUMBOLDT COUNTY TUNGSTEN MINES CO. (Lovelock)—New mill at Toulon running smoothly; practically all construction completed. Output contracted to Eastern firm.

Nye County

TONOPAH MINE WAGES increased 5 c. per day by the Tonopah Mine Operators' Association; effective so long as silver maintains a monthly average price of over 70c. per oz.

TONOPAH EXTENSION (Tonopah) October profit, $50,251 from treatment of 10,038 dry tons. Bullion production, 153,317 oz. silver and 1,488.12 oz. gold.

TONOPAH ORE PRODUCTION for week ended Nov. 25 was 10,442 tons valued at $203,896, compared with 9,579 tons for week previous. Producers were: Tonopah Belmont, 2,999 tons; Tonopah Mining, 2,750; Tonopah Extension, 2,380; Jim Butler, 1,050; West End, 687; Halifax, 210; Rescue-Eula, 188; McNamara, 52; miscellaneous, 126 tons.

White Pine County

NEVADA CONSOLIDATED (McGill)—October copper output 8,676,327 lb., a gain of 316,147 lb. over September and a new high record. Last year, production was 5,880,083 lb. in October.

NEW MEXICO

CHINO (Santa Rita)—October copper production, 6,921,081 lb., a reduction of 476,123 lb. from the September output. Last year, produced 6,319,1[illegible]4 lb. in October.

TENNESSEE

TENNESSEE COPPER CO. (Copperhill)—Control passed Nov. 28 to Tennessee Copper and Chemical Corporation, formed with 400,000 shares, to re-establish the standing of the old company and to furnish it with working capital. Adolph Lewisohn succeeds Utley Wedge as president of the Tennessee Copper Co.; Sam A. Lewisohn will be vice-president, and E. H. Westlake, secretary and treasurer. The new board will comprise these officers and other directors as follows: S. S Rosenstamm, J. H. Susmano, J. Parke Channing, J. S. Bache, H. M. Kilborn, Richard Sutro, W. B. Joyce, Martin Vogel.

UTAH

Juab County

LOWER MAMMOTH (Mammoth)—Lead-silver ore as well as copper being mined; shipments coming from 1,000, 1,400 and 1,500 levels.

YANKEE (Eureka)—Eighteen inches of ore running high in silver recently opened; followed about 30 ft.; more lead appearing in the ore.

TINTIC OUTPUT for first 11 months of 1916 amounted to 8,522 cars or about 400,000 tons. November shipments were 884 cars, estimated at 44,200 tons; in October 788 cars were shipped.

TINTIC STANDARD (Eureka)—Progress of 5 ft. daily in shaft sinking with small hoist. With new equipment—expected by Dec. 9—it is hoped to make 8 ft. daily. November shipments, about 12 cars.

COLORADO (Silver City)—Contract given to Walter Fitch, Jr., to sink shaft from 1,500- to 2,000-ft. level. While this work is being done the large fissure on the 1,500 will be prospected. Property adjoins Iron Blossom on north.

EAGLE & BLUE BELL (Eureka) Shipped in November 36 cars; 34 cars in October. Water encountered in main shaft at 2,018 ft., about 50 ft. higher than expected. Work discontinued here for present and development of new orebodies undertaken. Elevation of collar of shaft is 6,816 ft. above sea level. Elevation of Chief Consolidated approximately 6,665 ft., and water encountered at 1,790. Other properties opened to water level and below are Gemini, Centennial-Eureka and Grand Central.

Salt Lake County

MICHIGAN-UTAH (Alta)—Development being done on new oreshoot in Lavinia fissure.

SELLS (Alta)—Ore being mined from development, and two cars awaiting shipment. Last lot brought $43 per ton net smelter returns.

SOUTH HECLA (Alta)—Slightly increased shipments possible owing to somewhat improved condition of roads. Between 150 and 175 tons shipped weekly.

ALBION (Alta)—Work in Quincy tunnel following vein carrying copper, and a little silver and gold. Two cars awaiting transportation to smeltery.

ALTA CONSOLIDATED (Alta)—Negotiations under way with Michigan-Utah, for use during night of that company's aërial tram line to Tanners Flat. New winze sunk in ore 60 ft. below tunnel level.

Summit County

BIG FOUR EXPLORATION (Park City)—Company's mill at Atkinson treating up to 1,000 tons of tailings daily.

SILVER KING COALITION (Park City)—November shipments were 2,046 tons of ore and concentrates; in October 1,878 tons.

SILVER KING CONSOLIDATED (Park City)—Tramway handling 50 tons of ore daily. Thaynes Cañon tunnel in 1,10 ft. Two shifts working.

THREE KINGS (Park City)—Rock carrying 5 to 6 oz. silver encountered in winze sunk 125 ft. below 500. Country rock is siliceous gray limestone and is mineralized with pyrite.

PARK CITY SHIPMENTS for November—according to preliminary figures—were 7,777 tons of ore and concentrates by 11 shippers. In October 6,350 tons were shipped, and in September 8,360 tons.

GRASSELLI CHEMICAL (Park City)—Recently opened offices in Salt Lake City, 1108 Newhouse Building. Purposes purchase of zinc ores, and investigation and development of zinc properties. Offices in charge of George H. Short, who has represented the company for some time in Park City.

Tooele County

IN DUGWAY DISTRICT, Mines Development Co., of Salt Lake City, has leased the Golconda and Bullion Hill properties and will use motor trucks for hauling ore to Lund on the Salt Lake Route. The Belcher mine has been leased by Salt Lake interests including W. F. Snyder, B. L. Cutler and O. Keeler. Other active properties are the Silver Bell and the Horn Silver, and work is to be resumed soon at the Black Maria and Rattler groups.

WISCONSIN

Zinc-Lead District

TIFFANY ZINC (Platteville)—New 200-ton mill at Potosi completed.

VINEGAR HILL (Platteville)—Completed the Yewdall mill at Livingston and the Meloy mill at New Diggings, each handling 150 to 200 tons of ore in 10 hr. Mill construction started on Jefferson property at Hazel Green.

WISCONSIN ZINC (Platteville,)—Three concentrating mills will be erected; the Champion-Church at New Diggings, the Copeland at Shullsburg and the Tom Calvert at Benton; the East End, Federal, Empire and La Fayette mills have been dismantled, the machinery and lumber of which will be used in constructing the new plants. A large warehouse is under construction at the Champion mine, also a wet concentrating plant at the Skinner roaster to wash the low-grade fines from the roaster. This company, together with the Mineral Point Zinc Co., Vinegar Hill Zinc Co. and others will build a spur 1.8 mi. long, with 630 ft. of tunnel, to connect the New Diggings camp with the Chicago & Northwestern Ry. at Strawbridge.

CANADA

British Columbia

PLATINUM is being recovered from placer workings on Tulameen River, one miner having secured 20 oz.

U. S. ORE SHIPMENTS TO TRAIL smeltery so far this year amount to 31,673 tons coming from 29 properties, mainly in Washington and Idaho.

CHAMBERS GROUP (Slocan)—J. Y. Kressler, one of the original locators of the Ruth mine, has taken a three-years' bond on this property east of the Noble Five mill.

Ontario

LALLY (Porcupine)—Asking tenders for approximately 4,000 ft. of diamond drilling.

AURUM (Munro)—On this property, formerly known as the Smith-Curry adjoining the Crœsus, encountered 4-ft. vein showing free gold.

TRETHEWEY (Cobalt)—Taking out good ore from old Rochester mine, worked under lease. Vein 1 in. wide on 290-ft. level carries some 2,000-oz. ore.

WEST DOME (Porcupine)—The 12-drill compressor is now being run by 100-hp. motor. New hoist is in place and the new shaft is down 30 ft. Crosscut being run from old shaft on 300-ft. level to connect with it.

PORCUPINE CROWN (Timmins)—New 200-ton crusher installed. Diamond drilling under way from 500-ft. level to cut at 1,000 ft. several veins paralleling vein now being developed at 800- and 900-ft. levels.

HOLLINGER CONSOLIDATED (Timmins)—During four weeks ended Nov. 3 gross profits were $241,591 from 49,956 tons of ore; average value of $8.62; working cost $3.64 per ton milled. Mill ran 93.3% of possible time. The total deficit to date resulting from increased dividends required by the merger is $238,148. Liability to the shareholders of the Acme, Millerton and Canadian Mining and Finance Co. under conditions of merger amounting to $720,000, is to be met by an issue of 120,000 shares of treasury stock at $6.50 per share, which is offered to shareholders in proportion of one share for every 40 held by them.

OPHIR (Cobalt)—Seven veins have been cut within 20 ft. in crosscut from bottom of shaft. Three of them converged into vein 14 in. wide

MEXICO

BOLEO (Santa Rosalia, Baja Calif.)—October copper production 984 metric tons.

SANTA GERTRUDIS (Pachuca, Hidalgo)—In October milled 14,823 tons; loss, £960. Owing to shortage of supplies, could only operate at half capacity.

EXPLORATION CO., LTD. (24 Lombard St., London, Eng.) This company, heavily interested in El Oro, Mexico Mines of El Oro, Buena Tierra and other companies, has reduced its capitalization from £750,000 to £375,000 on account of depreciation of its Mexican investments.

COLOMBIA

DREDGING CONSOLIDATION effected of Western placer properties of Anglo-Colombian Development Co. and of the Henry G. Granger properties, controlled by Adolph Lewisohn interests, which it is understood will assume the management.

GREAT BRITAIN

THE MOELWYN BLENDE MINES, at Festiniog, in northern Wales, have been reopened by the Zinc Mines of Great Britain, Ltd.

GERMANY

ALUMINUM WORKS, according to a wireless report from Berlin, are to be erected "by a Bavarian syndicate; capacity to be 6,000 tons per annum, or about one-third the German requirements."

CHOSEN

ORIENTAL CONSOLIDATED (Unsan)—Cable estimate, November cleanup $135,865. Final October results from 27,569 tons were $121,218. Bullion party left on Nov. 4, composed of five white men, company's Japanese secretary and five governmental police officers, mounted on excellent Manchurian ponies, lately purchased especially for bullion trips.

The Market Report

Metal Markets

NEW YORK—Dec. 6, 1916

Copper and lead were both conspicuously strong and advanced on relatively small business. Spelter was weak, declining sharply on small business.

Copper, Tin, Lead and Zinc

Copper—The volume of business was small, not so much owing to absence of buyers as to the inability of producers to supply any more copper previous to the middle of 1917. There are still manufacturers who are willing to buy at current prices if they can get the copper. On the other hand, there are manufacturers who need the copper but are willing to wait and take their chances on the market becoming easier.

The chief business during the last week was for second-quarter delivery and was done at advancing prices. Sales of prompt copper were made as high as 35½c., r.t., while first-quarter business was done at 34c. r.t. At the close the position of the market was about as follows: Prompt, 35@35½c.; first-quarter, 34@34½c.; second-quarter, 33½c.; all regular terms.

Some business was reported done for second half of 1917 at relatively low prices, 30@31c., etc., but such transactions were only sporadic.

Copper Sheets—Base price for copper sheets remains at 42c. for hot rolled and 43 for cold rolled, as reported last week. Wire is on a base of 37c., f.o.b. mill.

Tin—This market was very quiet. At the opening, prompt was 45c. and futures, 43¾c.; at the close, the quotations were 44c. and 43c., respectively.

Lead—The chief feature of the last week was the advance by the A. S. & R. Co. to 7¼c. on Tuesday morning, and the announcement of a further advance to 7½c. an hour or so later. The simple explanation of these events, which have been regarded as somewhat mysterious, is that the advance to 7¼c. was decided on the previous afternoon, and the second advance was rather in the nature of a change of mind. Although lead had previously been advancing in the outside market and continued to do so, the amount of business done by producers was not very large and was decidedly less than in the previous week. In some quarters producers are so completely sold that they have nothing further to offer for early delivery, but that is probably not the case in all quarters. There are suspicions, moreover, that supplies of prompt lead are held speculatively and that the market is being boosted by speculative influences.

Spelter—Right from the beginning of the week this market declined sharply on offerings by second hands. Most producers stood quite aloof and continued to ask higher prices, but some of them met the market on such small orders as could be obtained. About Dec. 5 there began to be offerings by first hands—small producers—as well as second hands, and considerably lower prices were indicated as being acceptable. The decline occurred in a dull market and the total volume of business transacted was light. Brass makers were only small buyers and galvanizers were conspicuous by their absence. Europe exhibited no interest whatever, prices over there being below our parity. The opinion is expressed that stocks of spelter in the hands of speculators are larger than was supposed.

Zinc Sheets—The price of zinc sheets remains based on $21 per 100 lb., f.o.b. Peru, Ill., less 8% discount, as reported last week.

Other Metals

Antimony—Market steady at 11½c., with fair business done. December-January shipment from China is quoted at 13½c., c.i.f., New York, duty unpaid.

Quicksilver—Price advanced to $8[illegible]. San Francisco reports, by telegraph, $78, firm.

Nickel—The price of nickel remains unchanged at 45@50c. per lb., electrolytic commanding a premium of 5c. per lb.

Aluminum—Quotations are at 64@65c. per lb. for No. 1 ingots at New York.

Gold, Silver and Platinum

NEW YORK—Dec. 6

Gold—The sum of $8,100,000 in gold imported from Canada was deposited at the New York assay office by J. P. Morgan & Co. A large amount of gold, said to be about $3[illegible],000,000, was [illegible] from San Francisco last week, destined to the Morgan firm in New York. It was sent by the Russian government. According to report of Samuel Montagu & Co., London, Nov. 23, the Bank of England reserve of gold against its note issue shows a slight increase of £12,955, as compared with the previous week's returns.

Silver—The latest advices from London indicate a healthy undertone to the market; not merely from European and Indian currency demands, but also from the firmness of the China exchanges. Telegraphic advices from the Far East claim "that a shortage of sycee is being really felt. With a possibility therefore of an inquiring for silver from China the market is expected to show a good tendency." This cable report has been followed by advance of silver to 36⅛d.

Report of Samuel Montagu & Co., London, Nov. 23, says that during the preceding week the market had been swept more or less clear of supplies. A further advance in rates became unavoidable, owing to the continued strength of the China exchanges which led to purchases in America and also in London. The quotation advanced daily from 34d., the price on Nov. 17, recording successive rises of ⅛, ¼, [illegible], ¼ and ⅛d.

Inquiry was not confined to mintage alone, but embraced orders for general purposes home and continental, and also for the Indian Bazaars. The unfavorable views taken in India have caused a "bear" position to be opened in the London market—a state of affairs, in view of the statistical position, not without danger.

It cannot be challenged that the present condition of the market is more sound than when the spectacular movements in May last carried the quotation to 37⅛. During the intervening period the Chinese stock has been greatly reduced, America has been relieved of certain accumulations she then held, and the Indian Currency figures, notwithstanding very large continuous purchases for the Indian Mints, show a declining tendency. The silver market has often lived up to its reputation of doing the unexpected, but the situation is such that further advances may be expected before the close of the year, provided no new factor intervenes.

Platinum—Declined owing to slackening demand from jewelry trade. We quote $9[illegible]@105.

Our Petrograd correspondent advises us, under date of Oct. 13, that there has been no notable change in the market for about six weeks. From Ekaterinburg it is reported that the dredges installed this year in the North Ural platinum areas are working successfully. At that time quotations in Petrograd were at $73.50 per oz., and those at Ekaterinburg were at $72.56 per oz.

Zinc and Lead Ore Markets

Platteville, Wis., Dec. 2—Quotations for the district are according to the following figures: Base price per 2,000-lb. ton for material assaying 60% zinc is $105 for premium ore down to $98 for medium grade. Base price per 2,000-lb. ton for material assaying 80% lead is $90. Shipments for the week ended Dec. 2, 3,5[illegible]1 tons of zinc ore, 179 tons of lead ore, and [illegible] tons of sulphur ore. For the year to date the figures are: 122,117 tons of zinc ore, 4,188 tons of lead ore and 29,653 tons of sulphur ore. Shipped during the week to separating plants, 2,921 tons of zinc ore.

Joplin, Dec., 2—Price quotations per 2,000 lb.: Blende high, $107.75; 60% zinc, premium ore, $105, medium $102@98, low $85. Calamine per ton, 40% zinc, $60@50. Average selling price, all grades of zinc, $88.56 per ton.

Lead, high price $91.10, base $[illegible]@88. Average selling price all grades of lead, $87.51 per ton.

Shipments of the week: Blende 10,88[illegible] tons, calamine, 511 tons; lead, 1,620 tons. Value all ores the week, $1,150,960; 48 weeks, $[illegible]1,755,110.

The invasion last week of a buyer of lead ore for shipment to Canada set other buyers busy gathering up all stocks, with a large [illegible] resulting. Zinc prices, showing weakness in midweek, were rallied at the close to last week's quotations, with some holders asking a [illegible] price level. The rally was occasioned by the breaking of an additional turbine of the [illegible] company, reducing two-thirds of the power supplied by this company for mining operation. No power is being furnished except for pumping. A large number of mills being idle tonight, with serious prospects ahead for an indefinite period. The production is being greatly [illegible], creating a shortage in output [illegible] buyers to purchase ore several weeks [illegible] production.

Other Ores

Tungsten Ore—Market active. Several hundred tons being reported sold both for domestic and foreign consumption. We quote $18 per unit [illegible] for prompt and forward delivery.

Molybdenum Ore—Still scarce. Small business reported at $1.75 per lb. MoS_2 contained.

Iron Trade Review

NEW YORK—Dec. 6

General attention is given to the shortage of pig iron, a situation which "Iron Age" says was clearly indicated a year ago when attention was called to the fact that the blast-furnace capacity of the country was not keeping pace with the increase in capacity of steel works.

SILVER AND STERLING EXCHANGE

Nov.-Dec.	Sterling Exchange	Silver New York, Cents	Silver London, Pence	Nov.-Dec.	Sterling Exchange	Silver New York, Cents	Silver London, Pence
30			35[illegible]	4	4.7550	75	35[illegible]
1	4.7563	75¼	35[illegible]	5	4.7544	75[illegible]	36[illegible]
2	4.7556	75¼	36	6	4.7544	75[illegible]	36[illegible]

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine.

DAILY PRICES OF METALS IN NEW YORK

Nov.-Dec.	Copper Electrolytic	Tin Spot	Lead N. Y.	Lead St. L.	Zinc St. L.
30					
1	32[illegible] @33	45	7.20 @7.30	7.10 @7.15	12[illegible] @12[illegible]
2	32[illegible] @33	45	7.20 @7.30	7.10 @7.15	12[illegible] @12[illegible]
4	32[illegible] @33[illegible]	44[illegible]	7.30 @7.50	7.15 @7.35	12[illegible] @12[illegible]
5	32[illegible] @33[illegible]	44[illegible]	7.50 @7.63	7.25 @7.50	12 @12[illegible]
6	33 @33[illegible]	44	7.50 @7.75	7.38 @7.63	11[illegible] @12[illegible]

The above quotations are our appraisal of the average of the major markets based on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for the deliveries constantly contracted for in the major markets, reduced to basis of New York, cash, except where St. Louis is the normal basing point.

The quotations for electrolytic copper are for cakes, ingots and wirebars. Electrolytic copper is commonly sold on "regular terms" (r.t.), including freight to the buyer's works, and is subject to a discount for cash. The difference between the price so reckoned and the New York cash equivalent is at present about 0.2c. on domestic business. The price of electrolytic cathodes is 0.05 to 0.10c. below that of electrolytic. Quotations for spelter are for ordinary Prime Western brands. We quote New York price at 17c. per 100 lb. above St. Louis.

Some current freight rates on metals per 100 lb. are: St. Louis-New York, 17c.; St. Louis-Chicago, 6.3c.; St. Louis-Pittsburgh, 13.1c.

LONDON

Nov.-Dec.	Copper Standard Spot	Copper Standard 3 Mos.	Copper Electrolytic	Tin Spot	Tin 3 Mos.	Lead Spot	Zinc Spot
30	151	143	16[illegible]	18[illegible]	19[illegible]	[illegible]	[illegible]
1	151	143	170	1[illegible]	1[illegible]	[illegible]	[illegible]
2							
4	151	142	170	18[illegible]	19[illegible]	[illegible]	[illegible]
5	152	143	17[illegible]	188	18[illegible]	[illegible]	[illegible]
6	153	144	170	187	1[illegible]	[illegible]	[illegible]

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2,240 lb. For convenience in comparison of London prices, in pounds sterling per 2,240 lb., with American prices in cents per pound, the following approximate ratios are given, reckoning exchange at $4.80. [illegible] 4.2[illegible]; [illegible] 6.4[illegible]; £40 = 8.[illegible]7; [illegible] 12.8[illegible]. Variation, £1 = 0.21c.

In the last month or two there has been a wild scramble for pig iron. This was probably exaggerated by heavy purchases of steel-making pig iron for export, but the shortage would have developed anyway. Never has there been such a situation as now exists, and it is such as to discourage any prophesy for the future. If the war continues for another year, the prices may reach a point that will make the present ones seem low.

Export inquiries for ship plates are keeping up a steady stream. Practically all the world seems to be coming to the United States for material of this character. Norwegian shipbuilders in person have been applying to Eastern platemakers for large tonnages. They state that up to September they were drawing the major portion of their supplies from Germany, but since the recent controversy over submarine operations between their country and the latter, these shipments have been shut off summarily. They now are appealing to the American mills to help them out.

PITTSBURGH—Dec. 5

Car shortages are as pronounced as ever at the coal mines, coke works and steel mills, and much hardship results. The traffic managers of the various companies are working very hard and shippers are endeavoring to arrange their shipments to the best advantage. The injury is thus minimized and there has been no serious curtailment in iron and steel production owing to the car situation, but there has been some. The weather has been exceptionally favorable for the season of year.

Wrought iron and steel pipe has been advanced two points or about $4 a ton. Black and galvanized sheets are up $5 a ton, to 4.25@4.50c. for black sheets and 6@6.50c. for galvanized. Iron bars have been advanced $5 a ton to 3.25c. As high as 5c. has been bid for ship plates for first half of 1917 delivery. Since Aug. 1 the railroads have bought about 100,000 freight cars, and during this period the market for plates, delivery at mill convenience, has advanced from 2.90c. to 3.50c., but some of the car plates were bought at premium prices, to secure earlier delivery.

Despite sharp price advances all along the line the buying of steel has continued heavy. The Steel Corporation's unfilled obligations increased by 497,000 tons in October and the increase in November may reach 750,000 tons, owing to heavy bookings of car and ship material, as well as of rails, as the mills have been heavier sellers, for 1918 delivery, since the $5 a ton advance of Nov. 15. There has also been heavy contracting for sheets and tin plates for the first half of next year. It is hardly expected that these heavy bookings will continue indefinitely and the tonnage of business on mill books may begin to decrease after this month.

Pig Iron—Several sales of bessemer iron have been made in the past few days at $35, valley, or $2 above the minimum of a week ago, and at least one sale has been made at $36. Basic has sold readily at $30, an advance of $2 in that grade, and $31 is believed to be obtainable now. Foundry has kept pace with basic. We now quote: Bessemer, $35@37; basic, foundry and malleable, $30@32; forge, $29@31, f.o.b. valley furnaces, 95c. higher delivered Pittsburgh. W. P. Snyder & Co. report average prices obtained in November in actual sales at $29.12, valley, for bessemer and $27.229 for basic. Foundry iron, averaged, from quotations, was $25.60, valley, in November.

Steel—There are reports that as high as $62 has been paid for sheet bars for prompt shipment, and $57 or higher has been done for first half 1917. We quote billets at $55@57 and sheet bars at $57@62, with no regular offerings. Forging billets are $75 and rods $65@70.

Iron Ore

Prices of Lake Superior iron ore for 1917 have been established by sales at the highest figures considered in any recent discussion of the matter. The advance of $1.50 a ton over the year's prices is about 50% more than the maximum talked of two or three months ago. The announcement of another general advance of 10% in wages was made by the leading steel companies on Wednesday, Nov. 22, carrying with it a 10% advance in wages of iron miners, and by late afternoon of that day important iron ore interests let it be known that $1.50 rather than $1.30 would represent the step between the furnacemen's iron-ore costs of 1916 and 1917.

Ferroalloys

Ferromanganese—The market is fairly strong but not particularly active. Domestic on contract is $165 and imported $164, prompt lots being $163@165.

Coke

Connellsville—Several sales of furnace coke for spot shipment were made today at $8, as high a price as has been reached on this movement. Shipments are not up to contract requirements, and some furnaces have had to slow down operations. There is some inquiry for first half, on which $4@4.50 will probably be quoted. Interest is arising in second half deliveries, and it is doubted whether operators would accept less than $5, in view of the high prices obtained for pig iron for that delivery. We quote: Spot furnace, $8; contract, $4@4.50; spot foundry, $9@10; contract, $5.50@6.50, per net ton at ovens.

STOCK QUOTATIONS

N. Y. EXCH.†	Dec. 5
Alaska Gold M	13¾
Alaska Juneau	8
Am Sm. & Ref., com.	117½
Am. Sm. & Ref., pf.	116⅞
Am. Sm. Sec., pf. A	99½
Am. Sm. Sec., pf. B.	96½
Am. Zinc	60⅞
Am. Zinc, pf.	18
Anaconda	99⅝
Batopilas Min	1⅞
Bethlehem Steel	610
Bethlehem Steel, pf.	155
Butte & Superior	71⅞
Chile Cop	33⅝
Chino	68¾
Colo. Fuel & Iron	57¼
Crucible Steel	86⅝
Dome Mines	22
Federal M. & S.	16
Federal M. & S., pf.	48
Great Nor., ore ctf.	43¾
Greene Cananea	52½
Homestake	130
Inspiration Con	70
International Nickel	48
Kennecott	57
Lackawanna Steel	104
Miami Copper	46⅞
Nat'l Lead, com.	68
National Lead, pf.	113
Nev. Consol.	31
Ontario Min.	6¼
Quicksilver	3
Quicksilver, pf.	2
Ray Con	33⅞
Republic I.&S., com.	88¼
Republic I. & S. pf.	115¼
Sloss-Sheffield	83
Tennessee Copper	24½
U. S. Steel, com.	126
U. S. Steel, pf	121⅞
Utah Copper	126¼
Va. Iron C. & C.	62½

N. Y. CURB†	Dec. 5
Buffalo Mines	1.10
Butte & N. Y.	2½
Butte C. & Z.	18¼
Caledonia	.51
Can Cop. Corpn	2⅞
Cashboy	06
Cerro de Pasco	42½
Con. Ariz. Sm	2⅞
Con. Coppermines	4
Con. Nev.-Utah	.25
Crystal Cop	⅞
First Nat. Cop	4½
Florence	.70
Goldfield Con	.54
Goldfield Merger	.05
Granite	¾
Hecla Min	8¾
Howe Sound	8
Jerome Verde	1¼
Joplin Ore & Spel.	47
Kerr Lake	4.70
Magma	54
Majestic	.81¼
McKinley-Dar-Sa	.64
Mother Lode	.36½
Nevada Hills	.21
N. Y. & Hond	16¾
Nipissing Mines	9¼
Oro	‡.03½
Ray Hercules	5½
Rochester Mines	75
St. Joseph Lead	21½
Standard S. L.	1 5/16
Stewart	.31¼
Success	.60
Tonopah	6⅛
Tonopah Ex	4⅞
Tribullion	.31¼
Troy Arizona	.93
United Zinc	5⅞
White Knob, pf.	2¾
White Oaks	4⅞
Yukon Gold	2⅞

SAN FRAN.*	Dec. 5
Alta	04
Andes	25
Best & Belcher	07
Bullion	.02
Caledonia	.32
Challenge Con.	‡.05
Confidence	.13
Cons. Imperial	‡.01
Con Virginia	.14
Gould & Curry	.03
Hale & Norcross	.13
Jacket-Cr. Pt.	.03
Mexican	.23
Occidental	.65
Ophir	.17
Overman	.03
Savage	.08
Seg Belcher	.02
Sierra Nevada	.22
Union Con.	.54
Utah Con	.01
Belmont	5.00
Jim Butler	.95
MacNamara	.05
Midway	.18
Mont.-Tonopah	.20
North Star	.13
Rescue Eula	.24
West End Con	.67
Atlanta	.08
Booth	.07
C.O.D. Con.	.02
Comb. Frac.	.04
D'field B.B	.05
D'field Daisy	‡.05
Jumbo Extension	.29
Round Mountain	.37
Sandstorm Kendall	‡.04
Silver Pick	27
Argo	04
Ariz Central	08
Big Jim	1.31¼
Lazy Boy	.07
Nellie	.29
Tom Reed	1.90
United Eastern	5.00
United Western	.05

BOSTON EXCH.*	Dec. 5
Adventure	5
Ahmeek	118
Algomah	1½
Allouez	77½
Ariz. Com., ctfs.	16¾
Bonanza	.25
Butte-Ballaklava	2½
Calumet & Ariz.	94½
Calumet & Hecla	600
Centennial	23½
Copper Range	79⅞
Daly West	3
East Butte	18¼
Franklin	11½
Granby	107
Hancock	20½
Hedley	20
Helvetia	.75
Indiana	4⅞
Island Cr'k, com.	69
Isle Royale	39½
Keweenaw	5
Lake	15½
La Salle	5½
Mason Valley	6¾
Mass	17¼
Mayflower	3½
Michigan	4¼
Mohawk	103
New Arcadian	6⅞
New Idria	16¼
North Butte	27⅝
North Lake	2⅞
Ojibway	2
Old Colony	‡3
Old Dominion	79½
Osceola	101
Quincy	97½
St. Mary's M. L.	104
Santa Fe	2½
Shannon	10½
Shattuck-Ariz.	33
So. Lake	6
So. Utah	.28
Superior	18½
Superior & Bost.	7⅞
Tamarack	45
Trinity	7½
Tuolumne	1½
U. S. Smelting	76⅛
U. S. Smelt'g, pf	52
Utah Apex	3¾
Utah Con	22
Utah Metal	7
Victoria	6⅞
Winona	6⅞
Wolverine	‡54
Wyandot	2½

BOSTON CURB*	Dec. 5
Alaska Mines Corp.	.90
Bingham Mines	10½
Boston Ely	70
Boston & Mont.	75
Butte & Lon'n Dev.	.59
Calaveras	5
Calumet-Corbin	.02
Chief Con	2⅞
Cortez	.25
Crown Reserve	.40
Davis-Daly	6 11/16
Eagle & Blue Bell	1⅞
Houghton Copper	2
Iron Cap Cop., pf.	16
Mexican Metals	.51
Mines of America	2
Mojave Tungsten	2¼
Nat. Zinc & Lead	.66
Nevada-Douglas	1 11/16
New Baltic	3¼
New Cornelia	19
Ohio Copper	1
Oneco	.90
Rex Cons.	.60
Rilla	.08
United Verde Ext.	41

SALT LAKE*	Dec. 5
Big Four	1.00
Black Jack	.06
Cardiff	7.00
Colorado Mining	.22
Crown Point	.05
Daly-Judge	8.00
Emma Cop.	1.93¾
Empire Copper	1.50
Gold Chain	.17
Grand Central	.59
Iron Blossom	1.57½
Lower Mammoth	10
May Day	10½
Opohongo	‡.01¼
Prince Con	1.35
Seven Troughs	‡.03
Silver-King Coal'n	3.20
Silver King Con	5.00
Sioux Con	12½
So. Hecla	1.60
Uncle Sam	06
Wilbert	09
Yankee	21

TORONTO*	Dec. 5
Bailey	07
Beaver Con	45
Chambers Ferland	.24
Coniagas	5.10
La Rose	.55
Peterson Lake	.20
Right of Way	.07
Seneca Superior	‡.09
T. & Hudson Bay	73.00
Temiskaming	65
Wettlaufer-Lor	10¼
Dome Exten	29
Dome Lake	.65
Foley O'Brien	.70
Hollinger	6.75
Jupiter	27
McIntyre	1.80
Newray	1.28
Porcu. Crown	69
Vipond	.42
West Dome	.34

STOCK QUOTATIONS—Continued

COLO. SPRINGS	Dec. 5
Cresson Con	7.95
Doctor Jack Pot	11¾
Elkton Con	10½
El Paso	40
Findlay	.07
Gold Sovereign	.07½
Golden Cycle	2.65
Granite	65
Isabella	.23
Mary McKinney	.29
Portland	2.05
Vindicator	1.52

LONDON	Nov. 22		
Alaska Mexican	£0	12s	6d
Alaska Tre'dwell	2	17	6
Burma Corp	3	16	3
Cam & Motor	0	11	0
Camp Bird	0	7	0
El Oro	0	7	6
Esperanza	0	9	6
Mexico Mines	3	15	0
Nechi, pfd.	0	12	0
Oroville	0	16	9
Santa Gert'dis	0	10	6
Tomboy	1	1	3

* Bid prices. † Closing prices. ‡ Last Quotations.

MONTHLY AVERAGE PRICES OF METALS

Silver	New York			London		
	1914	1915	1916	1914	1915	1916
January	56.572	48.855	56.775	26.553	22.731	26.960
February	57.506	48.477	56.755	26.573	22.753	26.975
March	58.067	50.241	57.935	26.788	23.708	27.597
April	58.519	50.250	64.415	26.958	23.709	30.662
May	58.175	49.915	74.269	26.704	23.570	35.477
June	56.471	49.034	65.024	25.948	23.267	31.060
July	54.678	47.519	62.940	25.219	22.597	30.000
August	54.344	47.163	66.083	25.979	22.780	31.498
September	53.290	48.680	68.515	24.260	23.591	32.584
October	50.654	49.385	67.855	23.199	23.925	32.361
November	49.082	51.714	71.604	22.703	25.094	34.192
Dec.	49.375	54.971	......	22.900	26.373	......
Year	54.811	49.684	......	25.314	23.675	......

New York quotations cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

Copper	New York		London			
	Electrolytic		Standard		Electrolytic	
	1915	1916	1915	1916	1915	1916
Jan	13.641	24.008	60.756	88.083	65.719	116.167
Feb	14.394	26.440	63.494	102.667	*	133.167
Mar.	14.787	26.310	66.152	107.714	*	136.000
April	16.811	27.895	75.096	124.319	*	137.389
May	18.506	28.625	77.600	135.457	*	152.522
June	19.477	26.601	82.574	112.432	95.333	137.455
July	18.796	23.865	76.011	95.119	91.409	125.500
Aug	16.941	26.120	68.673	110.283	82.333	126.304
Sept	17.502	26.855	68.915	113.905	85.250	134.071
Oct	17.686	27.193	72.601	122.750	88.000	142.523
Nov	18.627	30.625	77.744	134.659	93.273	155.432
Dec	20.133	.....	80.773	.....	100.430	......
Year	17.275	......	72.532	......	......	......

Tin	New York		London	
	1915	1916	1915	1916
January	34.260	41.825	156.550	175.548
February	37.415	42.717	176.925	181.107
March	48.426	50.741	180.141	193.609
April	47.884	51.230	166.225	199.736
May	38.790	49.125	162.675	196.511
June	40.288	42.231	167.636	179.466
July	37.423	38.510	167.080	168.357
August	34.389	38.565	151.440	169.870
September	33.125	38.830	152.625	171.345
October	33.080	41.241	151.554	179.307
November	39.224	44.109	167.670	186.932
December	38.779	.....	167.000	....
Av. year	38.590	....	163.960	....

Lead	New York		St. Louis		London	
	1915	1916	1915	1916	1915	1916
January	3.729	5.921	3.548	5.826	18.606	31.167
February	3.827	6.246	3.718	6.164	19.122	31.988
March	4.053	7.136	3.997	7.375	21.883	34.440
April	4.221	7.630	4.142	7.655	21.094	34.368
May	4.274	7.463	4.182	7.332	20.347	32.967
June	5.932	6.936	5.836	6.749	25.170	31.011
July	5.659	6.352	5.531	6.185	24.611	28.137
August	4.656	6.244	4.520	6.088	21.946	29.734
September	4.610	6.810	4.490	6.699	23.151	30.786
October	4.600	7.000	4.499	6.898	23.994	30.716
November	5.155	7.042	5.078	6.945	26.278	30.500
December	5.355	......	5.266	......	28.807	......
Year	4.673	......	4.567	......	22.917	......

Spelter	New York		St. Louis		London	
	1915	1916	1915	1916	1915	1916
Jan.	6.386	16.915	6.211	16.745	30.844	89.810
Feb	8.436	18.420	8.255	18.260	39.819	97.762
Mar	8.541	16.846	8.360	16.676	44.141	95.048
April	10.012	16.695	9.837	16.525	49.888	99.056
May	14.781	14.276	14.610	14.106	68.100	94.217
June	21.208	11.752	21.038	11.582	100.614	68.591
July	19.026	8.925	18.856	8.755	97.250	50.750
Aug	12.781	8.730	12.611	8.560	67.786	51.587
Sept	13.440	8.990	13.270	8.820	67.841	52.095
Oct.	12.800	9.829	12.596	9.659	66.536	54.159
Nov.	15.962	11.592	15.792	11.422	88.409	56.023
Dec	15.391	......	15.221	......	89.400	....
Year	13.230	......	13.054	......	67.553	....

New York and St. Louis quotations, cents per pound. London, pounds sterling per long ton. * Not reported.

Pig Iron, Pitts.	Bessemer‡		Basic‡		No. 2 Foundry	
	1915	1916	1915	1916	1915	1916
January	$14.59	$21.60	$13.45	$18.78	$13.90	$19.70
February	14.55	21.16	13.45	18.93	13.90	19.51
March	14.55	21.81	13.45	19.20	13.95	19.45
April	14.55	21.65	13.45	18.95	13.95	19.45
May	14.61	21.78	13.60	19.11	13.83	19.58
June	14.70	21.95	13.67	18.95	13.77	19.34
July	14.94	21.95	13.91	18.95	13.68	19.20
August	16.01	21.95	15.31	18.95	14.75	19.25
September	16.86	22.88	15.95	19.58	15.70	19.53
October	16.95	24.61	15.96	21.26	15.80	21.51
Novemoer	17.57	29.12	16.47	27.23	17.20	25.60
December	19.97	......	18.44	......	18.95	......
Year	$15.82	......	$14.76	......	$14.95	......

‡ As reported by W. P. Snyder & Co.

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The Big Pine Cyanide Mill

By C. H. Dunning*

SYNOPSIS—An 80-ton cyanide plant in Arizona obtains an extraction of 90% with milling costs of $1.37 per ton. The plant has several interesting features, among which are the method of starting the tube mills, the natural counter-current pulp and solution flow, and the absence of agitators due to the granular character of the ore.

The Big Pine Consolidated Mining Co. has recently completed the installation of an interesting cyanide plant at its mine 12 mi. south of Prescott, Ariz.

The ore occurs in a mineralized fault fracture in quartz diorite and consists of fragments of altered quartz diorite of variable size cemented together by quartz carrying gold, silver and iron, with a very little lead and no copper or zinc. The oxidation extends in most places to 500 ft. in depth, and of the 70,000 tons the company has developed, about 50,000 is oxidized ore. The ore in the mine averages $9.50 per ton, and it is expected that the mill heads will average at least $8 per ton. The mine is exceptionally well situated for economical operation, and the ore is being delivered to the mill at a cost of about $1.25 per ton.

The ore is run out of the tunnel by hand to the mill and is dumped upon a grizzly with 1½-in. openings in the usual manner. Just before dumping the trammer adds about 2 lb. of lime to each ton car. The oversize from the grizzly is shoveled into a 9x15-in. Blake crusher set to crush to 1½ in. The man at the crusher sorts out all very hard pieces of ore, which he throws into a special chute to be used for tube-mill pebbles.

The bin is rectangular and holds about 100 tons. It has a flat bottom and is set on posts with the bottom 7 ft. from the ground. Two plunger feeders in the bottom discharge upon a 12-in. conveyor running lengthwise under the bin. This in turn discharges upon another conveyor at right angles, which carries the ore to a set of 11x27-in. Colorado Iron Works rolls. This roll is only a temporary installation and is doing over duty in crushing from 1½ in. to about ¼ in. It will be replaced later by a ball mill.

The rolls discharge upon a short conveyor which carries the ore to the box in which the tube-mill scoop operates. Cyanide solution of 2 lb. strength is introduced at this point. The tube mill is 5x22 ft. and runs at 28 r.p.m. It is operated by a 100-hp. three-phase 220-volt motor. The motor is rigged with a reversing switch so that throwing the switch in one direction will drive the mill one way, while throwing it the other way will reverse the direction of the mill. This is a very simple electrical device and has been found to be of great assistance in starting the mill. The switch is first thrown in one direction and the starting lever thrown over on the starting side. This will drag the mill around for a few feet to a point where it will stop. The starting lever is then thrown out and the switch quickly reversed and the lever thrown in again. For a moment the load in the mill is working with the

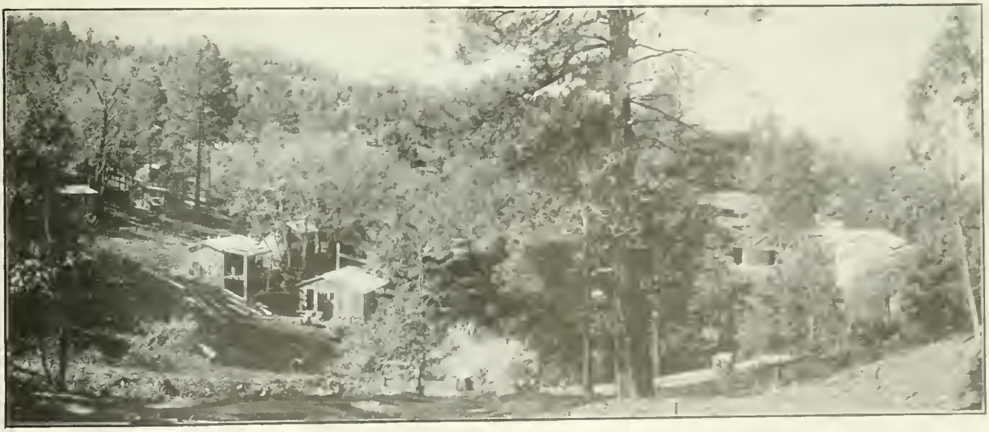

FIG. 1. THE CAMP AND MILL OF THE BIG PINE CONSOLIDATED MINING CO.

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*Manager, Big Pine Consolidated Mining Co., Prescott, Ariz.

motor and considerable additional momentum is obtained on the back swing. After two or three reversals of the switch a complete revolution is obtained, the mill picks up speed and the starting is completed. I can strongly recommend this simple little device to anyone having trouble in starting tube mills.

Hard mine ore is largely used for tube mill pebbles. Rounded pebbles of hard blue diorite from a local creek are also used when the mine ore cannot be obtained in sufficient quantity. About three tons per day is necessary, and the loading is done through the door.

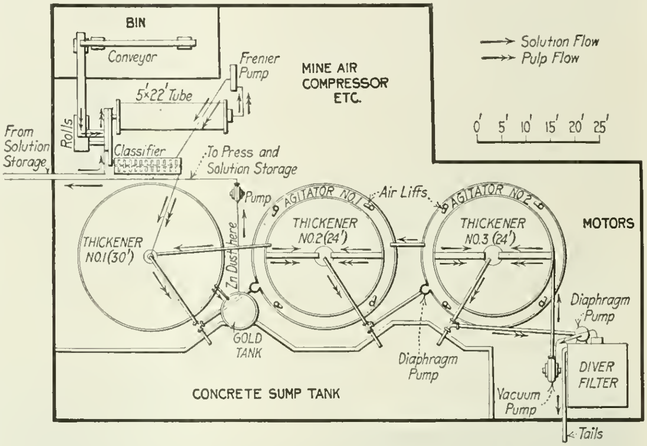

FIG. 2. GENERAL ARRANGEMENT OF THE MILL

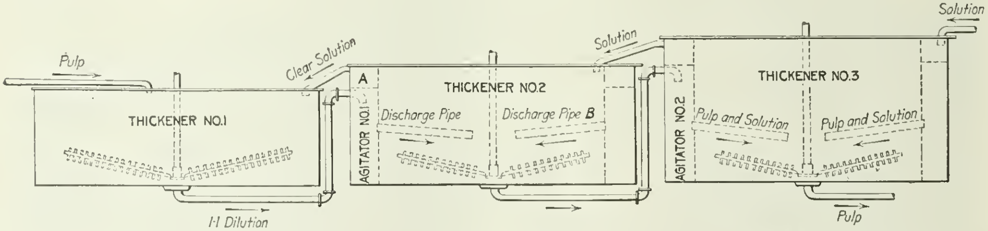

FIG. 3. THE AGITATOR-THICKENER SETS. SHOWING THEORETICAL COUNTER-CURRENT PULP AND SOLUTION FLOW

The discharge from the tube mill is maintained at about 40% moisture and goes through an 8x54-in. Frenier pump to a 45-in. Akins classifier. The classifier separates at about 100-mesh, the sands dropping directly into the tube-mill feed box and the slimes going by gravity to the No. 1 Dorr thickener on the next floor. An extraction of about 75% is obtained up to this point. The No. 1 thickener is 30x11 ft. The overflow runs into the gold-solution storage tank. No clarifying tank has been found necessary. The storage tank is connected to the suction of a Dean triplex solution pump, zinc dust being fed in between. The pump forces the pregnant solution through a Merrill press, which is set on top of the barren-solution storage tank and drains directly into it. This tank is set on trusses directly over the tube mill, and it has been found advantageous at times to have it inside of the building. The thick pulp at 50% moisture is lifted by a 4-in. diaphragm pump into agitator No. 1. The agitators are of a modified Parral type, the invention of D. H. Bradley, Jr., and I believe this is the first installation of the kind.

They consist of an annular tank 3 ft. wide surrounding a 24-ft. Dorr thickener. In it are arranged at equidistant points four 6-in. air lifts which pick up the pulp at the bottom and discharge it just below the surface with considerable force, so as to give the mass a swirling motion. The air lifts are set at the outer edge of the tank and discharge tangent to the inner edge in order to take care of any tendency toward an accumulation of heavier particles near the outside. Two 4-in. pipes carry the discharge from the agitator to the center of the inside thickener, just below the clear solution level. The agitator is fed continuously, and discharges continuously to the thickener.

An interesting feature of one of these agitator-thickener sets is the natural counter-current flow of pulp and solution theoretically possible. This is due to the fact that the pulp in the agitator above the discharge point is of a much higher specific gravity than in the thickener above the same point. Referring to Fig. 3 the pulp in thickener No. 1 flows by gravity to agitator No. 1 until it reaches the level *A*, which is the level of the pulp in thickener No. 1. In the agitator an even dilution of 3 to 1 is maintained throughout the tank. The pulp flows through the discharge pipe *B* to the thickener No. 1. *B* is placed at approximately the bottom of the clear-solution level and goes to the center of the thickener so as not to spoil the efficiency of the settling. Therefore in the outside agitator above the pipe *B* we have a 3 to 1 pulp, while in the inside thickener above this same point we have nearly a clear solution, and the difference in specific gravity forces the solution in the inside thickener to a level about 16 in. higher than in the outside agitator, where it flows by gravity back to No. 1 thickener. The same applies to the next set and so on, so that by adding pulp at one end of the system and solution at the other both will flow by gravity in opposite directions.

This has not been attempted in practice, however, on account of the fact that the pulp is often so sticky and thick that it would clog the pipes. It is assisted out of each thickener by a diaphragm pump. A Marsh 14x12-in. air compressor running at 80 r.p.m. and consuming about 10 hp. supplies sufficient air at 7 lb. pressure for the eight air lifts in the two agitators. A blower would no doubt be a more economical method of obtaining the air, as this compressor is not designed for that kind of work.

In No. 1 agitator the thick pulp is diluted to 3 to 1 by the clear overflow from No. 3 thickener. No cyanide is added after this agitator, the remainder of the plant being merely for washing purposes. The thick pulp from No. 2 thickener goes to No. 2 agitator, where it is diluted by the solution from the filter vacuum pump.

The pulp from No. 3 thickener goes to a 9x14-ft. Oliver filter. The solution and wash from the filter are drawn through the vacuum pump and discharged to No. 2 agitator. The tailings are discharged upon a conveyor belt. An extraction of over 90% is being obtained.

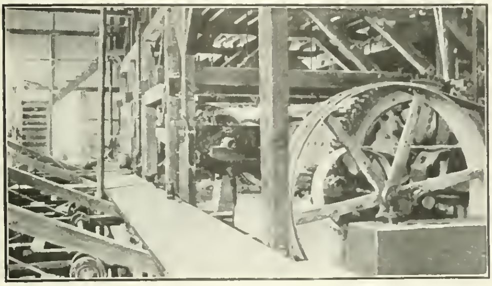
FIG. 4. TUBE MILL AND RUNWAY

The ore does not make a true slime, but rather a fine granular product that settles readily. Furthermore, it was found unnecessary to grind very fine, and the resulting comparatively coarse product gave considerable trouble in the agitators by settling between the air lifts. Since an exceptionally high extraction was obtained in the tube mill, it was decided to try the experiment of eliminating agitation altogether. This worked out very well, and the mill is now running without agitators. These agitators probably would be entirely successful on a true sliming ore.

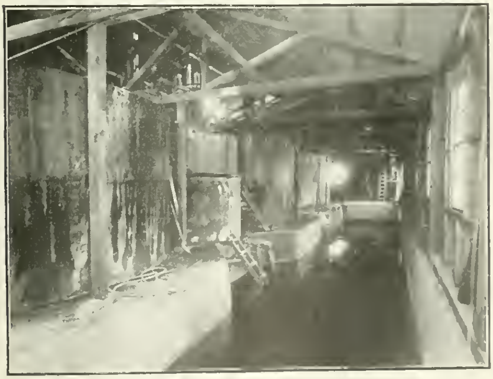
FIG. 5. AGITATOR-THICKENER SETS AND SUMP

The main part of the mill consists of the two floors mentioned, one containing the grinding machinery and the other the cyanide tanks and filter. However, there is a small third floor running along the front of the mill, which forms a concrete tank of 10,000 cu.ft. capacity. The mill has concrete floors which drain into this tank, and any leakage or breakage throughout the plant is caught here. This tank has performed good service and has paid for itself several times over. If necessary, we can empty any tank in the mill and flush the contents with fire hose into this sump, whence it can be pumped back to the classifier.

The mill has not operated long enough to obtain an accurate account of costs, but they are approximately as follows per ton on an 80-ton basis. The consumption of cyanide is 0.5 lb. per ton; zinc dust, 0.5 lb.; lime, 2 lb.; power at 2c. per kw.-hr., $0.11; labor and superintendence, $0.14; chemicals, etc., $0.27; repairs and miscellaneous, $0.25; making a total cost per ton of $1.37

* * *

The Mining Debris Problem

A notable contribution to geological literature in its broadest relations has been completed for publication by the United States Geological Survey. The report, which will be issued during the coming year, is entitled "Hydraulic Mining Debris in the Sierra Nevada" and represents an extremely thorough investigation by Grove Karl Gilbert. In a memorial presented to the President of the United States in 1905, the California Miners' Association, after emphasizing the contribution of placer and hydraulic mining to California and to the nation, expressed the conviction that a rational application of the natural laws governing the deposition of sediment from torrential streams would permit both hydraulic mining and agriculture to be carried on in this region, not only without hinderance to each other, but to their mutual advantage. In the belief that the question was primarily geological, as it involves the study of erosion and of sedimentation in the mining districts as well as in the lower valley regions, the association requested that the Director of the United States Geological Survey should be instructed "to undertake a particular study of those portions of the Sacramento and San Joaquin valleys affected by the detritus from torrential streams."

The investigation then begun by Mr. Gilbert was planned to include a field study of the natural phenomena connected with the problem and a laboratory study of the laws of transportation of detritus by running water. The results of this laboratory study have already been published in Professional Paper 86 of the United States Geological Survey, entitled, "The Transportation of Débris by Running Water," and the report just prepared, which deals with the geologic and physiographic phases of the problem, presents the results of the completed investigation and contains conclusions much broader than the answers to the specific questions raised by the California Miners' Association.

This report, which will be published as Professional Paper 105, will also assist materially in solving the problem, which involves mining, agriculture and navigation. The studies cover every phase of the subject, from the original source of the detritus in the Sierra Nevada to the possibility of its transportation through the Golden Gate to the Golden Gate Bar, and in this broad treatment Mr. Gilbert has not only estimated the waste due to agriculture, grazing, roads and trails, and mining and traced its movement seaward, but he has supplemented his observations and estimates with instrumental surveys of impounded detritus as well as with measurements of tidal currents in the Golden Gate.

The investigator appreciated the fact that the problem was complex, involving many factors other than those directly connected with mining, and recognized that the beneficial use of these rivers, now overburdened with débris, must be effected by coöperative endeavor on the part of several interests. The public interests in agricultural reclamation, as well as in placer mining, must now be harmonized with the public interest in navigation. In its conclusions, therefore, this scientific study, which had its origin in the antagonism of mining and agriculture, is found to involve a question of relative values between commerce and agriculture, as well as between mining and irrigation and power development.

* * *

Diagrams from Air Compressor

The accompanying indicator diagrams, by R. S. Hawley in *Power*, Dec. 12, were taken from the air cylinders of a two-stage tandem compressor. Figs. 1, 3 and 5 show the high-pressure diagrams, and Figs. 2, 4 and 6, the low-pressure diagrams. A 40-lb. spring was used for the high pressure and a 60-lb. spring for the low pressure. The valves of the compressor are of the spring-poppet type inserted in cages and the cages screwed into the cylinder head. The lower end of each cage presses against a copper gasket, which prevents leakage at that point.

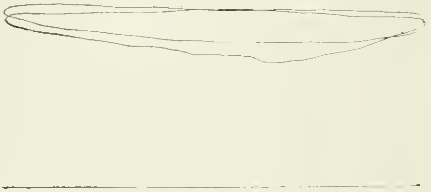

FIG. 1. VERY POOR DIAGRAM FROM HIGH-PRESSURE CYLINDER

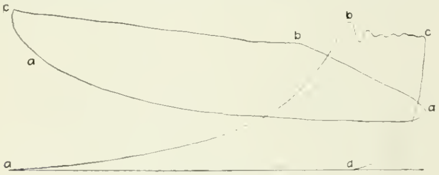

FIG. 2. LOW-PRESSURE DIAGRAM WITH LEAK IN INTERCOOLER INDICATED

Before the diagrams were taken the compressor was pounding badly, its strokes were not uniform and the low-pressure cylinder was excessively hot. Pressure in the receiver could not be maintained as usual, and the consequent decrease in the air supply was noticeable.

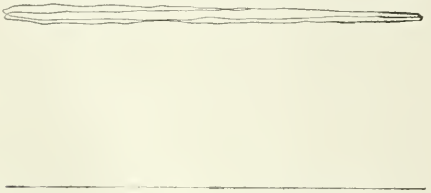

FIG. 3. HIGH-PRESSURE CYLINDER DOING LITTLE WORK

Diagrams 1 and 2 were then taken. Fig. 1 shows that the high-pressure cylinder is doing little work. The diagram is so irregular that it is impossible to follow the events of the stroke. The head end of Fig. 2 is nearly perfect in form, but the compression is too high. Air enters along line *da* at atmospheric pressure, is compressed along *ab* to about 60 lb. pressure and is delivered along *bc*. Reëxpansion of air in the clearance space then occurs along *cd*. The crank-end diagram shows that air enters this end of the cylinder at an average pressure of about 30 lb. This indicates a leakage from the intercooler back through the discharge valves into the cylinder.

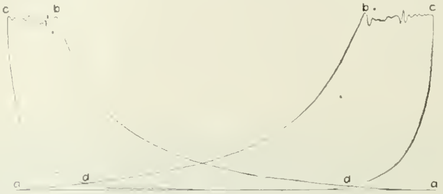

FIG. 4. TOO HIGH DISCHARGE PRESSURE FOR LOW-PRESSURE CYLINDER

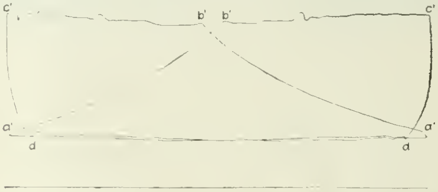

FIG. 5. HIGH-PRESSURE DIAGRAMS—REPAIRS COMPLETED

Examination of the valves on the low-pressure showed that the gaskets under the cages were all defective or broken out, allowing air to pass back into the cylinder from the intercooler. After these gaskets were renewed, diagrams 3 and 4 were taken. Fig. 4 is of good form, but the extremely high pressure of discharge indicates that the valves are operating against practically receiver pressure. Fig. 3 shows that little work is being done by the high-pressure cylinder, and since all the air must pass through this cylinder, considerable leakage through its valves is indicated. Examination of the valves of this cylinder showed that the gaskets were all so badly worn as to be useless, so the piston was simply churning air back and forth while the low-presure was doing all the work of compression. After repairs were made, Figs. 5 and 6 were taken. The compressor is working against too high a pressure for best results.

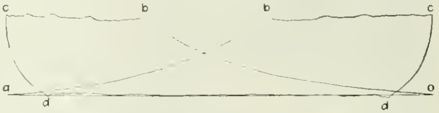

FIG. 6. LOW-PRESSURE DIAGRAMS—REPAIRS COMPLETED

* * *

Packing Between a Cylinder Head and the cylinder should be thin, the thinner the better. Thick packing is more likely to blow out, and the additional thickness unnecessarily increases the clearance in the cylinder.

Efficiency of Compressed-Air Installations—I

By Theodore Simons*

SYNOPSIS—One pound of air is followed through the various stages of compression, transmission and use, and the final efficiency is calculated. Its lowness (10-25%) calls attention to the need of care in compressed-air operation. Suggestions and examples show how efficiencies in compression can be increased by proper design of equipment.

The engineer who has occasion to study mining operations in various camps cannot fail to be struck by the surprisingly low mechanical efficiency of many of the compressed-air installations. Upon investigation he will find that unsatisfactory conditions are usually due to lack of a rational conception on the part of the operator regarding the occurrence of avoidable and unavoidable losses in such installations and to failure to realize the magnitude of these losses.

Air is such an unstable substance that an installation doing satisfactory work in one locality, if exactly duplicated in another, may prove a complete failure. In designing and operating the plant, all local conditions, particularly those referring to altitude, must be given due consideration in order to accomplish results that are satisfactory both from a technical and economic point of view. In this connection it must be borne in mind that the plant showing the highest mechanical efficiency is not necessarily the most economical one.

The Question of Mechanical Efficiency

The mechanical efficiency of a compressed-air installation, consisting essentially of compressor plant, pipe line and air engines, is evidently the ratio of the useful work performed by the air engines and the actual work required to produce and transmit the compressed air operating the engines.

Perhaps the most lucid way of realizing all possible losses that may occur in the production, transmission and use of compressed air is to follow a definite quantity of air—one pound, for instance—from the moment it enters the air cylinder of a compressor until it is exhausted from the cylinder of the air engine. To do this we must imagine that the pound of air, upon being discharged from the compressor, is left entirely to itself while traveling to and through the air engine and is not assisted in any way by new compressed air coming in behind it, as it is in actual practice at the expense of extra energy for which there is no useful return.

The theoretical net work required to compress adiabatically in one stage V_a cu.ft. of air from an initial absolute pressure P_a to an absolute pressure P_2 in pounds per sq.in. and to deliver the compressed air at that pressure into the receiver is

$$W_n = \frac{144 n P_a V_a}{n - 1}\left[\left(\frac{P_2}{P_a}\right)^{\frac{n-1}{n}} - 1\right] ft.\text{-}lb. \qquad (1)$$

in which $n = 1.406$.

First Loss[1]—Assume the outside temperature to be 62° F. Upon entering the air cylinder of the compressor, the temperature of the pound of air, as it passes over the heated inlet valves and cylinder walls of the compressor, is increased. How much we have no direct means of measuring. For our problem we will assume that it is raised to 80° F. The direct effect of this is an increase in the volume of the pound of intake air and, as a consequence, an increase in the power required to compress it. This loss is unavoidable, but can be minimized by properly dimensioning the compressor and providing it with ample cooling devices.

One pound of 62° air at sea level (atm. pres. = 14.7 lb.) occupies a volume of 13.111 cu.ft. Heated to 80° F., it occupies a volume of $V_a = 13.593$ cu.ft. To compress this volume adiabatically in one stage to 80 lb. gage and deliver it into the receiver requires theoretical work (from equation 1),

$$W_n = 71{,}400 \; ft.\text{-}lb. \qquad (2)$$

The volume V_2 which the pound of air occupies after compression, we find from equation

$$V_2 = V_a\left(\frac{P_a}{P_2}\right)^{\frac{1}{n}}$$

or

$$V_2 = 13.593\left(\frac{14.7}{94.7}\right)^{0.71} = 3.6 \; cu.ft. \qquad (3)$$

Second Loss—This is due to clearance and volumetric efficiency of the compressor. Clearance is necessary for well-known mechanical reasons. Its effect is the cutting down of volumetric efficiency. The clearance air, upon expanding on the return stroke of the piston, takes up part of the cylinder contents, leaving only a portion of it for incoming free air. As a result, at each stroke not a cylinderful of new free air is taken in, but a volume diminished by the volume of the expanded clearance air. This means that, in order not only to compress but to deliver a definite quantity of air per stroke, the volume of the intake cylinder must be made larger by the volume of the expanded clearance air.

The latter, in expanding, helps compressing an equal amount of air on the other side of the piston. Theoretically, therefore, clearance affects volumetric efficiency only and not the power required for compression. In practice, however, the fact that the compressor must be larger in order to take care of clearance losses entails more friction and therefore an increased consumption of power.

Third Loss—In addition to compressing air, the energy supplied to a compressor must also overcome friction and inertia of the moving parts of the engine. The energy consumed is a loss that is unavoidable, but can be minimized by intelligent design of the compressor and by proper care on the part of the operator.

Losses 1, 2 and 3, being due to variable conditions, are not susceptible of precise computation. It is customary to make allowance for these three losses by adding 15% to the theoretical power required for compression and delivery, as found by equation 1.

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*Professor of mining engineering, Mining Dept., University of Montana, Butte, Mont.

[1] In this paper all losses are based on [illegible] with operations carried on at sea level.

Referring to equation 2 and adding 15%, we get actual work:

$$W_n' = 82{,}200\ ft.\text{-}lb. \tag{4}$$

Fourth Loss—The theoretical absolute temperature of the pound of compressed air when leaving the compressor is

$$T_2 = T_a \left(\frac{P_2}{P_a}\right)^{\frac{n}{n-1} = 0.29}$$

in which $T_a = 80 + 461 = 541°$; $P_2 = 94.7$ lb., and $P_a = 14.7$ lb.
whence

$$T_2 = 930°\ absolute. \tag{5}$$

Under favorable conditions the actual temperature of the compressed air should be less, owing to radiation and water cooling. In many installations it is found to be more, because of imperfections of the compressor, such as leaks around piston and sticky discharge valves.

The volume of the pound of compressed air from equation 3 is $V_2 = 3.6$ cu.ft. In actual practice the air cools to outside temperature (62° F.) before reaching the air engines. If left alone its pressure would decrease to

$$P'_2 = P_2 \left(\frac{T_a}{T_2}\right)$$

in which $T_a = 62 + 461 = 523°$ and $T_2 = 930°$
whence

$$P'_2 = 53\ lb.\ absolute. \tag{6}$$

This represents a pressure loss of 42 lb. due to dissipation of compression heat. It is by far the greatest loss occurring in compressed-air installations and, in general, it is unavoidable.

UNAVOIDABLE LOSSES IN THE TRANSMISSION OF COMPRESSED AIR

The pound of air on entering the pipe line may be considered as occupying a volume $V_2 = 3.60$ cu.ft. (from 3) and to have a pressure $P'_2 = 53$ lb. abs. (from 6).

Fifth Loss—In passing through the pipe line, the air undergoes a further loss of pressure due to friction. The smaller the pipe the greater the friction and the greater the pressure loss. This loss is unavoidable, but can be minimized by ample dimensions of pipe. For our problem we will assume that the loss amounts to 5 lb. The pressure of the pound of air at the discharge end of the pipe line is, therefore,

$$P_3 = 48\ lb.\ abs. \tag{7}$$

This decrease in pressure is accompanied by an increase in volume, hence loss of potential energy due to loss of pressure is partly compensated by increase of volume.

The new volume will be

$$V_3 = V_2 \left(\frac{P'_2}{P_3}\right) = 3.60 \left(\frac{53}{48}\right) = 4\ cu.ft. \tag{8}$$

Sixth Loss—In compressed-air installations it often happens that the engines using the air are situated at a considerable elevation above the compressor plant. Failure to take that fact into account leads to unsatisfactory results such as may be observed in many existing installations.

If air at a given pressure is to be delivered through a pipe at a point above the compressor plant, it stands to reason that in addition to the energy required for merely making the air flow, as in a horizontal pipe, energy is required to lift the air from the compressor up to the point of use.

The problem usually appears in the form of an example such as: A set of mine pumps, situated 1,500 ft. vertically above the compressor plant require air at 80-lb. gage. The compressor is at an elevation of 5,000 ft. above sea level and is capable of compressing air to 90 lb. gage. How much pressure can we afford to lose in the pipe line?

Air pressures at different elevations may be ascertained very closely from the following equation:

$$log\ P_2 = log\ P_1 - 0.0000157\ h \tag{9}$$

in which P_2 = absolute pressure of air in lb. per sq.in. at top, P_1 = absolute pressure at bottom, and h = vertical distance in feet between top and bottom.

Atmospheric pressure at pumps (from equation 9), $\log P'_2 = \log 14.7 - 0.0000157 \times 6{,}500$; whence $P'_2 = 11.6$ lb. per sq.in.

Atmospheric pressure at compressor, $\log P'_1 = \log 14.7 - 0.0000157 \times 5{,}000$; whence $P'_1 = 12.3$ lb.

Absolute pressure required in air cylinders of pumps, $P_2 = 80 + 11.6 = 91.6$ lb. absolute.

Absolute air pressure required at bottom of pipe, neglecting friction, $\log 91.6 = \log P_1 - 0.0000157 \times 1{,}500$; whence $P_1 = 96.7$ lb. abs.

Since the selected machine compresses to 90 + 12.3 = 102.3 lb. abs., we can afford a pressure loss, due to friction in pipe line of 102.3 — 96.7 = 5.6 lb., and the dimensions of the pipe must be computed accordingly.

Had the machine in the instance stated been able to compress air only to 84 lb. gage, the air at the pumps would never have reached a pressure of 80 lb. gage, no matter how large the pipe had been made.

Loss 6 is unavoidable and cannot be minimized by any known means. To bring the compressor up to the same level with the pumps would entail an equivalent loss as explained under loss 10.

Seventh Loss—We have in the end a pound of air occupying a volume of 4 cu.ft. at a pressure of 48 lb. absolute to operate the air engine (equations 8 and 7). In order to overcome the friction of the engine near the end of the stroke and to cause the air to properly exhaust against the back pressure, the exhaust pressure P_1 must be somewhat above atmospheric pressure P_a at the particular locality; hence all the energy residing in the pound of compressed air is not available for doing useful work. This is an unavoidable loss.

The theoretical work W_n which a volume V_3 cu.ft. of air at an absolute pressure P_3 lb. can develop during admission and partial adiabatic expansion is

$$W_n = 144\left(P_3V_3 + \frac{P_3V_3 - P_1V_1}{n-1} - P_aV_1\right) ft.\text{-}lb. \tag{10}$$

in which V_1 = volume of exhaust air.

If the engine is adjusted to exhaust at 16.5 lb. absolute pressure (atm. pres. being 14.7 lb.), then

$$V_1 = V_3 \left(\frac{P_3}{P_1}\right)^{\frac{1}{n}} = 4 \left(\frac{48}{16.5}\right)^{0.71} = 8.5\ cu.ft. \tag{11}$$

$$W_n = 144\left(48 \times 4 + \frac{48 \times 4 - 16.5 \times 8.5}{0.406} - 14.7 \times 8.5\right) = 28{,}000\ ft.\text{-}lb. \tag{12}$$

Eight Loss—Part of the energy is consumed in overcoming friction, inertia, etc., of the air engine. To obtain the actual useful work performed, it is customary to subtract 15% from the theoretical work; thus,

$$\textit{Actual work } W'_a = 23{,}800 \textit{ ft.-lb.} \qquad (13)$$

MECHANICAL EFFICIENCY OF SYSTEM AT SEA-LEVEL

$$E = \frac{\textit{actual work performed by air engine}}{\textit{actual energy consumed by compressor}}$$

$$= \frac{23{,}800}{82{,}200} = 29\%$$

In the preceding calculations rather perfect conditions were assumed and unavoidable losses only were considered in the computation of efficiency.

Ninth Loss—In rock drills and underground mine pumps, compressed air is generally used nonexpansively, for the principal reason that such machines are simpler in construction, smaller in bulk, lighter in weight and therefore easier to handle and to manipulate. These advantages alone compensate to a large extent for the losses due to the air being exhausted practically at full pressure. In underground operations the loss is further compensated by the fact that the exhaust air furnishes ventilation that would have to be provided by other artificial means.

Using compressed air nonexpansively nevertheless entails an actual loss which it is well to recognize when planning an installation. Air drills of the reciprocating type, inasmuch as they perform useful work only on the forward stroke, are (theoretically) the least efficient machines as regards consumption of energy.

The theoretical net work in foot-pounds that a volume V_1 cu.ft. of compressed air is capable of performing, when used nonexpansively is

$$W_n = 144(P_1 - P_a)\,V_1 \textit{ ft.-lb.} \qquad (14)$$

in which P_1 and P_a = absolute pressure in pounds per square inch of initial and of back pressure respectively.

According to equations 7 and 8 the pound of air as it leaves the pipe line has a volume of 4 cu.ft. and a pressure of 48 lb. abs. If employed nonexpansively to operate an air drill, we can perform work (from equation 14) to the amount of:

$$W_n = 144(48 - 14.7)4 = 19{,}200 \textit{ ft.-lb. (theoretical)} \qquad (15)$$

Subtracting 15% for unavoidable mechanical defects, we get actual W_n = 16,300 ft.-lb. Since only half of the work is useful work, we have

$$\textit{Useful work of drill} = 8{,}150 \textit{ ft.-lb.} \qquad (16)$$

From equation 4, the actual work required to produce the 4 cu.ft. of compressed air is W'_n = 82,200 ft.lb.; hence the efficiency of the system, using air nonexpansively to run rock drills, is

$$E = \frac{8{,}150}{82{,}200} = 10\% \textit{ (approx.)} \qquad (17)$$

Such low efficiency, in spite of the assumption of rather perfect conditions, evidently points to the necessity of guarding assiduously against all losses that are avoidable.

THE EFFECT OF ALTITUDE ON EFFICIENCY

Tenth Loss—At high altitudes we shall find efficiencies to be still lower, though the conditions may be as perfect as at sea level. This is due to the fact that in order to produce at an altitude a certain volume of compressed air having a pressure of, say, 80-lb. gage, which is equal to a volume of 80-lb. air produced at sea level and can therefore do the same amount of work, we must start with a larger volume of free air at the altitude compressor and must therefore spend more energy in compressing it. The required volume may be ascertained either from tables or from the following equation:

$$V_1 = V_a \frac{P_a(p + P_1)}{P_1(p + P_a)} \qquad (18)$$

in which V_1 = volume of free air at altitude (atmospheric pressure P_1) which, after being compressed to a gage pressure p, is equal to a volume of 80-lb. air produced at sea level from a volume V_a of free air (atmospheric pressure P_a).

Solved for an altitude of 8,000 ft. above sea level (atmospheric pressure = 10.87 lb.), the pound of 80-lb. free air would occupy a volume of

$$V_1 = 13.593 \frac{14.7(80 + 10.87)}{10.87(80 + 14.7)} = 17.6 \textit{ cu.ft.} \qquad (19)$$

To compress this volume adiabatically in one stage to 80 lb. gage and deliver it into the receiver at that altitude requires (from equation 1)

$$W_n = 81{,}200 \textit{ ft.-lb. (theoretical)} \qquad (20)$$

and

$$W'_n = 93{,}400 \textit{ ft.-lb. (actual)} \qquad (21)$$

which is 14% more than at sea level (see equation 4).

The amount of work we can perform with this pound of compressed air is practically the same at the altitude as at sea level: that is, 23,800 ft.-lb. (from equation 13). This gives the mechanical efficiency at 8,000 ft. altitude as

$$E = \frac{23{,}800}{93{,}400} = 25\% \qquad (22)$$

THE AVOIDABLE LOSSES IN THE PRODUCTION OF COMPRESSED AIR

Eleventh Loss—Assuming that a compressor has been installed of proper design and capacity to supply the normal demands of a plant, it will nevertheless fail to do the desired work if not properly treated. The best compressor will fall short of the performance claimed by the builder, if, for instance, the intake air is not as cool as might be; that is, if it is taken from the sunny side of the compressor building or from near a boiler plant, etc.

Had the temperature of the pound of intake air been 90° F. instead of 62° F., it would have occupied a volume of 13.815 cu.ft. Upon being heated to, say, 100° F. by passing over the heated inlet valves of the compressor, its volume would have been 14.096 cu.ft. To compress to 80 lb. gage and deliver this pound of air at sea level, as before, would take (from equation 1)

$$W_n = 71{,}000 \textit{ ft.-lb. (theoretical)} \qquad (23)$$

Compared with equation 2, this shows an increase of 4% in the required power due to an increase of 28° F. in the temperature of the intake air, or 1% for every 7°.

The volume of the compressed air in the first case was V_2 = 3.60 cu.ft. (from equation 3); in the second case it would be

$$V_2 = 3.74 \textit{ cu.ft.} \qquad (24)$$

either volume weighing one pound. Since the energy residing in the pound of air for doing work depends on volume as well as on pressure, it would seem that though we spent more work in producing that increased volume, we could also perform more work with it. This would be true if the compressed air could be employed as soon as it leaves the compressor. But during transmission to the points of use all of the compression heat is dissipated.

The increase in volume due to an increase in the temperature of the intake air is therefore only temporary and not available for doing useful work. Hence the extra energy expended in producing it is sheer waste. This points to the advantage of bringing air to the compressor as cool as possible.

Twelfth Loss—Frequently compressors are installed that are not suited for the required work and are therefore inefficient. At camps situated far above sea level, I have often seen in operation small and large compressors designed for sea-level performance and therefore unsuited for the work. The effect of altitude has been pointed out under loss No. 10. Assuming that a compressor has been selected of a capacity corresponding to equation 13, the energy required to compress in one stage, say, 1,000 cu.ft. of free air per min. to 80 lb. gage at an elevation of 8,000 ft. above sea level (atmospheric pressure = 10.87 lb.) is 140 hp. (theoretical). (25)

A compressor designed to compress 1,000 cu.ft. of free air per min. at sea level consumes 160 hp. (26)

Using such a compressor at a higher elevation entails, a waste of energy for which there is no useful return.

For temporary work it may be quite legitimate to employ a compressor that can be bought cheaply, though not especially adapted to the work; but for continuous performance the compressor should be designed for the altitude at which it is to be installed.

Thirteenth Loss—Neglect of frequently removing the accumulated carbonaceous matter of the lubricating oil from the valves in the air cylinder leads to a contraction of the air passages, to an increase in pressure and temperature of intake and discharge air, and as a consequence, to a loss of energy. The wasteful effect of high temperatures has already been pointed out. Improper lubrication causes pistons to wear loose, permitting leakage of the compressed air into the intake side of the air cylinder. This, in its turn, results in a cumulative increase in the temperature of the intake air with the consequent losses referred to and with the danger of an explosion and all the expense and annoyance due to an interruption in operation.

Fourteenth Loss—A compressor not provided with an automatic regulator, when used to supply an intermittent demand, as happens so often in mining operations, is very wasteful of energy in that any surplus air is simply blown off through the safety valve of the receiver without doing useful work. This is another loss that is excusable only in temporary work when the extra cost of regulating devices is not warranted.

(*To be concluded*)

Chilean Nitrate Production

September was notable for the large exportation of sodium nitrate from Chilean ports, the 7,697,000 quintals (390,268 tons) shipped being the record for any month and an increase of 3,359,000 quintals over August, according to a recent communication in *Commerce Reports* of the Department of Commerce. This increase in exports was due to the unusual amount of tonnage available in the nitrate ports. The large shipments have served to reduce the stock of nitrate at coast ports, and recently some of the railroads have been taxed to their capacity to bring sufficient nitrate from the *oficinas* in the interior to supply ships waiting for cargo.

Production during September was about 669,000 quintals less than in the previous month, being 4,724,400 quintals, against 5,393,391 for August. Compared with September in the three preceding years, the production and exportation of Chilean nitrate were:

SEPTEMBER PRODUCTION OF NITRATE IN CHILE

	Production Quintals	Exportation Quintals
1916	4,724,400	7,697,000
1915	3,492,260	3,970,004
1914	2,855,330	2,119,891
1913	4,516,288	4,118,906

Prices of nitrate advanced during the month, but there were greater advances for early deliveries than for deliveries during 1917, and the market was much firmer for prompt supplies. Ordinary nitrate was quoted at \$1.95 to \$2.07 per quintal, depending on delivery offered. For refined, 96% less 1%, prices were \$2.11 for early delivery and \$2.03 for 1917 delivery.

Tunnel Survey Methods Used Driving Strawberry Tunnel

The Strawberry tunnel, constructed by the United States Reclamation Service in connection with the storage works of the Strawberry Valley Irrigation Project, is located under the rim of the Great Basin, in Utah and Wasatch Counties, near Provo, Utah. The tunnel is about 3½ mi. long and is straight for its entire length. The finished section is 7 ft. wide by 8 ft. 6 in. high, with an arched top. About 3 mi. of the tunnel was driven from the lower or west portal, and ½ mi. from the upper or east portal. As Project Engineer, J. L. Lytel was in charge of the construction of the tunnel, while the engineering work was in direct charge of F. W. Cater, Assistant Engineer. Several other engineers, of whom the writer was one, were employed from time to time on the routine engineering work.

The profile of the ground surface along the tunnel line was such that only two intermediate set-ups were necessary between the two portals. Four large concrete monuments were therefore placed along the tunnel line, one just beyond each portal and one at each of the two intermediate points. The exact location of the line on these monuments was checked from time to time and was finally decided upon some time before the work was started at the east portal. Two independent "double rodded" level lines were run along the wagon road between the two portals, a distance of about 7 mi.; and as these checked by less than 0.10 ft., which was close enough for construction purposes, no further work was deemed necessary. The distance along the line (about 3½ mi.) was determined with a slope board. Two independent measurements gave results differing by less than a foot, and so it was not thought necessary to determine the length by triangulation. This work was done by the resident or assistant engineer in charge and one or two rodmen, as necessary.

The construction line in the tunnel was carried on screw hooks placed on the center line of the tunnel, either on wooden plugs driven into holes drilled in the roof, or on timber sets where convenient. These screw hooks were placed 50 ft. apart throughout the tunnel, and a new one was placed whenever the last one became 125 ft. from the heading. In order to facilitate the handling of muck-cars in the heading a section of double track, about 200 ft. long and with a switch at either end, was kept as close to the heading as possible. Hooks to be used as set-up points were set with special care at a point approximately in the center of this section. By setting the transit up in this particular spot it was possible to move empty muck-cars from a point ahead of the transit to the heading and back, leaving them (when loaded) on the other track, but still ahead of the transit. In this manner, construction work was not in any way interfered with, which is perhaps the most important feature of tunnel surveying.

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*By L. M. Hammond, Assistant Engineer, United States Reclamation Service, Provo, Utah, in Engineering News, Dec. 7, 1916.

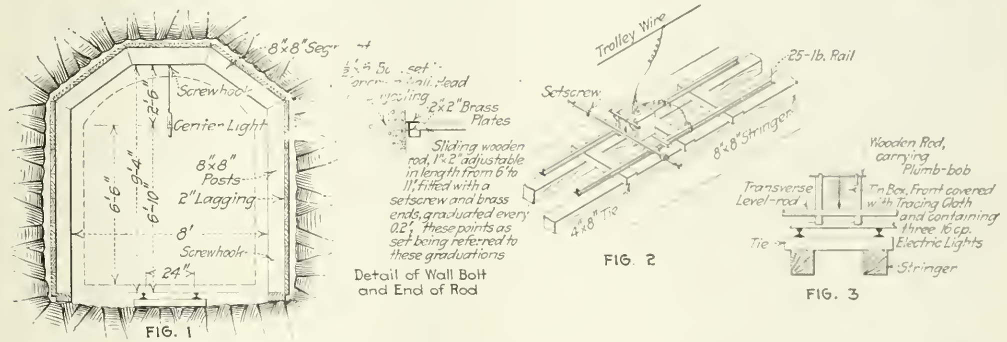
A plumb-bob suspended from the previous set-up point and illuminated by electric lights if convenient, and by candles if not, served as a backsight, so that only two men were required for this work, one at the instrument and the other at the foresight. When the screw hooks were placed in plugs in the roof, there was practically no danger of their shifting; but when placed on timber sets, they had to be checked constantly, and it was customary after taking a backsight to check on one or two intermediate hooks before setting the new point ahead.

After the center screw hook had been set, levels were run, the elevation of the bottom of the hook determined and a grade hook set opposite the center hook and 1 ft. above true grade. This latter was to assist in laying track and placing timber sets. For the leveling, any convenient hook was used as a backsight, and for reasons explained above a sight was always taken on at least one other hook. In using overhead benchmarks it was of course necessary to use the level-rod inverted and to subtract backsights and add foresights.

The location of the center lights and their relation to the screw hooks and the neat lines of the tunnel, are shown in Fig. 1. The elevation of the screw hook once determined, it was an easy matter to adjust the length of the wire holding the center light (a candle stuck in a bushing) so as to bring the flame of the candle to the springing line of the arch. There were two of these center lights, one for each of the last two center hooks set. To avoid confusion a metal tag was kept fastened to the head light. This system of center lights was devised to give the shift boss or superintendent line and grade without the necessity of calling on the engineer at any time of day or night that he saw fit, and it made it necessary for the engineers to go into the tunnel only whenever a new center hook was necessary—at every 50-ft. progress of the tunnel, or approximately every third day. By hanging the two lights on their respective hooks the shift boss had a "line of sight" that would give both line and grade, sufficiently accurate for his purposes, at the face of the tunnel (or any other point) at any time. Having one fixed point, it was easy for him to "spot" the location of the various holes to be drilled.

Control Line and Grade in Tunnel

Permanent benchmarks (for levels) were placed at various points in the tunnel, and the elevations of the construction points in the heading were checked up from one of these benchmarks at least once a month (from 300 to 500 lin.ft.). The elevations of the benchmarks were checked up occasionally from the portal benchmark. A 22-in. Gurley Y-level was used for all work, and sights were limited to 200 ft. and kept equal. While this instrument was somewhat heavy and cumbersome for tunnel work, the increased accuracy and its ability to hold its adjustments under somewhat trying conditions compensated for the inconveniences.


8"×8" Seg
Screwhook
2'-6"
Center Light
9'-4"
6'-6"
6'-10"
8"×8" Posts
2" Lagging
8'
Screwhook
24"
FIG. 1
2"×2" Brass Plates
Sliding wooden rod, 1"×2" adjustable in length from 6' to 11', fitted with a setscrew and brass ends, graduated every 0.2', these points as set being referred to these graduations
Detail of Wall Bolt and End of Rod
Trolley Wire
25-lb. Rail
Setscrew
8"×8" Stringer
4"×8" Tie
FIG. 2
Wooden Rod, carrying Plumb-bob
Transverse Level-rod
Tin Box, Front covered with Tracing Cloth and containing three 16 cp. Electric Lights
Tie
Stringer
FIG. 3

FIGS. 1 TO 3. SPECIAL SCHEMES IN STRAWBERRY TUNNEL SURVEY
Fig. 1—Sketch of location of construction-line points. Fig. 2—Arrangement for reading exact alignment on transverse level-rod. Fig. 3—Light-box

The apparatus used in checking the line is shown in detail in Fig. 2. For the first 2 mi. of tunnel, concrete monuments were placed at 1,000 ft. intervals along the floor of the tunnel and the line carried on them. At that point, however, a 7-sec.-ft. flow of water was encountered in the heading, which covered the floor of the tunnel with a foot or more of water and rendered useless all the carefully determined and preserved monuments up to that point. An entirely new system of marks was then determined upon and the line rerun several times.

Bolts were set in the concrete wall of the tunnel (or in the rock wall, if the tunnel had not yet been lined) about 1 ft. above the level of the water, with only their heads projecting. Three adjustable wooden rods were then made. The ends were capped with brass and had a small projecting brass lip (as shown), so that the ends of the rods could be made to rest upon and butt against the bolts on either side of the tunnel. The point was then determined on the rod. The rods were graduated to the nearest 0.2 ft., and the points as set were recorded as being so far to the north or south of any one graduation. It was thus an easy matter to take a numerical average of the location of the various shots. The rods were numbered, and the same rod was always used at any particular station. The point as finally determined was marked on the rod, and its location was carefully noted, so that it could be restored if obliterated. As temperature and humidity were practically constant, expansion and contraction were negligible; and it was possible for a point, once determined, to be relocated in practically exactly the same place at any future time.

These "benchmarks" were located at 1,000-ft. intervals (there were 16 between the west portal and the point where the headings met). The foresight was always kept at 1,000 ft., and the backsight was varied between 1,000 ft. and 5,000 ft. according to conditions.

The greatest difficulty, of course, was in getting the line started into the tunnel. In order to avoid heat waves and condensation of moisture, it was necessary to select a time when the temperature inside and outside the tunnel was about the same, but even with the best of conditions it was necessary to take more than 100 shots on each of the first two points in the tunnel before results satisfactory to the observers were obtained. Once inside the tunnel the work was much easier, and from 8 to 24 shots were usually sufficient to determine a point with a fair degree of accuracy.

One of the hardest tasks connected with the engineering on any construction feature, and particularly on tunnel construction, where all the work is being carried on in a very narrow space, is to do the engineering in such a manner and at such times as to cause the least delay and inconvenience to the construction. The superintendent is almost always intolerant of delays, and it is hard to convince him that the engineers have difficulties as well as he. In this case the engineering work was done with practically no delay whatever to the construction work.

Inasmuch as the driving of the tunnel was carried on with three shifts, a great deal of time was lost in disturbing and readjusting the instrument and sights to allow the muck trains to pass. The concreting gang worked only in the daytime; and so this engineering work was done at night, as it would have been absolutely impossible to dodge both muck and concrete trains and still do any work.

Light-Box and Instrument

The method of supporting and illuminating the plumb-bob is shown in Fig. 3. It will be noticed that the plumb-bob, its support and light are entirely independent of the rod on which is the "monument," being supported on the tramway tracks.

Six men were always used on this work, two each at backsight, instrument and foresight. The men at the instrument and foresight took turns with their work, while the extra man at the backsight acted as messenger whenever necessary. Owing to the fact that the work was done at night, in long shifts, in a very wet and comparatively cold place and in a tedious and painstaking manner, it was exceedingly fatiguing to all the party.

The instrument used was a large Berger transit-theodolite. It gave excellent results and held its adjustments well. The instrument used in the construction work at the heading was a small Buff & Berger transit, which did very satisfactory work.

When the two headings met, it was found that there was an error in alignment of 0.18 ft., in grade of 0.13 ft., and in chaining of 2.5 ft. Considering the difficulties encountered and the fact that at no time was construction work interfered with, these results were considered satisfactory.

The methods and apparatus described are not exactly original with this tunnel, they being in some respects patterned after the methods used in the Gunnison tunnel, Colorado; neither can the changes and improvements be ascribed to any one man. They are an evolution rather than an invention.

Corrosion of Cast Iron

According to B. Bauer and E. Wetzel, in *Mitt. K. Materialprüf.* 1916, XXXIV, 11-40, through *Journ. Soc. Chem. Ind.*, cast iron embedded in moist soil is subject to a peculiar form of corrosion, known as "graphitization," "iron cancer," etc., in which it is converted locally into a soft, friable, gray mass. The authors have investigated a number of cases of corrosion of this type and also made experiments with the object of producing similar effects in laboratory tests. Their results indicate that the fundamental condition for the production of corrosion of this kind is the presence of water in the liquid state. The phenomenon is usually associated with gray cast iron, but white cast iron may be corroded in a similar manner. The corrosion is accelerated by the application of an electric current—for example, by stray currents in the soil—but also takes place, though much more slowly, in the absence of external electric currents. The oxidation products of the iron, in a spongy condition at first, are retained in place by the network of graphite in the case of gray cast iron, or of cementite in the case of white iron, and are gradually agglomerated to a more or less firm mass. In gray cast iron the corrosion appears always to proceed from the laminæ of graphite and gradually to spread outward.

Taxation of Mine Proceeds

By A. L. H. Street[*]

The provisions of the Idaho statutes for taxation of mining property by assessing the net proceeds of operations for the preceding year, instead of basing the tax on the value of orebodies in place, were recently attacked before the United States District Court for the District of Idaho as being violative of the state constitution, which requires all taxes to be levied in proportion to value and to be uniform upon the same class of subjects. The court, however, upheld the validity of the statutes. (Hanley vs. Federal Mining and Smelting Co., 235 Federal Reporter, 769.)

⁂

Vanadium in Peru is found as the chief element of a mineral deposit, according to a recent consular report. The mines at Minasragra, the largest in the country, are the property of the American Vanadium Co. The exports of this mineral for the last five years were as follows: 1911, 2,251 tons; 1912, 3,048 tons; 1913 and 1914, exports suspended; 1915, 2,526 tons to the United States. The production is, of course, controlled by the vanadium company, which regulates its output according to its demands. Larger quantities, it is stated, could easily be produced. There exists a zone in the Department of Junin where numerous veins of asphaltite are to be found, which are analogous to the grahamite, gilsonite, and albertite found in the United States, with the peculiarity that nearly all contain vanadium, some having as much as 30% of vanadic acid in the ash.

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[*] Attorney at law, 829 Security Building, Minneapolis, Minn.

Reduction of Stope Contours

By J. J. Bristol*

SYNOPSIS—The ordinary reduction of stope contours is accomplished by means of pantographs, successive steps being required to accomplish the necessary scale reduction and also the reduction of inclined stoping values to horizontal components. A compact, rigid appliance to accomplish this result in one operation is described. This consists of a reduction pantograph to which is attached a cosine pantograph, the entire apparatus operating in a horizontal plane.

This article considers mainly the mechanical reduction of stope contours from the plane of the vein or slope plane to the horizontal plane by means of modified pantographs. These, while adaptable to various reductions or projections, have been evolved primarily in connection with the methods of stope measurement used on the Witwatersrand of South Africa and minor African localities as a means of quickly and accurately reducing the contours of stopes as plotted on the slope plane to the horizontal plane of the working plan.

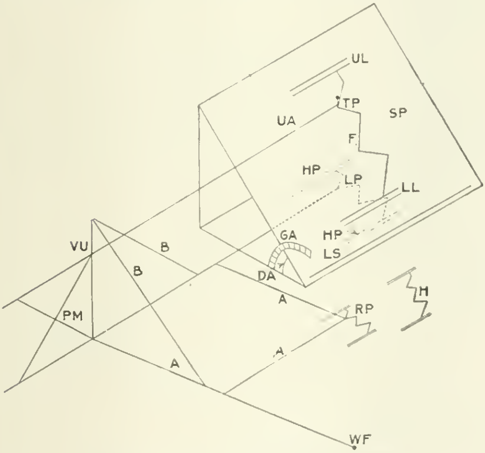

FIG. 1. ISOMETRIC PLAN OF STOPE SHOWING PRESENT PANTOGRAPH REDUCTION PRACTICE

Since the points used to determine the face contours are on the hanging wall, it is taken as the stope plane. The ordinary pantograph effects reductions equally proportional in two perpendicular directions. Besides the reduction required according to the ratio of the scale of the stope plan to that of the horizontal plan, a further reduction proportional to the cosine of the angle of dip in the direction of the line of dip is necessary. The other direction to which the dip line is perpendicular is the line of strike, both lines being in the slope plane. The line of strike is taken as the axis of *X* and the dip line as the axis of *Y*.

In order to render the application of the pantographs clearer, a description of the method of reduction ordinarily used follows. Fig. 3 represents a stope plotted on the stope plane, showing the monthly contours of the stope, the triangulation system of stope points used in the determination of the face contours by offsets from a tape held taut from point to point, the line of strike *LS* of the vein (drawn through point 1652A) and the dip line *DL*. Fig. 4 represents the stope on the horizontal plane, showing the reduced contours at trimonthly intervals. A scale equivalent to 10 ft. = 1 in. is placed on the stope plan, coinciding with the dip line, zero being at 1652A. An offset scale is then moved along the edge of the first scale so that the graduated edge intersects successively the points of change on the contour of the face and pillars. The distances along the first scale and the offsets are recorded; the distances are reduced proportionally to the cosine of the angle of dip (in this case of 30° 5′) most readily by means of a traverse table to single degrees. Then on the horizontal plan a scale equivalent to 20 ft. = 1 in. is placed with divided edge coinciding with the dip line, zero being at point 1652A. An offset scale is then moved along the edge of the first scale, the reduced distances and the offsets are laid off and the points connected according to the contour on the stope plan, the resulting contour being the reduced contour of the stope face and pillars. At best, when the transfers are made at quarterly intervals, the method is a laborious one.

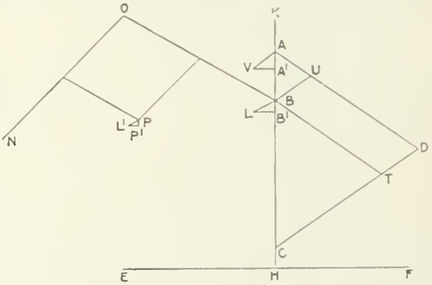

FIG. 2. BRISTOLS' METHOD OF CONTOUR REDUCTION

Present Pantograph Reduction Practice

Several schemes may be adapted for reduction, all involving the use of one or two pantographs. The one that first comes to mind is to revolve the stope sheet about the line of strike as an axis until the plane of the stope sheet makes an angle with the horizontal plane equal to the angle of dip, the line of strike being parallel to the horizontal plane. Then project the contour on the horizontal plane and reduce the projection with an ordinary pantograph in the required ratio of stope plan to horizontal plan. The actual projection may be eliminated and the reduction from the inclined to the horizontal [illegible] by moving over the face contour on the stope a vertical tracing point fastened to an auxiliary arm attached by a parallel arm to the [illegible] the pantograph on the horizontal plane, so that the upper tracing point is vertically above the lower point, which is raised from contact with the paper. The reducing point traces out the reduced contour.

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*The author died Aug. 30, of miner's phthisis contracted during underground work in the Transvaal and on the Gold Coast of Africa.—Editor

A tentative arrangement is shown in line only in Fig. 1. which is an isometric sketch to no particular scale and not representing an actual stope. *SP* is the stope plan placed on a drawing board turned up to the angle of dip with the line of strike *LS* parallel to the edge of board and also to the horizontal plane; *UL* is the upper level; *F*, the face contour; *LL*, the lower level; *UT*, the upper tracing point; *UA*, the upper, or auxiliary arm; *GA*, the divided arc for setting the drawing board to the angle of dip *AD*; *H* is the horizontal plan; *HP*, the horizontal projection of the face contour; *WF*, the weighted fulcrum; *A A A* are arms; *LA* is the lower arm; *LT*, the lower tracing point; *R*, the reducing point; *VU*, the vertical upright to guide the auxiliary arm; *B B* are braces to vertical upright; *P* is the parallel arm arrangement of pantograph; *RP* is the final reduced stope plan on a horizontal isometric plane; *H* is a transformation of *RP* from the isometric to the rectangular, showing the face contour.

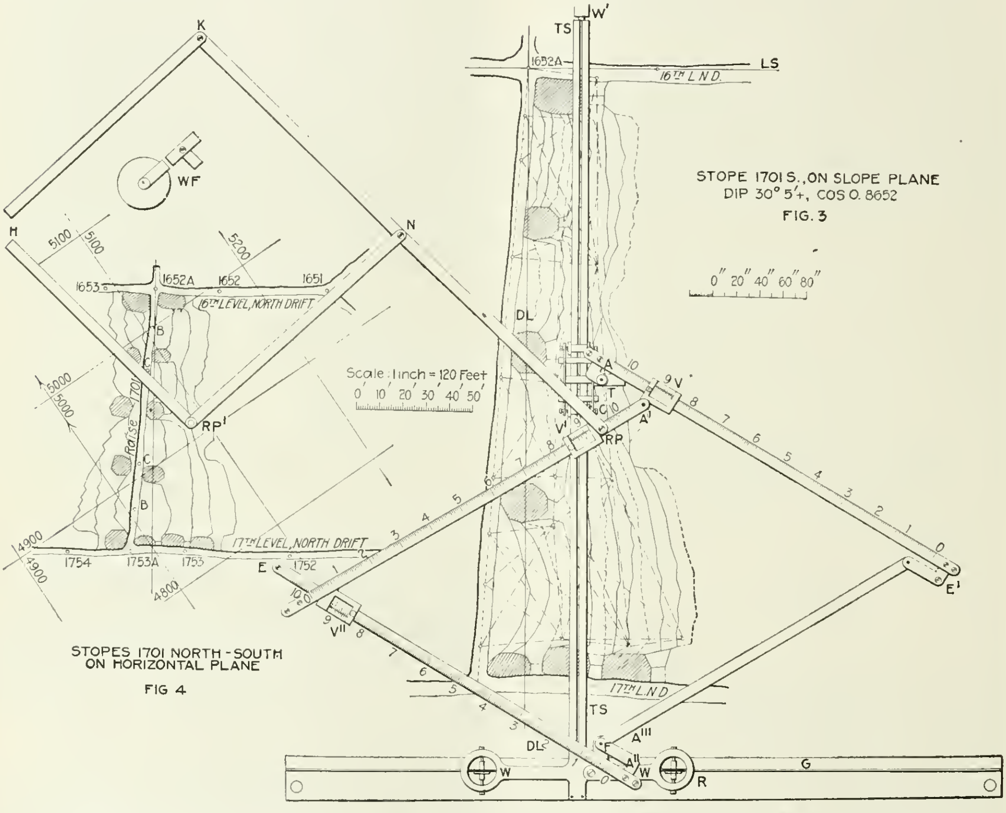

FIG. 3. SHOWING STOPE PLOTTED ON SLOPE PLANE AND FIG 4 SHOWING THE SAME STOPE PLOTTED ON THE HORIZONTAL PLANE, AND THE REDUCTION-COSINE PANTOGRAPH BY WHICH THIS IS ACCOMPLISHED

A seeming defect is that for a stope dipping 60° and with a length of back of 200 ft. the upper tracing point would have to be about 18 in. above the paper on the horizontal plane, giving rise to lateral error or else entailing a heavy cumbersome construction to insure rigidity. Some advantages are that only one pantograph is required, and the setting for the angle of dip is made directly by means of graduated arcs at the ends of the board, supporting the stope plan; whereas, other modified pantograph apparatus requires two pantographs and also that three settings of the cosine of the angle of dip be made on the auxiliary pantograph.

Seeking to evolve an apparatus that would be confined entirely to the horizontal plane, eliminating the drawing board, heavy clamps for fastening the board to the table, compact and less liable to distortion, the idea occurred to me that if an ordinary pantograph were constrained to move so that the line through the tracing point, reducing point and fulcrum moved perpendicular to a fixed straight line, with the fulcrum at a constant distance from the fixed line, in the direction of movement—that is, in the direction of the fixed line—no reduction would occur. However, in the perpendicular direction reduction would take place according to the setting of the pantograph arms. This would meet the requirements of the contour reduction. The direction of movement, or fixed line, would represent the line of strike, the perpendicular direction the line of dip and the setting of the pantograph arms the cosine of the angle of dip. Fig. 2 illustrates the idea graphically. *ABCD* represents a pantograph with arms set to the cosine of the angle of dip, *CT*, *TB* and *DU* representing the cosine; *A* and *B* are restricted to move along line *HK*, which moves perpendicular to the fixed line *EF*; hence *C* moves with *HK* and at a constant distance from and parallel to *EF*. As *A* is moved from *A* to *V*, *B* would move from *B* to *L*, the components of the movement of *A* perpendicular and parallel to the line of strike (represented by *EF*) being *AA′* and *A′V*; similarly *B*, *BB′* and *B′L*. *A′V* would be equal to *B′L* and *BB′* would be equal to *AA′* reduced proportionally to the cosine of the angle of dip. Similarly for an entire contour. Now if a second pantograph *ONBP* has the tracing point *B* attached to the cosine pantograph at *B*, with arms set to the ratio of stope plan to horizontal plan, then the reducing point will trace out the required reduction *PP′*. The fulcrum of the second pantograph remains fixed during the reduction, and *B* is raised from contact with the paper. If the ratio of the plans is 1 to 1, then the second pantograph is not attached to the cosine pantograph, *B* remaining in contact with the paper.

A mechanical arrangement with application to the reduction of a stope plan is illustrated in Figs. 3 and 4. *R* is a brass rail held from shifting on the paper by short needle points near the ends or by lead weights: *G* is a groove in the rail parallel to its edge, serving as a guide for the hardened steel wheels *WW* on hardened-steel spindles running in hardened-steel bearings on the short arm of the T-square *TS*. *TS* is supported at the outer end by the rolling wheel *W′*, so that *TS* can be moved easily along the rail. *TS* is perpendicular to the edge of the rail *R* as well as to the plane of the front or back faces of the steel disks of the wheels *WW*; the spindles of the wheels are parallel to the edges of *TS*. A pantograph with arms *A*, *A′*, *A″* and *A‴* has the fulcrum *F* on *TS* at *F*. Arm *A* is attached at the tracing point *T* to a frame *C* confined to and rolling on the long arm of *TS*. Arms *A*, *A′* and *A″* are graduated, the large divisions numbered from 0 to 10, each large division is divided into ten parts, each of these being subdivided into two. The verniers *V*, *V′* and *V″* are movable along arms and have nine of the last small divisions divided into ten parts, numbered from 0 to 50 by tens, so that the cosines of the angles may be set off to the fourth place of decimals by differences of 0.0005, which is sufficiently accurate for plotting purposes. Besides the support at *F* on *TS* and at *T* on *C*, the arms of the pantograph are supported at *E* and *E′* by ball rollers rolling on the paper. The frame *C* extends to the right of *T* and bears a ball roller similar to *E* and *E′* resting on the paper near the pointed end of the ivory tracing point *T*, so that as *T* is moved along the contours, it cannot scratch the stope plan. The secondary pantograph consists of four rigid metal arms, graduated with the usual tracing point attached to the cosine pantograph at *RP*.

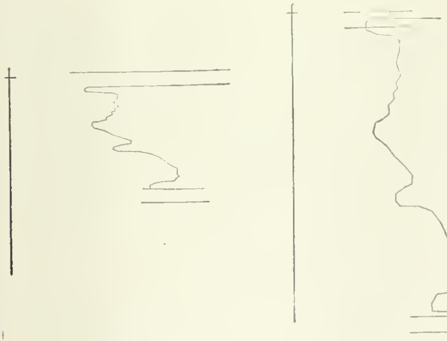
Fig. 5 Fig. 6

FIG. 5. REDUCTION FROM STOPE PLAN TO HORIZONTAL PLAN. FIG. 6. VERTICAL PROJECTION OF CONTOUR IN FIG. 4

The procedure of reduction is about as follows. The stope plan is placed on the horizontal working plan with the dip line parallel to the dip line of the stope on the working plan; the apparatus is placed with *TS* parallel to the dip line, the cosine pantograph with arms set to the cosine of the angle of dip; the secondary pantograph is set to the ratio of the plans for orientation, the tracing point *T* is placed at point 1652A on stope plan, and the weighted fulcrum *WF* of the secondary pantograph is moved until *RP″* coincides with 1652A of the working plan. *T* is then moved from point to point at change of direction of the face and pillar contours.

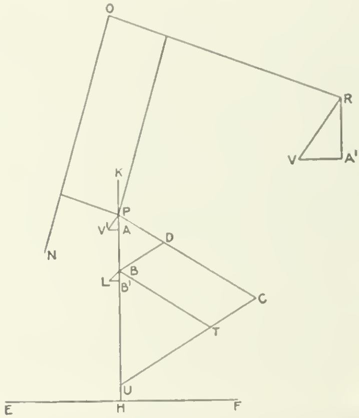

FIG. 7. REARRANGEMENT OF FIG. 2 TO PERMIT SMALLER MECHANICAL ARRANGEMENTS

At each point *RP″* is pressed downward, making a small dot; pressure is removed, and *RP″* is raised by a spring from contact with the paper. The points thus marked are joined, indicating the reduced contour. To protect the working plan from wear, a better procedure would be to place the apparatus in a fixed position on a separate table, making the reductions on tracing paper, transferring for orientation, position of reference point and dip line, then tracing contours on the working plan. With an assistant to do the tracing while making the reductions, the transfer is effected rapidly. If the ratio of the scales of the two plans is 3 : 4 or 7 : 8 or 1 : 1, this must be the method of transfer, as the reduction would not otherwise clear the stope plan.

Fig. 5 shows a reduction from stope-plan scale 10 ft. = 1 in. to a horizontal-plan scale 20 ft. = 1 in. of the last contour of Fig. 4, assuming that the dip of the stope is 80°. Fig. 6 shows the vertical projection, or reduction to the vertical plane of the last contour of Fig. 4, [illegible] 30° 5′, the roof and floor of the drifts being plotted from data of elevations. Also in Fig. 6, that part of the drawing showing face contour would be the reduction to the working plan on the assumption that the dip was 59° 55′.

Where the ratio of reduction from the stope plan to the horizontal plan is definitely established at 1 : 2 or 1 : 4 or 120 : 500 a rearrangement of Fig. 2, as shown in Fig. 7, is more advantageous in that the size of the mechanical apparatus, as compared with that of Fig. 4, may be materially reduced. The secondary pantograph now has the reducing point P attached to the former tracing point of the cosine pantograph at A (P of Fig. 7). B (R of Fig. 7) becomes the tracing point to be passed over the face contour. The reducing point B (of Fig. 2) of cosine pantograph remains the point B of cosine pantograph (see Fig. 7), now tracing the reduced contour on the working plan, instead of P of secondary pantograph of Fig. 2. Comparing the two procedures, one notices that in Fig. 2 the bench AV of the stope face is first reduced according to the *cosine of the angle of dip* to BL; that this reduction is then reduced by secondary pantograph in the *ratio of the stope plan to horizontal plan* to PL'; whereas in Fig. 7 the bench RV of the stope plan is first reduced by the secondary pantograph in the *ratio of the stope plan to horizontal plan* to PV', that this reduction is then reduced according to the *cosine of the angle of dip* to BL.

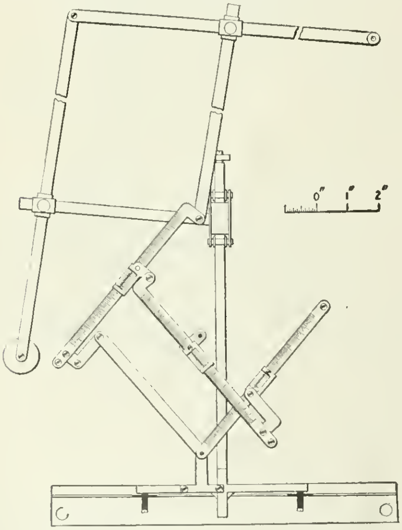

FIG. 8. COSINE-REDUCTION PANTOGRAPH

Fig. 8 shows, according to the rearrangement, a plan of a cosine pantograph with secondary pantograph for a reduction of 1 : 4 (a ratio generally in use) from the stope plan to the horizontal plan. The secondary pantograph is so arranged that the arms can be set to allow for expansion or contraction of the two plans.

Among several other schemes of reduction, one that merits attention and that may be converted mechanically is that represented by Fig. 9. This apparatus effects the combination of the component of motion of the tracing point of the pantograph parallel to the line of strike reduced in the ratio of the stope plan to the horizontal plan, with the component parallel with the dip line reduced to the combined ratio of the proportions of the stope plan to the horizontal plan, with the ratio of the cosine of the angle of dip to 1, the locus of intersections of the components being the required reduced contour. Referring to the diagram, if the tracing point T of a pantograph $FDRT$ is guided over the line TL, representing a single bench of a stope-face contour, then the reducing point R will trace out RL', TL being reduced proportionally in the ratio of the stope plan to the horizontal plan to RL', provided the arms RN, RB, DT and DF are set to the same ratio; the component TH parallel to the dip line OY being reduced to RH' and the component HL parallel to the line of strike OX reduced to $H'L'$ in the same ratio as TL. Now if two auxiliary arms VE and VA are attached to TD and DF respectively and set to the ratio of the cosine of the angle of dip 1 multiplied by the ratio of the stope plan to the horizontal plan, then as the tracing point T is moved from T to L, V moves to V'; TL, TH, HL are reduced to VV', VK', $K'V'$ in this combined ratio.

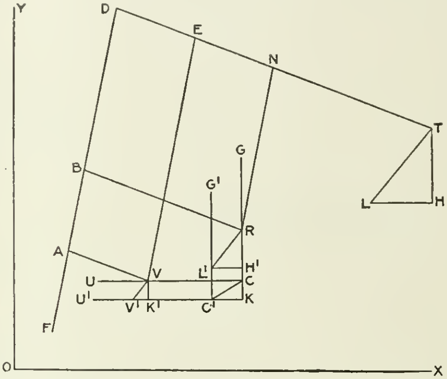

FIG. 9. COMBINATION COSINE AND SCALE PANTOGRAPH OPERATION TO GET HORIZONTAL VALUES OF ANY REQUIRED REDUCTION

If, at the beginning of movement of T, a square CGU is placed with edge GC in contact with V, contact being maintained throughout movement of T, with GC parallel to OY and hence CU parallel with OX, then as T is moved to L, C moves to C'; CK-VK' is TH reduced according to the combined ratio, and KC'-$H'L'$ is HL reduced according to the ratio of the plans, hence CC' is TL reduced from the slope plane to the horizontal plane. The reducing point C may be at any point on CU or CG or on any line parallel or perpendicular to CU or CG, so long as it remains fixed in reference to the intersection of CU and CG during the movement of pantograph. Orientation is secured by placing T on the stope plan at any point whose position is designated on both plans, with GC parallel to the dip line and moving the weighted fulcrum F until C corresponds to the same point on the horizontal plan. For general reductions the mechanical apparatus is impractical on account of the extreme length required for GC and UC for stopes dipping from 60° to 90° with ratio of plans from 3 : 4 to 1 : 1. For special cases, such as a ratio of 1 : 4 or 1 : 2 for dip angles from 0° to 90°, the mechanical apparatus is accurate, compact and moves freely. Two arrangements differing only in the method of securing parallel movement of the square that I applied to the reduction of stope shown in Fig. 4 gave precisely the same contours as shown in Fig. 3.

Apparatus based on principles similar to those illustrated in Fig. 1 costs on the Rand, £60 ($292), while the arrangement in Figs. 3 and 4, ordinary pantograph included, should not cost above £12 and £15 in Europe during normal times. If the office equipment includes a pantograph, then for the cost of the general cosine pantograph of Fig. 4, £10 would be ample, while for the special pantograph, £7 would suffice.

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Safety First at Omaha

For the last six months there has been such a remarkably low accident record at the Omaha plant of the American Smelting and Refining Co. that it can no longer be regarded as a "flash in the pan," but must be attributed to the excellent work of the management and the men themselves, says the *Safety Review* of the American Smelting and Refining Co. The manager of this plant, Walter T. Page, gives the following interesting description of the method used for securing these results:

In the chasing down of accidents and the very great reduction of same at this plant, the following method in outline has been adopted:

In the first place, the personnel of the plants is divided up into three committees, made up of the workmen of the various departments. The numbers are divided up as nearly equal as possible, and they are made up also with reference to exposure to accidents, so that they are as nearly as possible all on the same plant. Each of these committees has a flag, and the committee which has had the least number of accidents in any one month has its flag at the masthead as a recognition of its good services.

Next, we have a rule book. This rule book is a good one. It was made up by the superintendents' committee and also the foremen, and was subject to much discussion pro and con before it was published; in fact, it is the result of the best thought of the experts in the whole plant to avoid accidents in every department.

We may say in passing that this rule book is printed in four or five different languages to suit each employee as the case may be. Each man is given one of these little books and is required to learn the general rules and also the special rules of his department. The superintendents, when they have the time, instruct them, and the foremen likewise. After they have progressed to a certain point as individuals they give them an examination, and if they pass that examination they are given fobs to wear. The fob is a sort of a bronze affair hung with a little leather strap. It makes a very good watch fob and is rather sightly in appearance. The men vie with one another to get these mementoes and work hard for them. The task is not difficult, and it all stimulates each department to become familiar not only with their work, but with the dangerous practices connected with it.

If a man meets with an accident violating a rule, it goes hard with him. The men themselves will take him in hand, and the foreman will do likewise. Immediately after each accident a meeting is held, bringing together all the witnesses, and the responsibility is placed, it matters not on whom it may fall, and the decision reached is placed on all the blackboards in the plant. The greatest publicity is given to all matters pertaining to safety, and on entering the plant the first thing that greets the eyes of the workmen is a great blackboard on which any recent information is published. Blackboards are furnished to each department, and these are scanned daily by the men in that department.

Near the gate is a target with a red bull's-eye and for each accident the ball is moved out from the center one division.

If any department has made an especially good record, it is recognized on the larger bulletin board as well as the one in that department.

So much for the real prevention of accidents. Aside from the above committees, there is a superintendents' committee and the general foremen's committee. Each of these committees meets every two weeks. All the accidents are gone over and discussed and recommendations come in from both as to any improvement that might be made in the plant to make it a little safer. Suggestions from the foremen's committee are passed on to the superintendents for action, and wherever it is feasible and necessary, these recommendations are adopted and the changes requested is made.

We encourage suggestions from the men and the foremen and wherever there is sufficient merit they are considered and a remedy applied. We find that doing this makes the men and also the foremen feel that they have a voice in the operating of the plant for safety purposes, and it increases their interest correspondingly.

We have spent a good deal of money in buying safety devices. Very many of them are excellent, but we believe that the greatest amount of good has come not from these expenditures, but from inculcating the safety habit in the man employed as soon as he is enrolled on our books. Immediately he is given the Rule Book with the injunction that he is to become a safety man from that time forward—that he is to safeguard others as well as himself and is told that careless men are discharged as soon as their habits become apparent.

We have a physician who comes to the plant at 10 o'clock every morning and remains one hour or more. He makes a physical examination of all the men newly employed in the last 24 hours with a view to their desirability. Some are rejected immediately, but most of them are retained. The doctor being in the plant enables the old men who are in any way ailing to reach him with the least amount of difficulty on their part, rather than have them go to his uptown office, which is not so accessible. It is optional with them, however, as to which place they may see him.

One of the real difficulties which we encountered was to have the foremen or mechanical men in charge slow their work down to a point where their operations were conducted in a safe manner. There is always a tendency to push the job along. That is almost invariably one of the elements which we have in operating, and when the limit at which the men can move safely and securely is exceeded, you are going to have bad accidents. This was a difficult point to overcome, but I believe it has been overcome by continued and energetic effort and warnings.

One more point: We do not believe generally in bonuses and premiums in welfare work, but in one respect we have diverged a little from this. We give cigars to the departments that have gone through the month without accident. The cost is not great, and the benefit has been real. It makes a little distinction between those who have been careful and those who have allowed accidents to creep in.

In concluding I must add that the methods outlined are good, and that our safety and welfare man, Mr. Rasmussen, who is simply a bunch of enthusiasm in himself, has the happy faculty of imparting this enthusiasm to others, and is in this way largely responsible for our obtaining the results which show for themselves.

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Discovery of the Miami Mine

The story of the discovery of the Miami has been told with an increasing number of fancies as the years have gone by, and irresponsible itinerants have given free rein to their imaginations. The true account of the find, as vouched for by a well-known engineer, is as follows:

The red iron-stained hills of what is now Miami had been known for many years in the Globe district before anyone considered them worth locating. Late in 1906, however, Fred Alsdorf, then a young mining engineer, was attracted by the possibilities of discovery on the property and took an option to purchase. A few evenings later, Mr. Alsdorf met J. Parke Channing, consulting engineer for the General Development Co., and interested him to the point of taking an option on the property for his company. Incidentally Mr. Channing looked at the Inspiration property at about the same time, but was more favorably impressed with the showing on what later became the Miami.

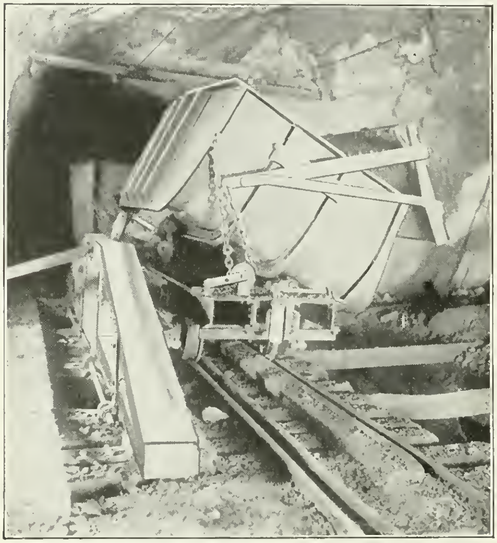
Aggressive development work was started, but ore was slow in showing up. At a depth of 190 ft. in the Red [illegible] shaft, the bottom was still in the leached zone. At this point Mr. Channing was called to New York and left the sinking in charge of Mr. Alsdorf. The latter continued sinking 20 ft. more and struck the [illegible] that made the Miami mine.

Details of Practical Mining

The Granby Mine Car

By C. M. Campbell*

The Granby company began shipping from its Phœnix mines in 1900. At that time the recovery was 31 lb. copper and $2.25 in gold and silver. In 1905 the shipments amounted to over 500,000 tons and the recovery had decreased to 24 lb. copper and $1.30 in gold and silver. This reduction in grade and the necessity for further reduction in order to include additional material in the reserves made a minimum mining cost imperative. During the five-year period referred to the cost of ore on cars was, therefore, brought down from $2 a ton to $1.14 and since then has been as low as $0.66.



THE 75-FT. GRANBY MINE CAR

During this period the haulage system has been entirely reconstructed. Electric motors running on a 3-ft. gage track with heavy rails and easy curves were introduced. Hopper-bottomed cars with a 10-ton capacity seemed to be the best at that time on the market, and this type was introduced. While a great improvement and very satisfactory when the ore was small, it was found that, as the bulk of the ore was coarse, the contents often had to be blasted out of the cars. This caused loss of time, extra cost for powder and labor and a heavy car-repair expense. For some time the possibility of an automatic side-dumping car had been under consideration, and in 1905 (when A. B. W. Hodges was local manager, O. B. Smith, mine superintendent, and F. J. Knott, mechanical draftsman), the type of car shown in the illustration was designed and 20 of them were put into commission. These cars, having a capacity of 95 cu.ft. each, have given satisfaction, the original installation being still in operation. The nature of the cars and of the dumping operation can be seen from the illustration. The motor goes ahead at slackened speed, and each car automatically dumps as the wheel on the box climbs the incline.

In later years various modifications of this car have been constructed. A smaller type, having a capacity of 75 cu.ft. has been used extensively. These cars operate on two levels where the gage of the track is 20 in. They are equipped with M. C. B. couplers and roller bearings. They all dump at an angle of 30°. This incline is satisfactory for Phœnix ores, which are coarse and comparatively dry. When the ore contains a proportion of fine, damp material, this incline is not steep enough. For this reason the cars recently constructed here for the Anyox mine, where a portion of the ore is fine and sticky, were built so that the incline of the box when dumping would be 45°. These cars, having a capacity of 135 cu.ft., also have a simplified leverage arrangement for opening the door, and as the door swings free, the opening will pass a rock 4 ft. in diameter.

Spring-Steel Prospecting Bit

By Sydney H. Ball* and L. S. Thompson†

In the southwest Virgina lead and zinc field the oxidized zinc orebodies are prospected by means of a light, spring-steel core drill. The cutting shoe of the drill, shown in Fig. 1, consists of a split steel ring 6 in. in diameter, beveled so as to make a cutting shoe and supported by a steel stirrup. The shoe weighs about 30 lb. and is operated as a percussion drill, being pulled about

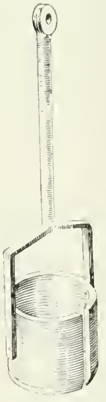


FIG. 1. CUTTING SHOE OF DRILL

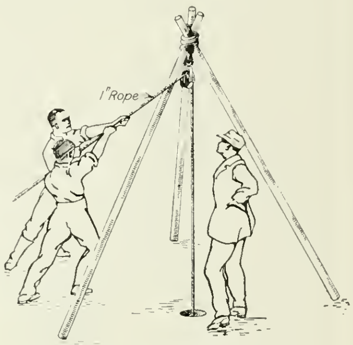


FIG. 2. DRILLING BY MAN-POWER

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*Superintendent, Granby Consolidated Mining, Smelting and Power Co., Phoenix, B. C.

*Mining geologist, 71 Broadway, New York.

†Geologist, 71 Broadway, New York.

every 6 in. (the height of the ring) and cleaned of its core of clay or oxidized zinc ores.

As usually operated, the shoe is slung from a 1-in. rope passed over a sheave mounted on a tripod, as shown in Fig. 2. Two men are employed on the rope to lift the bit, while a third stands at the hole to rotate the rope, direct the blows and throw the bit downward—as it is too light to work by gravity alone—and to clean the bit. From 40 to 50 ft. are drilled per day of 10 hr., the drilling costs, exclusive of fixed charges and re-sharpening being about 7c. per ft. The whole outfit, including tripod, rope and shoe, weighs from 150 to 200 lb. and is readily set up at a new location.

At the Ivanhoe Furnace Co.'s property at Ivanhoe, Va., Charles Huddle improved the drill by attaching a 2-hp. gasoline motor to a hoisting drum by a slack belt provided with a tightening pulley, as shown in Fig. 3. One man directs the blows, and a second operates the tightening pulley, hoisting and releasing the shoe. The mobility is increased by mounting the engine and head gear on a truck. This machine is claimed to drill 150 ft. or more per day at a somewhat less cost than with the hand type. The capacity may later be increased by the use of a 100-lb. bit and by replacing the driving mechanism with a friction clutch. Further, the machine may be made self-propelling by putting a chain drive on the truck.

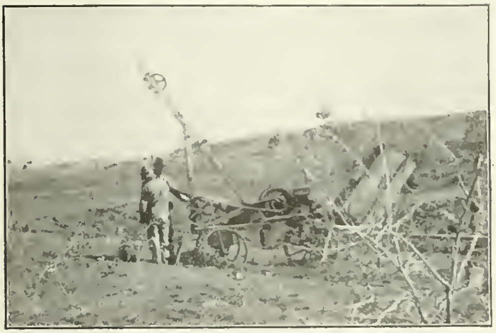

FIG. 3. IVANHOE FURNACE CO. PROSPECTING DRILL

This type of drill has proved to be efficient and economical in prospecting the sticky clays that overlie the oxidized zinc ores in this region. It is only satisfactory for prospecting plastic materials, permitting the retention of a satisfactory core in the annular piece of steel. As a cheap drill, however, to prospect for oxidized zinc ores, brown-iron orebodies and kaolin deposits, and sometimes to spud for diamond drilling, it has considerable merit.

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Motor Would Not Start

The failure of a continuous-current motor to start is usually due to one of several conditions, among which are the following, according to E. C. Parham, in *Power* Dec. 12, 1916: A dead line, an open-circuit, a short-circuit, a ground, low voltage and an overload. In case of a dead line or an open-circuit, unless the open-circuit happens to involve the shunt-field winding, there will be no sign of a flash when the starter is thrown on and off. In the case of low voltage, short-circuit, ground or of overload, however, there will be a flash when the starter is thrown on and off. In all cases except that in which failure to start is due to an excessive load, the trouble may be readily located by checking the connections and by testing the voltage and the insulation. The condition of overload in starting usually is not so easy to determine unless the motor is also found to be overloaded when running. Occasionally local conditions like the following suggest the cause of the failure to start.

A direct-current motor, which was used for the pumping of water and which was controlled by means of an automatic controller that was adjusted to close the motor circuit when the water pressure reached a minimum of 40 lb. and to open the circuit at a maximum of about 60 lb., was complained of because it would not start. Troubles as reported often need qualification, and in this particular case "would not start" meant that the operator had left the motor running all right one night and the next morning found the pressure well below the starting value, the motor stopped and apparently was unable to start. An inspector found that the apparent inability to start was due to a fuse having blown. On replacing the fuse, the motor started all right and promptly pumped up the pressure; but the pressure switch failed to operate even when the pressure had reached 75 lb. Above this pressure the decrease in the motor speed was plainly evident, and a grinding noise emitted by the motor indicated overload conditions; had the motor been permitted to continue to run, the fuses would have blown.

The whole trouble was due to the fact that someone had been tampering with the pressure-switch adjustment and had raised the cutting-out pressure to a value that overloaded the motor and caused its fuses to blow before the pressure could reach the value at which the switch would act.

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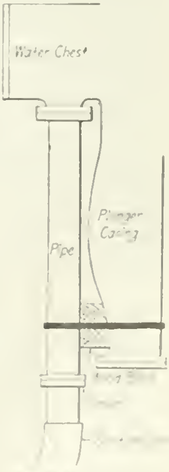
Steadying the Suction Pipe

The device illustrated herewith is for use on sinking pumps, and though it may be quite contrary to common practice, I have found it useful on a number of troublous occasions, says J. F. K. Brown in a recent contribution to *Coal Age*. In sinking it has always been my custom to use a length of pipe at the suction which will reach just below the bottom of the pump, and to attach the hose at this point with a union. This has been done because there is little room between the body of the pump and the pipe in which to place a union and to take off and put on the hose. It is easier doing it just below the pump. When this pipe was first used it caused trouble by frequently breaking off where it entered the pump, because of being knocked against the sides of the shaft in raising or lowering. To obviate this a piece of wood is now inserted as shown in the drawing. This has the effect of making this piece of pipe solid with the pump throughout its entire length. Breakage of this pipe is now rendered infrequent as the pipe is thoroughly steadied by the block and cannot vibrate.



THE STEADY BLOCK IN PLACE

Details of Milling and Smelting

Launder Flotation Machine

By B. M. Snyder*

The flotation machine described in this article is of the pneumatic type. It consists essentially of a series of short and flat launders placed side by side and connected by pipes or bypasses, each launder or cell having a separate air-box, or distributor, covered with canvas, for aëration of the pulp. It was designed in May, 1915, by George Crerar, who was experienced in the use of Callow machines, and it has been in successful operation during the year.

The launders, or cells (of which there are six in the machine as modified), are 14 in. wide and 6 ft. in length, each cell discharging at the end into the next cell in series, giving a travel for the pulp of 36 ft. The effect is the same as if the pulp were run through a straight launder (with baffles in it 6 ft. apart), but the construction is obviously improved by division of the launder into sections placed side by side. There is a drop of 3 in. from cell to cell, but each cell is flat-bottomed. The flat bottom permits an even distribution of air to the cell, as the depth of pulp and therefore the pressure is the same at every point. Each cell has its own air distributor, controlled by a globe valve. The drop of 3 in. from cell to cell provides sufficient hydraulic head to keep the pulp moving freely, and the greater depth of cell at the discharge makes it less easy to pull over gangue as the pulp becomes impoverished in mineral.

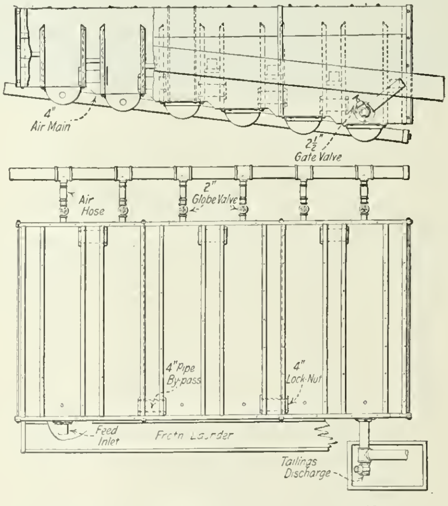
The narrow cells with froth launders on both sides facilitate overflow of froth, the maximum horizontal travel of bubbles being only 7¼ in. The froth launders are flat and are allowed to fill with concentrates and make their own slope to the main launder outside the machine proper. Water sprays are used in the launders if the persistence of the froth makes it necessary. The most effective spray is that produced by a single small stream of water shot down the slope of each launder under a good pressure.

The porous medium used has been 14- or 16-oz. canvas, 4-ply, sewed 1 in. centers both ways, being practically the same as used in Callow cells. They ordinarily last about six months before "blubbing" badly. The canvas bottoms are simply stretched and tacked while dry to the under side of the wooden cells, and the steel pans bolted tightly against them. No wire screens are used above the canvas, since the latter shows little tendency to bulge under pressure of air, on account of the narrow span. The air pressure required varies from 3 to 5 lb. per sq.in.; and is best supplied by a cycloidal blower designed for 6 lb. pressure. In the first machine built, porous bricks 1½ in. thick were tried, but on account of variations in porosity, were soon discarded.

The first cells built had sheet-iron baffles spaced 3 in. apart and reaching to within one or two inches of the canvas bottoms. These were intended to confine the travel of the pulp to a narrow space at the bottom of the cell and thus prevent the banking of sand, but in practice they were not found necessary and in later installations have been dispensed with.

The depth of pulp in the cells is usually maintained at about 12 to 24 in. in the deepest cell, the cleanest concentrates being made with a low pulp level. In the first machine the pulp level was maintained by float valves, but the simpler method shown in the accompanying drawing has been tried and found satisfactory. The gate valve is closed just enough to give an overflow in the standpipe, which can be raised or lowered by turning the tee. The gate valve passes heavy sand, and the overflow takes care of any excess of pulp. A series of drilled plugs could be used in place of the gate valve, or a valve similar in design to a molasses gate might be used to advantage.

The air distributors are simply air-tight steel pans bolted to the bottom of the wood cells and connected to the air main by 2-in. pipes and air hose, the latter suggested by J. C. Draper as a substitute for unions. The steel pans are not removed except for replacing canvas blankets, which ordinarily last about six months.



THE LAUNDER FLOTATION MACHINE

The control of air is effected by globe valves, which are conveniently placed at the ends of the air distributors. The operating platform is at the same height as the valves, and the operator walks along the line of cells, turning the valves with his foot, until the right overflow of froth is obtained.

As indicating the work the machine will do under proper conditions, the following results obtained in a typical ten days' run, are given: About 60 tons of ore was treated daily in one machine of the type described. The ore was crushed to pass 99.5% through 60-mesh and 94% through 100-mesh. Concentrates were recleaned in a

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*Mining engineer and metallurgist, 924 Washington Building, Los Angeles, Calif.

2-cell machine and then tabled for separation of lead-iron concentrates. The ore was low-grade blende carrying pyrite and a little galena in a gangue of quartz and siderite. Carbonate zinc was present to the amount of 0.2%. The oils used amounted to 1.1 lb. per ton of ore, of a mixture of 70% coal-tar creosote and 30% refined pine oil, added at the ball mill. Acid to the amount of 7 lb. per ton of ore was also added.

ASSAYS OF HEADS AND TAILINGS IN TEN DAYS' RUN

Date	Flotation Heads, % Zinc	Flotation Tailings, % Zinc	Concentrates, % Zinc
July 22	4.3	1.00	49.8
July 23	4.0	0.64	48.1
July 24	3.9	0.71	48.0
July 25	4.0	0.61	48.7
July 26	4.1	0.56	49.0
July 27	4.3	0.51	46.3
July 28	4.4	0.41	45.4
July 29	4.5	0.51	41.1
July 30	4.3	0.40	39.3
July 31	4.8	0.56	44.2
Average	4.26	0.592	45.99
Extraction of zinc by flotation			87.3%
Extraction of sulphide zinc by flotation			92.0%

In another plant the extraction by flotation in a similar run was 92.8% of the total zinc in the flotation heads, which averaged 13.2% zinc.

The machine is simple in construction and, except for the air distributors, can be constructed and erected complete in one or two weeks' time by any good carpenter or millwright. The air distributors are of simple design and can be made by any boiler maker, though to prevent air leaks it is best to have them made at a boiler shop equipped to weld joints by acetylene flame. The cost of a machine erected complete was as follows:

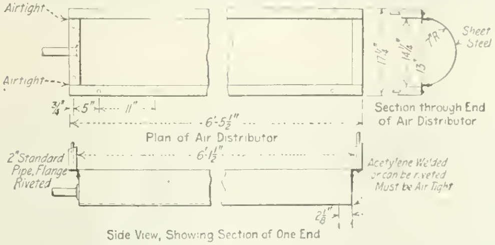
Airtight
Airtight
3/4"
5"
11"
6'-5½"
Plan of Air Distributor
17¼"
14¼"
13"
7R
Sheet Steel
Section through End of Air Distributor
2" Standard Pipe, Flange Riveted
6'-1½"
Acetylene Welded or can be riveted Must be Air Tight
2⅛"
Side View, Showing Section of One End

DIAGRAM OF THE AIR DISTRIBUTOR

COST OF THE FLOTATION MACHINE

Item	Cost
Tank lumber (tongued and grooved)	$31.15
Air distributors (made to order at boiler-shop)	113.72
Pipe fittings and iron rods for bolts (estimated)	116.00
Hauling material	15.00
Blacksmith labor on bolts (estimated)	18.00
Labor, carpenter and pipemen	164.25
	$458.12

The labor required to attend to the regulation of the cells is small; one man should easily look after six or eight machines under normal running conditions. The air valves do not require frequent changes, if feed, oil and air supply are regular. Regularity of feed (both as regards percentage of solids in pulp and its regular flow), regularity of oil and air supply, a constant pulp level in the cells and regular attendance will insure good results, once the matter of the proper "dope" to use has been determined.

The air required is seldom more than 10 cu.ft. of free air per minute per square foot of frothing area, and the power consumption under usual pressure (3 to 5 lb. per sq.in.) will not exceed 0.2 hp. per sq.ft. of frothing area. The air consumption of course varies considerably, according to the frothing character of the ore and oil mixture, whether ephemeral or persistent, etc. The capacity of the cells also varies widely with conditions. In one case 250 lb. of mineral was lifted daily per square foot of rougher frothing area, and this can be taken as a fair average.

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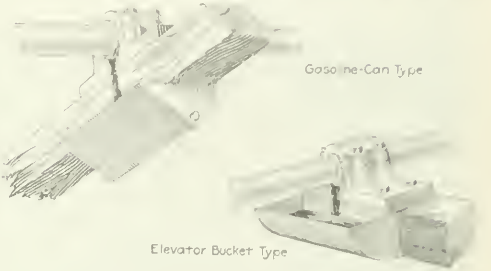
Shaft Oil-Drip Receptacles

The illustration from a recent contribution to *Power* by A. C. Daman, shows two line-shaft oil-drip receptacles, cheap, serviceable and homemade. Of the two the oil-can type, made out of half a five-gallon oil can nailed to the bottom of the timber directly under the line-shaft bearings, is the cheaper. Use is made of the spout to draw off the oil when necessary. The bucket type is easily made where old discarded elevator buckets are obtainable. The oil that accumulates is dipped out and put through a filter.



TWO EASILY MADE OIL CATCHERS

⁂

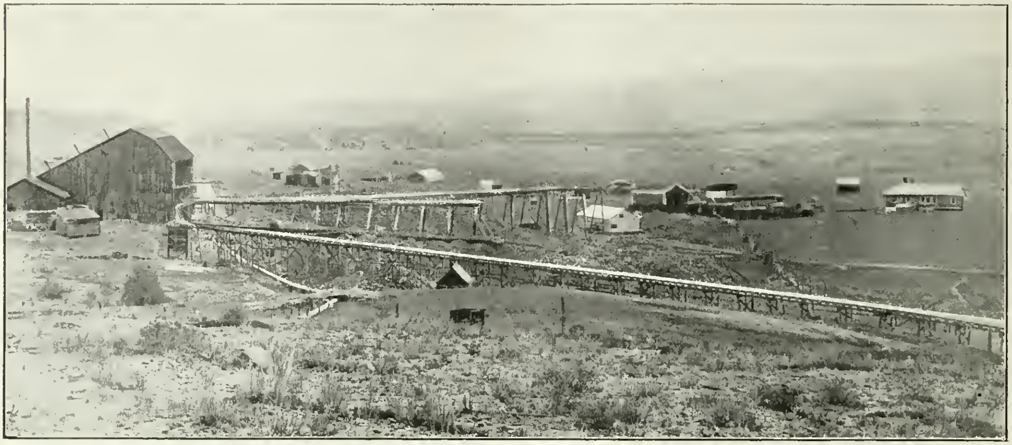
Protecting the Gas Ports of Openhearth Furnaces

In order to overcome the rapid deterioration of the gas nozzles of openhearth furnaces, caused by the action of the intensely hot outflowing gases, rendering the furnace unfit for use until repaired, says *Iron Age* Nov. 30, 1916, James W. Barnes, Youngstown, Ohio, has provided a mechanism (U. S. Patent 1,186,370) whereby communication between each gas nozzle and its gas chamber is cut off at the outflow end of the furnace so that the hot products of combustion will pass from the furnace solely through the air outlets. An arrangement of ports and valves is also provided by means of which the gas nozzle at the supply end will be placed in communication with its gas chamber simultaneously with the cutting off of communication between the other gas nozzle and its gas chamber.

⁂

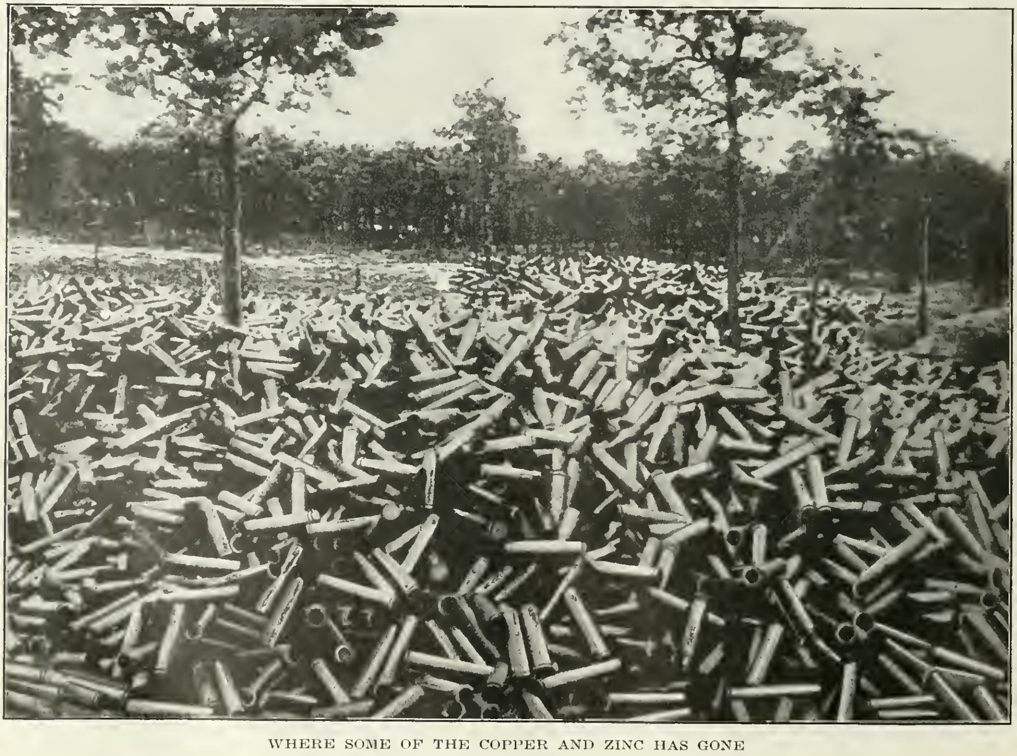
Mining in British Guiana, according to United States Consul George E. Chamberlin, of Georgetown, yielded [illegible] oz. gold valued at [illegible] in 1915, as compared with [illegible] oz. valued at $1,156,783 in 1914. About one-fifth was secured by dredging and the remainder by placer washing. The [illegible] output of diamonds was 6,293 carats valued at [illegible], as compared with 9,7[illegible] carats valued at $87,1[illegible] in 1914. Bauxite deposits are known to exist but have not yet been [illegible]. Some 13,000 acres of private lands have been [illegible] for [illegible] negotiations for Crown lands have been [illegible] on account of the European War. In the northwest district the [illegible] of oil has been reported. Applications for [illegible] licenses have been made but no satisfactory results have been obtained. Drilling is being carried on by only one party.

Photographs from the Field



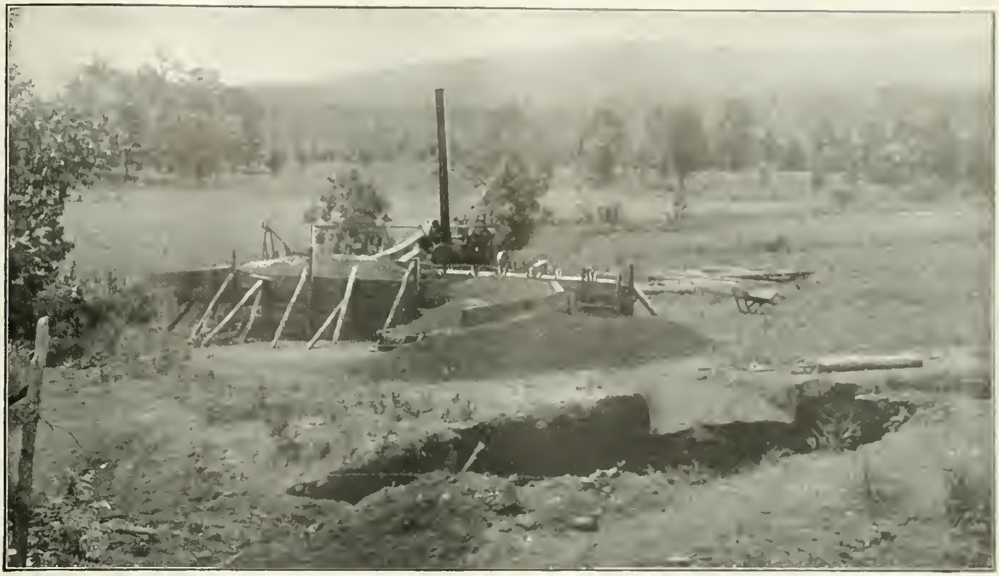
PLANT OF THE YOGO SAPPHIRE MINES IN FERGUS COUNTY, MONTANA

Fergus County, Montana, is said to be the only locality in the world where sapphires are profitably mined "in place," all other production coming from placers. The principal American deposit is now owned by a British company



WHERE SOME OF THE COPPER AND ZINC HAS GONE

Cartridge cases from ammunition expended by 75-mm. guns "somewhere behind the trenches"



A COMPLETE MANGANESE MINING AND MILLING PLANT AT CARTERSVILLE, GA
Openpit in foreground; in center, the log washer, power plant and the product of a season's operation

NOT A BATTLEFIELD SCENE—MERELY A TOO-AMBITIOUS ATTEMPT AT MANGANESE MINING IN GEORGIA

Correspondence and Discussion

Labor Conditions

A constant reader of the invaluable *Engineering and Mining Journal* for many years, I cannot agree with its views on the labor situation, as indicated partly by the reproduction in the issue of Aug. 12 of a paragraph from a circular published by the National City Bank, and partly by the *Journal's* comment thereon.

I have been a life-long student of labor, of the relations of the employer and the employee to each other, of their attitudes toward each other and toward the public, and of the attitude of the public toward them and their several problems. I have done this not as a student merely nor as an idealist, but as one actually employed and responsible for the employment of many thousands of others, as worker, timekeeper, foreman, contractor, superintendent, manager and owner, and feel that I can speak of this matter from a practical standpoint.

Without going into an analysis of the subject, which limitations of space would forbid, I concur with the opinion that there certainly is an "alarming increase in the inefficiency of labor" if we think only of the shiftless or "I. W. W." class among laborers. And this is really surprising, in view of the general progress of the workers. Then, too, there is a large number of employers who, in the handling of their labor, certainly must be classed as "inefficient." This is still more surprising in view of the great activity in recent years of efficiency and other industrial students. Much valuable knowledge has been obtained and printed on this most important topic, but as yet it has reached a very small percentage of our people. To this must be attributed this class of "inefficient" employers to whom we refer. A few of their greatest sins against efficiency are:

1. Some pay their men by the day, varying the rates according to the *class* of work rather than according to *class and amount* of work performed.
2. Some pay on contract or piecework basis, placing a limit, beyond which they refuse to go.
3. Some pay on contract or piecework basis, cutting the rates when men show their ability to earn more than the maximum allowed.
4. Some, when men on contract demonstrate their ability to produce much more than before, return to daywork, expecting to compel like efforts by the men.
5. Some, when on contract basis, charge exorbitant and fictitious prices for supplies.
6. Some, like the considerate and sympathetic employer referred to by the bank mentioned, pay an unusually high rate per day when business is good, with results almost invariably in line with those noted in the circular.
7. Some do not classify labor charges or keep close "tab" on labor costs.
8. Some do not make any effort to provide attractive quarters or surroundings for their employees.
9. Some who do, seem to think that these advantages should be accepted in lieu of better rates.
10. Some do not seem to realize the actual interdependence of the employer and employee classes.

Without wishing to criticize, I feel that the employer is under obligation to himself, his fellows, his workmen and the public, to study and acquaint himself with the results of various methods and systems of employment; and this obligation, by the way, extends also, in a measure, to engineering journals and to the leading magazines and industrial students of the country. Of course our labor and other governmental departments should make this whole problem an open book to the public, but the pernicious influence of the politician and the professional agitator will probably prevent this.

As an example of what I believe is a very general lack of information on the merits of different systems of employment, I cite the experience of a small corporation here, which for the last 15 years has employed a large number of men and almost invariably on the day-wage basis.

About six months ago laborers were very scarce, wages were high, the product was small, efficiency was low, markets for the product were active and prices soaring, and the little community was in the dumps. Something had to be done. A proposal to change to a contract and bonus system found company and men very skeptical, some dreading disaster in one direction and some in another. A few men were persuaded to give it a trial, and soon a very salutary change was effected.

As a result several men have more than tripled their earnings, about half had their wages doubled, others have added 50 to 75 per cent. to their daily earnings, and the average of all the rates has been raised approximately 50%, purely on an efficiency basis.

In the meantime the product has increased 400%, men have been attracted from outside, the property and community values have gone "skyrocketing," the profits, we are assured, are very gratifying, while unit costs have been lowered decidedly and everybody "wears a smile." There is an air of partnership and prosperity about the place, and the walking delegates have all left us.

The explanation seems to be that even in the best of times men can be found who are able, anxious and willing to do several times the ordinary day's work, but they are men of ambition who expect extra remuneration for doing it. What could be more like human nature?

The problems then, seem to be to reach such men, to conclude a satisfactory agreement with them, to be absolutely frank and fair and to ask and expect them to "hit the ball." In this case the contract and bonus system has effected the solution of the problem.

H. F. Ellard,
Superintendent, Pittsburg-Idaho Co., Ltd.
Gilmore, Idaho, Nov. 25, 1916.

[We concur in principle with all that Mr. Ellard has said and point out to him that it is not in conflict with the opinions expressed in the editorial to which he refers. He is fortunately able to report some experiences different from what were summarized in our article. In offering a generalization nobody, of course, excludes possibilities of exceptions.—Editor.]

The Huayni-Potosi Bismuth-Tin Mines of Bolivia

By Benjamin LeRoy Miller* and Joseph T. Singewald, Jr.†

SYNOPSIS—District is distinct from Potosi, the name being due to similarity of deposits. Spaniards worked oxidized silver ores and ignored tin. Bismuth discovered later and, with tin, now chiefly sought. Zinc present, but transportation cost is prohibitive. In one group well-defined veins occur in shattered zones. In the other group vein-system is less definite. Mining methods are crude and output is small. Work consists principally of development. Ores generally stamped to 16-mesh, classified or screened, and concentrated on tables, etc. Ores or concentrates containing over 5% bismuth are shipped without further treatment. Tin concentrates, shipped as "barrilla," carry about 65% tin.

The traveler passing over the great altiplain of Northern Bolivia or crossing Lake Titicaca has his attention repeatedly called to three beautiful snow-capped mountains rising above the general elevation of the Eastern Andes, or Cordillera Real. These are Illampu (Sorata), Huayni-Potosi, and Illimani, the three highest and most impressive mountains of Bolivia, each over 20,000 ft. in height. At the base of these mountains much mining has been done during the last three centuries, and yet these revived mines are still producing considerable mineral wealth and may even exceed their former records when the mines now in operation are properly developed and equipped. Near Illampu and Illimani the gold deposits have attracted the most attention; while the mineral deposits of Huayni-Potosi are mainly silver, tin and bismuth, with subordinate amounts of gold and wolframite.

The mountain of Huayni-Potosi lies east of the southern end of Lake Titicaca and about 30 km. north of La Paz. Near the base of the mountain silver was discovered by the Spaniards, after the rich silver mines of Potosi had been opened; and as the deposits of the two places seemed to be similar, the new region received the name of Huayni-Potosi, which in the Quichua language means "young Potosi." Potosi itself means "thunder" and was so named because of the frequent great electrical displays seen there.

The Spaniards worked the oxidized silver ores, the *llampus*, but evidently did not do much mining after the sulphide zone was reached. About 20 years ago, when the tin deposits of Bolivia began to attract attention, the possibilities of Huayni-Potosi were investigated and the mines reopened for tin ores, the materials ignored by the silver miners. In some of the mines bismuth was later discovered, and the ores of these two metals [illegible] now sought. Some gold and tungsten deposits have been investigated, but so far have not been [illegible]. There is also considerable [illegible]. [illegible] through the Andean mining districts [illegible]

THE GLACIERS OF MT. HUAYNI-POTOSI FROM THE CARMEN MINE, BOLIVIA received little attention, as the cost of transportation of these ores has been prohibitive; therefore little information is available in regard to the character and amount of these ores.

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*Professor of geology, Lehigh University, South Bethlehem, Penn.

†Associate in economic geology, Johns Hopkins University, Baltimore, Md

The mines of Huayni-Potosi are not reached by the rail road, consequently all supplies must be brought in from La Paz or from the branch line that runs from Viacha to Guaqui on the southern end of Lake Titicaca. Llamas are used almost exclusively, as they are better adapted to the high-altitude conditions than any other animals. The mines are chiefly in two groups several kilometers apart—at Milluni and near the Union Mill, where the Carmen mine is the most important one. The operating mines are owned by the Huet Hermanos, Frenchmen who have long lived in Bolivia.

Leaving La Paz on muleback, at 8:30 a.m. on a June morning, we ascended the steep slopes of the great gorge, 1,500 ft. in height, and emerged on the extensive altiplain formed by the alluvial gravels and sands brought by rivers and glaciers from the nearby mountains. Heaps of cobbles scattered over the surface, picked from the surface soil by the Indians, who here raise their scant crops of barley and potatoes, could be seen on every side, while in places the soil was being prepared for the next crop. As we proceeded, the country became gradually higher and the irregularities greater, and a strong, cold wind blowing from banks of snow and ice thoroughly chilled us even though we were well within the tropics. About noon we reached the highest point on the route, over 15,000 ft. above sea-level, and then followed a trail down into a valley where the Milluni mines and mill are situated. The mill and small settlement are at an elevation of over 14,000 ft., while the mine openings are at various places on the steep slopes up to 15,000 ft. or even more. From the mines and settlement the great glaciers and ice cascades of Huayni-Potosi Mountain are most beautiful, yet the cold blasts that blow from them are not so pleasant. Fuel is too scarce for use in heating the houses, so when night comes on it is necessary to wear heavy overcoats, and notwithstanding the extreme attention given to social form and etiquette in the Latin-American countries, comfort demands that hats and overcoats be worn in the house, even during the meals.

Geology of the Milluni Mines

The country rocks of the Huayni-Potosi region consist of black arenaceous slates, micaceous sandstones and gray quartzites of Devonian age, into which have been intruded many dikes of quartz-porphyry and other closely related rocks. The sedimentary strata rest upon a large mass of granite, which is exposed a few kilometers distant. The slates and quartzites strike approximately north-south, dipping to the west at various angles from 5° to 50°.

The veins occur in shattered zones that approximately conform in strike with that of the inclosing slates and quartzites, but in general dipping to the east at high angles instead of west as do the rock strata. In some cases the veins are true fissure veins, but in the main consist of stringers of ore within shattered rock.

The veins at Milluni differ from those near Union Mill by the absence of bismuth. Mineralogically or structurally, four distinct types of veins are recognized, as follows:

1. Quartz-pyrite veins carrying cassiterite in very fine grains. Near the surface these veins have been oxidized, forming a gossan that carries fairly high values in tin or, where quartz predominates, a rusty mass of porous quartz containing small druses of quartz or cassiterite crystals. This is the most common type of vein and is represented by the Concepción, Salvadora and Coquelin veins.

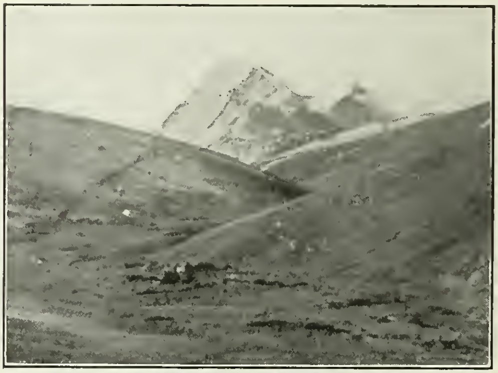
2. Sphalerite veins containing siderite, quartz and small quantities of cassiterite, and carrying considerable silver. These veins are mainly fissure veins and show prominent banding. Veins of this kind, represented by the Roche vein, are not extensively worked at present.

3. Brecciated quartz-pyrite-cassiterite veins cutting across the bedding planes of the quartzites, with occasional stringers of rich ore developed along the bedding planes adjacent to the shattered zone. These veins are variable in both width and values.

4. A quartz-pyrite vein, no longer worked, which contained some uraninite. Much silver ore was taken from this vein by the early Spaniards.

Mining and Milling at Milluni

When the European War broke out, one of the Huet brothers, owners of the mines, went back to France to serve in the French army and the operations of the mines were considerably curtailed. We visited a number of places where ore was being removed, in some cases in opencuts, but in most places through adits run into the side of the mountain. Some stoping is done, although most of the ore is obtained in driving the adits on the veins with the intention of later opening up stopes where the ore is most promising.



DISTANT VIEW OF MT. HUAYNI-POTOSI

All mining is done by hand with chisels and hammers. The ore is thrown into cars in the main drifts, but elsewhere is put into raw-hide bags, which Indian women and boys carry to the cars. On the steep mountain sides far above the mill the ore is put in large rawhide pouches that are let down by cable to the tracks that run to the mill. From the highest mine openings the ore is handled three times before it finally reaches the mill. While the Milluni mines are producing considerable tin barrilla, so far the work has been mainly of a development character, and better equipment is necessary before the output can be materially increased.

The ore brought down to the mill is dumped into a bin over a 2-in. grizzly. The oversize goes to the same bin after passing through a Blake-style crusher. The bin feeds two pneumatic stamps, which crush the ore to pass 16- or 18-mesh screens and have a daily capacity of 10 tons each. The stamp pulp is classified to five sizes, each of which feeds a table. These tables make a finished concentrate, a middling which carries whatever pyrite the ore contained, and tailings and slimes. The middlings from the two coarsest tables are ground in a chilean mill and re-treated on two other tables. The middlings of these tables, together with those from the three finer tables of the first group, are calcined if much pyrite is present. The calcined material is screened by hand through a 60-mesh screen, the oversize of which goes to a second chilean mill and the undersize to an eighth table. The tails and slimes of the sixth and seventh tables go to the buddles, those from the first five tables to a spitzkasten, the settlings of which go to a ninth table. If the ore does not require calcining the middlings of tables 3 to 7 are reground in the second chilean mill and retreated on tables 10 and 11. The tails and slimes of tables 6 to 11 are treated in buddles, of which there are 12, with a diameter of 240 cm. The concentrates of the buddles are returned to the second chilean mill, the middlings are re-treated on the buddles and the tailings discarded. The overflow of the buddles is settled in sluices, and the settlings returned to the buddles.

At present the equipment of the mill is such that only one stamp can be used at a time, but it is proposed to put in three more tables and another chilean mill, whereby it will be possible to take care of the pulp of both stamps and hence double the capacity of the mill.

A GROUP OF AYMARA INDIANS OF NORTHERN BOLIVIA

From Milluni we crossed a snow-covered divide, said to be over 17,000 ft. in elevation, to the group of bismuth-tin mines. On one side of a snow-capped ridge is the Santa Rosa and other mines not now in operation, where formerly considerable tin ore was obtained. There are several different veins in sandstones in which the cassiterite is associated with quartz and pyrite. At the margins of the veins some native bismuth was obtained. Because of the extreme altitude, almost 17,000 ft., and the inaccessibility of these mines they have all been closed, although they contain some promising leads of ore.

On the opposite side of the mountain are the Carmen, Esperanza and Santa Alberti mines. At the time of our visit the principal mining was being done in the Carmen mine, where the bismuth ore is of greater value than the tin. The vein system in the Carmen mine is less definite than in the Milluni mines, much of the ore occurring in stringers in the quartzite where there has been considerable shattering of the rock. The greatest amount is found in the quartzite near the contact with the slate, with a small quantity of ore in small stringers in the slate. Drifts are run in the quartzite near the slate, and the bunches of ore encountered are separated from the barren rock. The fine large specimens of native bismuth exhibited by Bolivia at the Panama-Pacific Exposition at San Francisco came from this mine. It is said that some years ago one mass of practically pure metallic bismuth was found, weighing two tons.

The ore of the Carmen mine consists of native bismuth, bismuthinite, and bismuth oxide associated with considerable pyrite, some cassiterite, and an extremely small amount of quartz. The native bismuth and bismuthinite are apt to have a coating of soft yellowish-white oxide. In some cases the native bismuth is surrounded by a band of bismuthinite but usually one finds specimens of radiating bladed ore with the two minerals alternating, indicating contemporaneous origin.

Almost all the tin-ore streaks contain some bismuth, although the largest masses of bismuth ore are practically free from cassiterite. As in the case of the Milluni mines, the mining is crude, the mines imperfectly equipped and the output small. The best-grade bismuth ore is sorted out by hand and sacked at the mine, while the lower-grade bismuth-tin ore is sent to La Union mill, 6 km. down the valley, in small cars run on a narrow-gage track.

LA UNION MILL OF HUET HERMANOS

The best grade of bismuth ore, brought to the mill in sacks, is dumped on a floor, where Indian women break the large pieces and sort them in three grades. The first grade consists of pieces of practically pure native bismuth, bismuthinite or bismuth oxide. The second grade contains the material in which considerable bismuth or bismuthinite shows distinctly, containing [illegible]% or more of bismuth. Since the beginning of the European War all ore containing 5% Bi has been exported to Europe without concentration. The third class is passed through stamps and then roasted to eliminate the sulphur of the pyrite and render the iron magnetic. The iron is then removed in a magnetic separator and the bismuth obtained by lixiviation, leaving the cassiterite to be recovered by the physical methods of concentration.

The ore that contains mainly tin, with small amounts of bismuth, passes over a grizzly, the fines going directly to stamps and the coarse first to a jaw crusher and then to the stamps. The materials from the stamps pass through a 16-mesh screen and thence to Wilfley tables, which produce five products. The first contains about 5% Bi and is shipped at once for export; the second, containing 65% Sn, is also shipped, as *barrilla*. The third and fourth grades, containing pyrite, some cassiterite and bismuthinite, are treated separately, but in the same way by roasting and the resulting iron oxide removed by a magnetic separator, and the bismuth recovered by lixiviation. The tailings are reground in a chilean mill, then passed over Wilfley tables with the seconds treated in a series of buddles. The coarsest material from the first buddle is again ground in a chilean mill and passed over a Wilfley table that produces *barrilla* for export, while the seconds and tailings go to buddles.

By way of summary it may be said that the mining situation in the Huayna-Potosi region at the present time is promising, on account of the tin as well as the bismuth now obtained there, but the mines and mills are greatly in need of improved equipment and more systematic management in order to achieve the best results.

Minerals Separation, Ltd., vs. James M. Hyde

On Dec. 11, 1916, Justice Clark delivered the opinion of the United States Supreme Court in the case of Minerals Separation, Ltd., against James M. Hyde. As is well known, Hyde installed a flotation process at the Butte & Superior property, at Butte, Mont., which Minerals Separation claimed was an infringement of their patent rights. The case has been in litigation for several years and has been carried up to the Supreme Court, whose decision has just been delivered. The following is the decision in full as rendered:[1]

"In this suit the complainants, the first named as the owner and the other as general licensee, claim an infringement of United States letters patent No. 835,120, issued on the 6th day of November, 1906, to Henry Livingston Sulman, Hugh Fitzalis Kirkpatrick-Picard and John Ballot. The usual injunction, accounting and damages are prayed for. The District Court sustained the patent as to claims numbered 1, 2, 3, 4, 5, 6, 7, 9, 10, 11 and 12; found that the defendant had infringed each of these claims, and granted the prayer of the petition. The Circuit Court of Appeals for the 9th Circuit reversed the decree of the District Court and remanded the case with instructions to dismiss the bill. The case is here on writ of certiorari to review that decision.

"As stated in the specification, the claimed discovery of the patent in the suit relates 'to improvements in the process for the concentration of ores, the object being to separate metalliferrous matter from gangue by means of oils, fatty acids, or other substances which have a preferential affinity for such metalliferous matter over gangue.'

"The answer denies all of the allegations of the bill and it avers that in 25 designated United States and 5 British patents the process described in suit was 'fully and clearly described and claimed,' and it also avers that the claimed discovery was invented, known and used by many persons long prior to the time when the application was made for the patent in suit. Notwithstanding this elaboration of denial, counsel for the defendant in the summarized conclusion to their brief rely upon only five of the many patents referred to as showing that the patent in suit was anticipated and is therefore invalid for want of novelty and invention, viz.: Everson (1886), Froment (Italy, 1902; Great Britain, 1903), Glogner (1913), Schwarz (applied for April 19, 1905, issued Dec. 19, 1905), and Kirby (applied for Oct. 17, 1903, issued Dec. 18, 1906). And the defendant, a man obviously experienced in the subject, says that, in his opinion, the whole basis of flotation concentration was disclosed in the Everson United States patent No. 348,157 and in the Froment British patent. It is clear that in the prior art, as it is developed in this record, it was well known that oil and oily substances had a selective affinity or attraction for, and would unite mechanically with, the minute particles of metal and metallic compounds found in crushed or powdered ores but would not so unite with the quartz or rocky metallic material, called 'gangue'—Haynes British patent (1860), and the United States patents, Everson (1885), Robson (1897) and Elmore (1901). It was also well known that this selective property of oils and oily substances was increased when applied to some ores by the addition of a small amount of acid to the ore and water used in process of concentration—United States patents, Everson (1885), Elmore (1901), and Cattermole (1904).

"Prior to the date of the patent in suit a number of patents had been granted in this and other countries for processes aiming to make practical use of this property of oil and of oil mixed with acid in the treatment of ores, all of which, speaking broadly, consisted in mixing finely crushed or powdered ore with water and oil, sometimes with acid added, and then in variously treating the mass—'the pulp'—thus formed so as to separate the oil, when it became impregnated or loaded with the metal and metal-bearing particles, from the valueless gangue. From the resulting concentrates the metals were recovered in various ways.

"The processes, of this general character, described in the prior patents may be roughly divided into two classes. The process in the patents of the first class is called in the record the 'surface flotation process' and it depends for its usefulness on the oil used being sufficient to collect and hold in mechanical suspension the small particles of metal and metalliferous compounds and by its buoyancy to carry them to the surface of the mixture of ore, water and oil, thus making it possible, by methods familiar to persons skilled in the art, to float off the concentrate thus obtained into any desired receptacle. The waste material, or gangue, not being affected by the oil and being heavier than water sinks to the bottom of the containing vessel and may be disposed of as desired.

"The process of the other class, called in the record the 'metal sinking process,' reverses the action of the surface flotation process and is illustrated by the Cattermole United States patent No. 777,273, in which oil is used to the extent of 4% to 6% to 10% of the weight of the metalliferous mineral matter, depending on the character of the ore, for the purpose of agglomerating the oil-coated concentrate into granules heavier than water, so that they will sink to the bottom of the containing vessel, permitting the gangue to be carried away by an upward flowing stream of water.

"The process of the patent in suit, as described and practiced, consists in the use of an amount of oil which is 'critical,' and minute as compared with the amount used in prior processes, 'amounting to a fraction of 1% on the ore,' and in so impregnating with air the mass of ore and water used, by agitation—'by beating the air into the mass'—as to cause to rise to the surface of the mass, or pulp, the froth, peculiarly coherent and persistent in character, which is composed of air bubbles with only a trace of oil in them, which carry in mechanical suspension a very high percentage of the metal and metalliferous particles of ore which were contained in the mass of crushed ore subject to treatment. This froth can be removed and the metal recovered by processes with which the patent is not concerned.

"It is obvious that the process of the patent in suit, as we have described it, is not of the metal sinking class, and while it may, in terms, be described as a surface flotation process, yet it differs so essentially from all prior processes in its character, in its simplicity of operation and in the resulting concentrates, that we are persuaded that it constitutes a new and patentable discovery.

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[1] This version is from an unofficial copy of the decision and is subject to revision, which, however, will probably be in minor details only. Our Washington correspondent reports an unusual feature of the handling of the case was the fact that the proof of the opinion was not made public. Uusually on decision days the galley proof of the decisions may be inspected by those interested. The reason for this is thought to be that substantial changes were made in the opinion after it had been put in type. The official text of the opinion will not be made public until the last of the week.

"The prior processes which we have described required the use of so much oil that they were too expensive to be used on lean ores, to which they were intended to have their chief application, and the efforts of investigators for several years prior to the discovery of the process in suit had been directed to the search for a means or method of reducing the amount of oil used, and it is clear from the record that approach was being made, slowly, but more and more nearly to the result which was reached by the patentees of the process in suit in March, 1905. The Froment Great Britain patent (1903) and the Kirby United States patent (applied for in 1903 and granted in 1906) are especially suggestive of the advance which was being made toward the desired result, but the Froment process was little more than a laboratory experiment and has never proved of value in practice, and the Kirby process though approaching in some respects more nearly to the end attained by the process of the patent in suit, found its preferred application in the use of an amount of oil in solution equal to one-fourth to three-fourths in weight of the ore treated, which was prohibitive in cost.

"Into this field of investigation at this stage of its development came the patentees of the patent in suit. They were experienced metallurgists of London, of inventive genius and with financial resources, and they entered upon an investigation of the processes of oil concentration on ores which was continued through several years and consisted of a very extended series of experiments in which the quantities of oil, of water and of acid used and the extent and character of the agitation of the mass under treatment resorted to, were varied to an almost unparalleled extent as to each factor and the results were carefully tabulated and interpreted. It was while pursuing a comprehensive investigation of this character, having, as the evidence shows, the special purpose in mind at the time to trace the effect on the results of the process of a reduction to the vanishing point of the quantity of oil used, that the discovery embodied in the patent in suit was made. The experimenters were working on the Cattermole 'metal sinking process' as a basis when it was discovered that the granulation on which the process depended practically ceased when the oleic acid (oil) was reduced to about 0.5% 'on the ore.' It was discovered, however, that, as the amount of oleic acid was further reduced and the granulation diminished, there was an increase in the amount of 'float froth,' which collected on the surface of the mass and that the production of this froth reached its maximum when about 0.1% or slightly less 'on the ore' of oleic acid was used. This froth on collection, was found to consist of air bubbles modified by the presence of the minute amount of oil used and holding in mechanical suspension between 70% and 80% of the total mineral content of the mass treated. It was promptly recognized by the patentees that this froth was not due to the liberation of gas in the mass treated by the action of the dilute acid used, and its formation was at once attributed in large part to the presence of the air introduced into the mixture by the agitation which had been resorted to to mix the oil with the particles of crushed ore, which air, in bubbles, attached itself to the mineral particles, slightly coated as they were with what was necessarily an infinitesimal amount of oil, and floated them to the surface. The extent of the agitation of the mass had been increased as the experiments proceeded until the 'series of Gadlett mixers, fitted with the usual baffles, were speeded at from 1,000 to 1,000 r.p.m.'

"Consideration of the record in this case convinces us that the facts with respect to the process of the patent in suit are not overstated by the plaintiff's witness, Adolph Liebmann, an expert of learning and experience, when he says in substance:

"'The present invention differs essentially from all previous results. It is true that the oil is one of the substances used but it is used in quantities much smaller than was ever heard of, and it produces a result never obtained before. The minerals are obtained in the froth of a peculiar character, consisting of air bubbles which in their covering film have the minerals embedded in such a manner that they form a complete surface all over the bubbles. A remarkable fact with regard to this froth is that, although the very light and easily destructible air bubbles are covered with a heavy mineral, yet the froth is stable and utterly different from any froth known before, being so permanent in character that I have personally seen it stand for 24 hr. without any change having taken place. The simplicity of the operation, as compared with the prior attempts, is startling. All that has been done is to add a minute quantity of oil to the pulp to which acid may or may not be added, agitate for from 2½ to 10 min. and then after a few seconds collect from the surface the froth which will contain a large percentage of the minerals present in the ore.'

"It is not necessary for us to go into a detailed examination of the process in suit to distinguish it from the processes of the patents relied on as anticipations, convinced as we are that the small amount of oil used makes it impossible that the lifting force which separates the metallic particles of the pulp from the other substances of it is not to be found principally in the buoyancy of the oil used, as was the case in prior processes, but that this force is to be found, chiefly, in the buoyancy of the air bubbles introduced into the mixture by an agitation greater than and different from that which has been resorted to before and that this advance on the prior art and the resulting froth concentrate so different from the product of other processes make of it a patentable discovery as new and original as it has proved useful and economical. It results without more discussion that we fully agree with the decision of the House of Lords, arrived at upon a different record and with different witnesses, but when dealing with the equivalent of the patent in suit, in Minerals Separations, Ltd., vs British Air Concentration Syndicate, Ltd., 27 R. P. C. 33. In this decision, Lord Shaw, speaking for the court and distinguishing the process there in suit especially from the Elmore oil-flotation process which had gone before but which was typical of the then prior art, said: 'They (the patentees of the agitation-froth process of the patent in suit) are not promoting a method of separation which had before been described, but they are engaged upon a new method of separation. Instead of relying upon the lesser specific gravity of oil as such they rely upon production of a froth by means of an agitation which not only assists the process of the minute quantities of oil reaching the minute particles of metal, but forms a multitude of air cells, the buoyancy of which air cells, forming around single particles of the metal, floats them to the surface of the liquid.' and Lord Atkinson said: 'In their process this mysterious affinity of oil for the metallic particles of the ore is availed of, yet the oil is used in such relatively infinitesimal quantities, that the metallic particles are only coated with a thin film of it, and the lifting force is found not in the natural buoyancy of the mass of added oil, but in the buoyancy of air bubbles, which, introduced into the mixture by a more or less violent agitation of it, envelop or become attached to, the thinly oiled metallic particles, and raise them to the surface, where they are maintained by what is styled the surface tension of the water.'

"The record shows not only that the process in suit was promptly considered by the patentees as an original and important discovery, but that it was immediately generally accepted as so great an advance over any process known before that, without puffing or other business exploitation it promptly came into extensive use for the concentration of ores in most, if not all, of the principal mining countries of the world, notably in the United States, Australia, Sweden, Chile and Cuba and that, because of its economy and simplicity, it has largely replaced all earlier processes. This, of itself is persuasive evidence of that invention which it is the purpose of the patent laws to reward and protect. Diamond Rubber Co. vs. Consolidated Tire Co. 220 U. S. 428; Carnegie Steel Co. vs. Cambria Iron Co. 185 U. S. 403, 429, 430; the Barbed Wire Patent, 143 U. S. 275; Smith vs. Goodyear Dental Vulcanite Co. 93 U. S. 486.

"The claim that the patentees of the patent in suit are not the original discoverers of the process patented because an employee of theirs happened to make the analyses and observations which resulted immediately in the discovery, cannot be allowed. The record shows very clearly that the patentees planned the experiments in process when the discovery was made; that they directed the investigations day by day, conducting them in large part personally and that they interpreted the results. Agawam Co. vs. Jordan 7 Wall. 583, 603, rules this claim against the defendant.

"Equally untenable is the claim that the patent is invalid for the reason that the evidence shows that when different ores are treated, preliminary tests must be made to determine the amount of oil and the extent of agitation necessary in order to obtain the best results. Such variation of treatment must be within the scope of the claims, and the certainty which the law requires in patents is not greater than is reasonable, having regard to their subject matter The composition of ores varies infinitely, each one presenting its special problem and it is obviously impossible to specify in a patent the precise treatment which would be most successful and economical in each case. The process is one for dealing with a large class of substances and the range of treatment within the terms of the claims, while leaving something to the skill of persons applying the invention, is clearly sufficiently definite to guide those skilled in the art to its successful application, as the evidence abundantly shows. This satisfies the law. Mowry vs. Whitney 14 Wall 620; Ives vs. Hamilton 92 U. S. 426; and Carnegie Steel Co. vs. Cambria Iron Co. 185 U. S. 403, 436, 437.

"The evidence of infringement is clear.

"While we thus find in favor of the validity of the patent, we cannot agree with the District Court in regarding it valid as to all of the claims in suit. As we have pointed out in this opinion there were many investigators at work in this field to which the process in suit relates when the patentees came into it, and it was while engaged in study of prior kindred processes that their discovery was made. While the evidence in the case makes it clear that they discovered the final step which converted experiment into solution, 'turned failure into success' (the Barbed Wire Patent, 143 U. S. 275); yet the investigations preceding were so informing that this final step was not a long one and the patent must be confined to the results obtained by the use of oil within the proportions often described in the testimony and in the claims of the patent as 'critical proportions' 'amounting to a fraction of 1% on the ore,' and therefore the decree of this court will be that the patent is valid as to claims numbered 1, 2, 3, 5, 6, 7, and 12 and that the defendant infringed these claims but that it is invalid as to claims 9, 10 and 11. Claims numbered 4, 8 and 13 were not considered in the decrees of the two lower courts and are not in issue in this proceeding.

"The decision of the Circuit Court of Appeals will be reversed and the decision of the District Court modified to conform to the conclusions expressed in this opinion, will be affirmed."

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Experimental Kelp Plant at Summerland, Calif.

The Bureau of Soils of the Department of Agriculture is preparing to erect at Summerland, Calif., an experimental plant for the production of potash from Pacific Coast kelp. The details of the plant are not completely developed yet, but D. F. Houston, Secretary of Agriculture, states that the plans contemplate the drying of the kelp as it comes from the water in a series of rotary driers, after which the dried material will be distilled in retorts analogous to a byproduct-coke oven.

Ammonia, combustible gas, tar and some other materials will be recovered, and the resulting charcoal will contain the potash salts. These will be leached out and recovered by evaporation, after which the charcoal will be available either as a marketable commodity or as fuel. By recovering the various byproducts and saving the heat units involved in the combustion of the kelp, the Bureau of Soils hopes to develop a process that will permit the continued production of potash from this American source.

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Minerals Separation North American Corporation

The Minerals Separation North American Corporation, incorporated under the Laws of Maryland, has taken over and assumed all the assets, interests and obligations of Minerals Separation American Syndicate (1913) Limited, as of Dec. 7, 1916. The capital of the corporation is divided into 500,000 shares of no nominal or face value. The directors are John Ballot, president; Dr. S. Gregory, vice president, and Frank Altschul. No dislocation or disturbance whatever will take place in the business as hitherto carried on by the old company.

Editorials

Minerals Separation, Ltd., Wins

The Supreme Court of the United States on Dec. 11 announced its decision in the suit of Minerals Separation, Ltd., vs. Hyde, involving the basic patent for the flotation process of concentrating ores. The opinion was written by the new justice, John H. Clarke, and was unanimous. The invention was held to be new and patentable insofar as the practice at the Butte & Superior mill is concerned and the operations of the defendant Hyde at the Butte & Superior mill in Montana were held to be an infringement.

The opinion reviews the history of the process and gives full credit to the Minerals Separation patentees for having made a real discovery. The prior patents that were relied upon by the defendant were carefully considered and held not to anticipate the invention. A decision of the British House of Lords is referred to as having recognized the novelty of the invention.

This decision is an event of major importance. The process has come into extensive use in the United States, about 25,000,000 tons of ore having been treated by it during 1916. About half of this was treated under license of the patentees, the remainder in defiance of the patents. Anaconda, Inspiration, Senator Clark's companies and numerous others secured licenses and paid royalties. The Hayden, Stone & Jackling group of companies, including Butte & Superior, Utah and several others, have proceeded in defiance of the patents and are now confronting the situation that the profits made by an infringer from the use of an invention belong to the patentee. The Hayden, Stone & Jackling copper companies have not been large users of this process until recently when they became alive to the desirability of correcting their metallurgical backwardness, which has been exhibited by their low extractions. Butte & Superior, on the other hand, has used the flotation process long and largely and admittedly owes much of its success to it. At a recent argument in Butte, before George M. Bourquin, U. S. district judge, it was contended by Minerals Separation, Ltd., that the profits of Butte & Superior, as shown by its own reports, attributable to the invention have been nearly $16,000,000. Butte & Superior will doubtless make a different contention. Settlement of this question will be, of course, a matter for adjudication.

The Miami Copper Co. also defied the patents, and there is already a judgment against it in the United States District Court at Wilmington, Del., and it has given a bond of $250,000 to stay the injunction pending appeal. It is a matter of much interest that the Supreme Court of the United States has closely followed the opinion of Judge Bradford, of Wilmington, Del., in the Miami case, so that a good part of his decision has been affirmed by the Supreme Court of the United States before it has reached the United States Circuit Court of Appeals at Philadelphia for review, but there were several important features in the Miami case that did not enter into the Hyde case and may still be contested if the Miami company desires to continue the fight. Anyway, Minerals Separation will probably desire to have a final decision respecting these.

The litigation that has now been finally decided has lasted more than five years. The first decision was by Judge Bourquin, of Butte, Mont., in July, 1913, holding the patent valid and infringed. The United States Circuit Court of Appeals at San Francisco, Calif., reversed this decision in May, 1914, and held the patent to be wholly void. This decision led many of the mines to believe that the process was free to all. In October, 1914, an application was made by Minerals Separation to the United States Supreme Court for a writ of certiorari, and to the surprise of everyone the writ was granted. The argument in the Supreme Court included demonstrations in the courtroom at an extraordinary and informal session in the forenoon of the several processes considered. Miniature machines operated by electricity were used, and the courtroom resembled a metallurgical laboratory. The decision was rendered very promptly, the argument having been completed only on Nov. 1.

Thus is ended the most important and most spectacular metallurgical litigation there has ever been in the United States. The opinions respecting the validity of the process—both pro and con—have been sincere, and the trials have been exhaustive and fair. The plaintiffs are Britishers. They will testify as to the fairness and absence of prejudice in American courts. We have deferred any comment upon the technical points of the supreme decision, awaiting the full text thereof. Practically, the next step will probably be an effort by the patentees to collect what is due them. This is a time for the victors to prove that they are generous and for the vanquished to show that they are good losers.

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Peace Prospects

The boom in copper stocks culminated on Nov. 18. Ever since then there has been liquidation, with lately some very weak days. On Dec. 12 the market declined, violently on news that Germany had made peace proposals. The copper stocks suffered more than most others. Some of them sank to about where they were before the autumn advance began. Chile, which was around 39 at the middle of November, was down to 23 before the middle of December.

Now the position of none of these companies had changed, except for the better. All had the benefit of one month's additional earnings and all had their expected total production up to the middle of 1917 sold at an extraordinarily high price. All had big surpluses and were assured of bigger ones. The only thing that changed on Dec. 12 was the prospect of the cessation of the war and the approach of the [illegible] to arise upon its termination. Yet even that was only a question of degree, for no conservative person has been expecting war profits to continue forever. It has been merely a matter of guessing whether they would run for another six months, or 12 months, or perhaps 18 months. But even as to the longer periods estimated for the war's duration, there has been the serious prospect that natural causes would reduce prices and diminish profits to normal, wherefore the days of enormous earnings were numbered anyhow.

For a year back the stock market has shivered at any intimation of peace, yet why it should do so is beyond comprehension except for the regard of unwise speculative commitments. The advent of peace—the cessation of further increase of misery and the destruction of people and of wealth—should be a great bull argument. Looking at it narrowly—from the selfish interest of this country—good opinion long ago ceased to be so sure that our prosperity would end with the war. On the contrary, it has been becoming more and more evident that prolongation of the war is producing domestic conditions that will be detrimental to our welfare.

What is the meaning of Germany's proposal, what it will come to, we know not. We know only that it comes as a surprise and is significant in that one of the great belligerent parties is willing even to talk of peace. But it is certain that nothing would be so great a blessing for humanity as an early peace on terms that would settle permanently and satisfactorily the questions about which races are in conflict.

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What's In a Name?

A rose might smell as sweet by any other name, but a new mining development in the eyes of its promoters must bear the magic of a famous name, plus the inconsequential but necessary "Consolidated" or "Extension." These are necessary, especially if there is no ore developed in the property. The imagination of the public puts the ore in the "Extension" and the flotation usually has a "psychological prosperity" for a time, though as a matter of fact it is remarkable how few of these famous "Extensions" make good. One can count them on one's fingers: United Verde Extension, and Tonopah Extension, and—well, a few others, though we do not recall any "Consolidateds" that have been successful except some real consolidations. In most mining districts it has been the other mines that have made good, and not the "Consolidated" and the "Extension" that traded on the name of the famous mine of the camp.

The geography of some of these flotations is often exceedingly vague. The "Extension" or "Consolidated" may be several miles away from the real mine of that name. A recent flotation stated that its mine was "in the heart of the district" and then proceeded to mention the Ray Consolidated, United Verde and Miami copper mines. We do not know to the heart of what district the promoter referred—probably the "district" of Arizona.

It is also worthy of note that mining companies with fool titles, such as the Intermountain & Intercolonial Mining, Milling, Smelting and Reduction Co., are usually failures; the air necessary to repeat such titles seems to exhaust all the energies of the promoters and prevent these companies from getting into the dividend list. Like the "Extension" and the "Consolidated," they are usually wrecked by poor management or too slender financing. United Verde Extension, now one of the conspicuous exceptions, was a failure until it came under the control of a group of capable mining men in the Southwest who made a careful study of the property and then had sufficient capital to put into effect the prospecting campaign outlined by the technical members of this syndicate.

What constitutes a good name for a mining company? The securing of an adequate name for a new mining development is something of a problem and not often successful. Many Eastern stockholders in mining companies have little idea of where their property is situated. When asked where the property is, they will usually reply that it is "out West," or if pinned down to more definite situation, the stockholder has "an impression that it is either in Nevada or Arizona." As everybody knows, there are a number of waste spots in both of those states, as well as several good districts.

A name such as "Old Baldy" may be satisfactory for a mining company so long as it is only of local interest, or if it has sufficient distinguishing characteristics to impress its remarkable qualities and situation upon its shareholders. Thus what constitutes a good name depends to a considerable extent on whether a company is to be purely local or is intended to appeal to the public generally. If the dominant capital interest is secured in one section and the mine is in another part of the country, it is fitting and enlighting to recognize these two features, as was done in the Pittsburgh-Silver Peak, Calumet & Arizona; the same might be said of some of the newer developments, such as the Calumet & Jerome, or the Pittsburgh-Jerome. But the United Verde Consolidated Copper Co.'s name is obviously a mere play on the success of the United Verde Copper Co.; it is not connected in any way with the present United Verde mine and is in no sense a consolidation of that property, though among the Eastern laymen this misconception may readily be assumed.

When such properties are quoted on the stock exchanges, the inevitable shortening of names for convenient trading identification makes the matter still more confusing to the uninformed mining investor, who for the good of the industry should be protected. An example of the confusion that may arise from similar names is the case of the United Verde Extension, which for months was referred to in the Curb list as United Verde, whereas the latter stock is practically never offered or traded in. There is a great public interest at present in mining stocks, especially in copper stocks. Perhaps it is the most wide-spread public interest that there has ever been in this country in mining stocks. Is the public going to be "stung"? Will the mining societies take any steps to prevent the market for legitimate prospects being destroyed?

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Great Britain Acts Respecting Copper

By order of the British government the importation of copper and dealings in copper without a special permit were forbidden on Dec. 8, except for the fulfillment of current contracts. The order also prohibits the use of copper except in case of pending contracts, and directs that all stocks of raw copper be reported not later than Dec. 16.

This drastic order indicates a firmer control of copper than ever by the British government. We have not been informed of its purport. We may imagine, however, that it means that the government will forbid the use of copper for any purpose that is not essential to the welfare of the empire.

For the present it will probably have no effect upon our copper market. Later it probably will, especially if it results in restriction of British consumption. There will be no restriction in the consumption for military purposes, but the man who is figuring on copper roofing will be told to use slate or something else, and so on.

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Protest the Postal Proposals

A strong effort is being made to enact in this Congress legislation increasing postal rates on second-class mail matter. It is proposed to introduce a zone system, and to make a large increase on matter going beyond a limited circle. This will be a direct blow to subscribers to periodicals, who will have to pay for their magazines a great deal more than at present, for the publishers can not stand it and will have to pass it on. Readers should communicate promptly with their representatives in Congress and protest vigorously against this proposal which will touch the pocketbook of every one who subscribes to magazines.

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A Four-Hour Day

The distinguished electrical engineer of the General Electric Co.—Charles P. Steinmetz—prophesies that the time is coming when men will have to work but four hours per day in order to get their living. This is to come from further development of the arts and sciences. The prospect is not quite pleasing. After golf, moving pictures and fishing have palled, what is anybody going to do with the rest of his time? Shall we perhaps some day hear the cry: "Give us work, not that we may eat and clothe ourselves, but that we may create and exercise the innate human desire to do something useful with brain and hands"?

BY THE WAY

There is growing up around the Guggenheims a legend that is about as inaccurate as such things usually are. Some Ferrero of the future probably will have to dig up the facts. One G. C. Forbes, writing recently in *Leslie's Weekly,* recorded that "No mountaineer, no prospector knew more hardships than the Guggenheim brothers went through. The Creator, they soon discovered, had invariably deposited mineral wealth far from settled centers of civilization and had surrounded it with obstacles which only the pioneer and brave elected to encounter. Daniel Guggenheim, with the other brothers, slept in tents or wagons amid wild surroundings as often as under a roof." And then some more slush. Daniel Guggenheim was a bold and far-seeing financier and exploiter, but he was not a pioneer of the type of Mackay and Hearst, and any such intimations are probably quite nauseating to him.

In the early 80's, Meyer Guggenheim, a lace manufacturer of Philadelphia, at the instigation of a fellow Philadelphian, Graham by name, acquired a half-interest in the A. Y. and Minnie mine in California Gulch at Leadville, Colo. The venture proved highly profitable, the A. Y. and Minnie becoming one of the big mines of the district. Benjamin Guggenheim, one of the sons of Meyer, was sent out to the mine as accountant, and he, acquiring more or less information concerning the smelting business, induced his father and brothers to go into it largely because of the unfavorable terms the smelters were making on the A. Y. and Minnie ore, which gradually became more zinky and consequently less desirable in character, from the lead smelters' standpoint. The Guggenheims in company with E. C. Holden (who soon retired) built the Philadelphia works, a large plant at Pueblo, Colo., in 1889. At first this venture was decidedly unsuccessful, but gradually coming to the appreciation of the necessity for securing the best possible technical advice and acting upon that principle, together with their own sharp commercial acumen, they converted into a success what promised to be a failure. Thus having acquired an insight into the smelting business, they early appreciated the great possibilities of smelting in Mexico when the lead-bearing ores of that country were practically excluded from the United States by the tariff of 1890, and erected works at Monterey and Aguascalientes. This expansion in business, to which the tariff of 1890 opened the way, was the real start of the business. When the Philadelphia plant was built, William and one or two other brothers went out to join Benjamin. In later years, when the business had become big, there was a little rift between the brothers who had been in the field and those who had stayed at home. And finally, Benjamin (who was lost with the "Titanic") and William retired from the smelting business.

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"We do not believe," says the market letter of a Stock Exchange house, "that the position can ever be essentially sound until the curb market has been put through a period of liquidation such as it has never known, and which it never needed more than today because of reckless dealings in many nondescript issues made only to sell." Whether one agrees with this or not, remarks the *Evening Post,* it calls attention to a probable condition. In an era of speculation such as this, there is drawn into the market not only the rich but the poor. Newspapers print stories of wealth over night, and men with anywhere from $25 to $100 to "invest" rush down to the curb market—the only place where they can speculate with so little—and buy some cheap mining stock, quoted, perhaps, as low as 25c. a share. Now it is true that some of these shares can go up, and some of them do; and when that happens office-boys and runners bloom into curb brokers, and a curb broker or two blooms into a millionaire, and the changes of fortune rival those of the Arabian Nights. But the chances are 100 to 1 that any given cheap stock is already overbought; for with this tremendous influx of penny-speculators (overwhelmingly bulls) into the market, who cannot afford to buy the higher-priced stocks, there is nothing to suppose but that they buy the cheap mining stocks; that the cheaper they are the more they are apt to be bought; that they are bought not on their merits, but simply as the only passage of fulfilment for the blind desire to "get aboard" the market and enjoy the rise. Consequently the probabilities are always that a curb stock nowadays selling at from 25c. to $5 (or perhaps a bit higher) isn't worth even that much. The price they are selling at, low as it is, is fictitious. The chances are always that the cheap stocks are far more overbought than the higher-priced ones; and for no other reason than that they are cheap.

New Publications

Cours d'Hydraulique. By J. Grialou. 6½x10, pp. 543, illus.; paper. Gauthier-Villars et Cie., Paris.

Standards for Electric Service. Pp. 262. Circular of the U. S. Bureau of Standards, No. 56, Washington, D. C.

Commission of Conservation, Canada, Seventh Annual Report. Pp. 283, illus. Commission of Conservation, Montreal, Canada.

Trust Laws and Unfair Competition. By Joseph E. Davies. Pp. 832. Department of Commerce, Bureau of Corporations, Washington.

Geology of the Nanaimo Map-Area. By Charles H. Clapp. Pp. 135, illus. Memoir 51, Canada Department of Mines, Geological Survey Branch, Ottawa.

Abstracts of Current Decisions on Mines and Mining, January to April, 1916. By J. W. Thompson, pp. 90. Bull. 126, U. S. Bureau of Mines, Washington.

Organic Chemistry for the Laboratory. By W. A. Noyes. Third edition, revised and enlarged. 5½x8¾, pp. 291, illus. The Chemical Publishing Co., Easton, Penn.

The Pleistocene and Recent Deposits of the Island of Montreal. J. Standfield. Pp. 80, illus. Memoir 73, Canada Department of Mines, Geological Survey Branch, Ottawa.

Economic Geology. By Heinrich Ries. 5½x9, pp. 856, illus. John Wiley & Sons, New York. An extensive review of this work will be published at an early date.

Iowa Geological Survey, Volume XXV. Annual Report, 1914, with accompanying papers. George F. Kay, State Geologist. 7½x10, pp. 627, illus. Iowa Geological Survey, Des Moines.

The Fundamental Principles of Petrology. By Dr Ernst Weinschenk. Authorized translation from German by Albert Johannsen. 6x9, pp. 214, illus.; $2.50. McGraw-Hill Book Co., New York.

An Introduction to Mine Surveying for Surveyors and Students of Coal Mining. By Thomas Bryson and George M. Chambers. 4½x7¼, pp. 288, illus.; $1.40. Longmans, Green & Co., New York.

Silver and Gold. A Pictorial Souvenir of the Mines of Northern Ontario. 12x9, pp. 64, illus., paper, $1.60. The Cobalt Daily Nugget, Ltd., Cobalt, Ont., Canada.

Booklet contains one page of production data and 62 pages of halftone illustrations of various mining properties in the Cobalt district.

The Geological and Mineral Resources of the Yilgarn Goldfield. Part II, The Gold Belt South of Southern Cross. By T. Blatchford, with petrological notes by R. A Farquharson and mineralogical contributions by E. S. Simpson and A. J. Robertson. Pp. 189, illus. Bull. 63, Western Australia Geological Survey, Perth.

Water Powers of Canada. A Reprint of a Series of Five Monographs Covering the Water-Power Situation in Canada, Prepared for Distribution in Connection with the Exhibit of the Dominion Water Power Branch in the Canadian Pavilion at the Panama-Pacific International Exposition, San Francisco, 1915. Pp. 361, illus. Department of Interior, Dominion Water Power Branch, Ottawa.

Transactions of the American Institute of Chemical Engineers, Volume VIII, 1915. 6x9, pp. 309, illus. D. Van Nostrand, New York.

Some of the articles contained in this volume which are of especial interest to the mining industry are: Resources and Possibilities of Chemical Industry in the Southwest; the Chemical Evidence of Smelter Smoke Injury to Vegetation; Cottrell Processes of Electrical Precipitation; the Fleming Patent Dust-Collecting System; the Thiogen Process for Removing Sulphur Fumes; the Production of Ammonia from Cyanamid.

An Introduction to Mining Science; A Theoretical and Practical Textbook for Mining Students. By John B. Coppock and G. A. Lodge. 4½x7, pp. 230, illus.; 60c. Longmans, Green & Co., London, England.

This is a practical little book with a misnomer. It is solely a book descriptive of that part of mining science having to do with combustible and incombustible gases underground and is therefore most applicable to coal mining. For the coal miner the book is a most valuable one. Each chapter is followed by a set of "quiz" questions, which is an excellent idea in a book of this kind.

Handbook of Rock Excavation Methods and Costs. By Halbert Powers Gillette. 4¾x7¾, pp. 835, illus.; leather; $5. Clark Book Co., New York, N. Y.

Like other cost handbooks by the same author, this volume is composed for the major part of material published in "Engineering and Contracting." For mining engineers it finds its chief use as the basis for preliminary estimates rather than as a comparison of existing costs. For the construction engineer it is useful as a means of assisting in the choice of methods to be employed, as it presents a variety of conditions and the expected costs under these conditions.

Coal and Coke. By Frederick H. Wagner. 6x9, pp. 431, illus.; $4. McGraw-Hill Book Co., New York.

The book was written, as the author states, to present to the American student of coal-gas production data in a concise form covering the various systems of coal carbonization. In Part 1, comprising about one-quarter of the book, the origin and classification of coal is discussed, together with the physical characteristics, oxidation and spontaneous combustion, the coking qualities of various coals, and the testing and analyzing methods. The rest of the book is devoted to the manufacture of coke, in retort benches and various types of ovens. The volume has many illustrations, diagrams and tables and well fulfills the aim of the author.

Hendricks' Commercial Register of the United States for Buyers and Sellers. 7¾x10½, pp. 1887, "Fabrikoid" binding; $10. S. E. Hendricks Co., New York.

The 21st annual edition of this well-known directory has just been issued, and in the main it follows out the plan of the preceding issues. However, it contains an important addition in the form of a list of trade names, brands, titles of identification, etc., which furnishes ready reference for purchasing agents and prospective buyers to distinctive products manufactured by firms listed in the work. This new feature accounts for the increase in pages from about 1,500 last year to over 1,800 this year, of which the index takes up about 150. The book is well indexed, well arranged as regards classification of the various industries, and, we believe, is as complete as it is possible to make such a directory.

The Mines Handbook. An Enlargement of the Copper Handbook. A Manual of the Mining Industry of North America. By Walter Harvey Weed. 5½x8¼, pp. 1,699; $10. Vol. XII, supplementing Volumes I to XI. The Stevens Copper Handbook Co., New York.

This work is a renewal of the "Copper Handbook," which was published for a number of years by the late Horace J Stevens, and was taken over by Walter Harvey Weed The last edition was published in 1914, and had consequently become somewhat out of date. The present volume has been enlarged to include mines of gold, silver, lead, zinc and other nonferrous metals, in addition to copper, and its value is thereby correspondingly increased. We observed a great deal of new and useful matter, such as chapters devoted to glossary of mining terms; mineralogy; complete list of copper minerals; the metal-mining industry, giving data on occurrence and uses of the different metals, with production, prices, etc., lists of obsolete mining securities, mining company officials; and geographical index. Descriptions of the foreign properties have been omitted, the present work covering the United States, Canada and Mexico. Detailed information regarding the companies in these countries takes up 1162 pages. The work seems to have been done better than ever before.

The Engineer in War. With Special Reference to the Training of the Engineer to Meet the Military Obligations of Citizenship By P. S. Bond. 5x7¼, pp. 187, illus., leather; $1.50. McGraw-Hill Book Co., New York.

One year ago the United Engineering Societies of New York City inaugurated a course of lectures by various officers of the Corps of Engineers, U. S. A., dealing with the work of engineer officers and troops in time of war. The object was to acquaint the engineers of the various societies with some of the details and specific work required, which it was presumed they would be ready and volunteer to do in case of war. A similar system of military-engineering lectures was immediately started in Chicago, the societies there being fortunate in securing Major Bond as lecturer. The present volume is the outcome of this series of lectures and in a way a résumé of all the ground covered. It gives in a most readable and interesting form a perspective of the scope of military engineering and does not attempt to cover the technical details. It is a valuable book and should be read by every engineer, and will be found especially valuable to those who purpose joining the Engineer Reserve Corps, recently provided for by Congress. At the end of the book is an extensive bibliography for further reading and study along military lines. This list was issued by the War Department and was published in the "Engineering and Mining Journal," Feb. 5, 1912.

Elements of Mining. By George J. Young. 6x9, pp. 628, illus.; $5. McGraw-Hill Book Co., New York.

As a textbook for students, it fills a need for an uptodate exposition of modern mining methods. In the section devoted to rock breaking, a table giving the physical properties of rocks tabulates the explosive force in foot-pounds per square foot of fracture necessary to effect disruption. Tables and formulas follow enabling the calculation of the amount of explosives consumed in blasting under given conditions. Copious illustrations show the approved methods of drilling and placing holes to attain maximum blasting efficiency with a minimum consumption of explosives. Cost data receive proper attention and comparative cost diagrams, showing tons broken per dollar spent under various conditions of mining, add the final touch. The section devoted to the support of mine workings is especially commendable, inasmuch as it clearly applies the principles of the strength of construction materials to the support of given rock masses. For the engineer perhaps one of the most valuable sections is that giving a compilation of uptodate mining methods underground Most textbooks written before caving systems, and others contemplating the reduction of timbering to a minimum, had been so extensively adopted as in recent years, are hopelessly out of date The present work gives a compilation of methods applied in the latest approved mining practice, which is admirably illustrated with copious drawings and diagrams. Sections are devoted to drilling, development, drainage, ventilation, openpit mining, organization, accounting and examination of mineral deposits.

Concentrating Ores by Flotation. A Description and History of a Recent Metallurgical Development, Together with a Summary of Patents and Litigation. By Theodore J. Hoover. Third Edition. 6x9, pp. 320, illus. The Mining Magazine, London, England.

The third edition of Hoover's classic on flotation appears bearing the date of June 14, 1916. The book, as before, supplies the reader with a comprehensive description of the flotation process its basic theory and the reasons for its application in practice. This edition contains a chapter, bearing on American practice, that did not appear in the former publication. The value of the book to readers in general has thereby been considerably increased. Mr. Hoover's close connection with the flotation process since its inception and his practical labors in it, including, as they do, the invention of some of its most successful machines, make this work of great value to the metallurgical world, while the author's fairness in discussion entitles him to the serious consideration of everyone interested in flotation. It is a pity, perhaps, that the part of the book that has been reprinted from former editions has not been more carefully revised in order to eliminate possible errors and to reconcile statements made during the darker days of the process with those now widely accepted. Nothing, however, can detract from the high value at which the book must be held, and the thanks of the metallurgical fraternity may not be withheld from the author, who, above all others, has made this newest of metallurgical processes well known to the professional world. Mr. Hoover is to be congratulated upon his work. The book is good and authoritative, and will always be highly valued.

The Flotation Process. By Herbert A. Megraw. 6x9, pp. 240, illus.; $2.50. McGraw-Hill Book Co., New York.

Any book dealing with a subject which is both deepening and expanding with the rapidity of the flotation process must labor under difficulties. If the present work fails to satisfy our curiosity as to the theoretical principles of the art, it affords as complete a record of present operating details as could be desired. Much of the material has appeared in print before, in the "Engineering and Mining Journal" and elsewhere, but the author of the book has exercised good judgment in its compilation and was himself the writer of some of the republished matter. The theoretical explanations are based on the opinions of Hoover, Ingalls, Rickard, Coghill, Free, Bancroft and Van Arsdale, with comments by the author. The chapter on "Oils and Their Uses" is one of the most valuable in the book. The author's comment that probably almost any oil can be made to yield a satisfactory frothing concentration on almost any ore, provided all the other operating factors are correctly adjusted, deserves careful consideration. The value of gas tar as a universal collecting agent is duly emphasized, and the peculiarities of a great variety of common and less common oils are noted. The chapter on "Testing" is enriched by actual data from a number of published tests. (The one by H. J. French is erroneously credited to the Colorado instead of to the Columbia School of Mines Quarterly.) Tests by the United States Bureau of Mines on Oxidized ores shed light on a most difficult problem, and the chapter devoted to the elaborate testing conducted at the Washoe plant offers a vast fund of suggestive information. In discussing the "Application of Flotation," the author takes the reasonable, but sometimes disputed, ground that for treating an ore from which, by any reasonable care, some coarse concentrate can be recovered by older methods, flotation should be considered as a last resort, for reducing tailings losses in slime. The final chapters record the latest practical applications of flotation as installed at some of the most important mines of the world. Broken Hill, Yerranderie, Newhouse, Park City, Cœur d'Alene district, Idaho Springs, Anaconda, Braden and Arizona. We commend this book especially to those who desire to know how flotation is actually working at present.

Personals

J. J. Hasbrouck has left Coquimbo, Chile, and is on his way to New York.

Horace N. Trumbull has been made advertising manager for the S K F Ball Bearing Co., Hartford, Conn.

Frank M. Leland has resigned as manager and consulting engineer for the Empire Copper Co., Mackay, Ida.

Nelson Dickerman has returned to San Francisco from Bolivia, where he has been doing examination work.

Fred. L. Vahrenkamp has become managing director and consulting engineer for the Empire Copper Co., Mackay, Ida.

Harold K. Hochschild, a director of the American Metal Co., sails on Saturday of this week for a visit to South America.

D. M. Liddell, consulting engineer for Merrill, Lynch & Co., has been visiting various steel plants in Pittsburgh, Buffalo and the Middle West.

S. D. Richardson has resigned the superintendency of the Boise-Rochester mine at Atlanta, Idaho, and is now at the Hotel Clark, Los Angeles.

J. B. Tyrrell, of Toronto, has gone to the East Kootenay district in British Columbia to examine and sample one of the silver-lead mines in that section.

F. H. Sistermans, of El Paso, formerly of the firm of Sistermans, Munro & Savage, recently dissolved, has gone to Sonora to investigate a mining property.

F. J. Brule has resigned as superintendent of construction for the Anaconda Copper Mining Co. to become chief engineer for the British America Nickel Corporation.

H. J. Wallace, formerly field engineer for the Anaconda Copper Mining Co. at the B. & M. reduction department, has been appointed superintendent of construction.

Harry B. Byrne, manager of the Butte office of Paine, Webber & Co., has resigned to accept a position with Hornblower & Weeks, in their New York copper department.

Charles F. Sturtevant, who was for years superintendent of the Cusi-Mexicana mines, has left Salt Lake to take charge of the Jerome-Pacific properties near Jerome, Ariz.

Prof. Heinrich Ries, of the department of geology, Cornell University, is giving a course of ten lectures on non-metallic products in the course on economic geology at Columbia University.

Charles L. Parsons, chief of the division of mining technology of the Bureau of Mines, is on his way back to the United States after a two months' study of processes of nitrogen manufacture in Europe.

Percy E. Barbour, managing editor of the "Engineering and Mining Journal," has returned to New York from Texas, where he has been since July 1, as first lieutenant in the 22d Regiment of N. Y. Engineers, N. G. U. S.

Charles Chynoweth, the well-known mining engineer, has returned from Arizona. He visited the Wolverine & Arizona property at Bisbee, of which company he is secretary. He also spent considerable time at the Jerome camp.

Dr. A. B. Macallum, professor of physiology and biochemistry at the University of Toronto, has been appointed chairman of the recently constituted Advisory Council on Industrial and Scientific Research at a salary of $10,000 a year.

F. B. Gleason, formerly in charge of the Western Electric Co.'s business in the Far East, with headquarters at Tokio, Japan, has been appointed manager of the Southern District of the same company, with headquarters at Atlanta, Georgia.

Edward C. O'Brien, formerly special assistant to the Attorney General of the United States, has resumed the practice of law, having established an office in the Continental and Commercial Bank Building, Chicago. He will specialize in the law of mining, irrigation, water power and Indian lands.

James K. Payne, formerly with Evens & Howard Fire Brick Co., has established an office in St. Louis, Mo., at 2013 Railway Exchange Bldg., to engage in mining and shipping of high grade Cheltenham fire clays, and to conduct a general brokerage business in refractories under the name of the Retort Clay Co.

L. H. Jones, president of the Detroit Copper and Brass Rolling Mill Co., gave a dinner at the Hotel Biltmore on Dec. 6 to 40 of his friends among the copper and zinc producers and his colleagues in copper and brass manufacturing. Mr. Jones celebrated with this dinner the completion of 35 years in his business.

Charles E. Van Barneveld has been appointed superintendent of the Tucson experiment station of the Bureau of Mines. Dr. Van Barneveld was formerly director of the department of mining of the University of Minnesota. He has specialized in the study of the metallurgical problems of the Southwest and was chief of the Department of Mines and Metallurgy at the Panama Pacific Exposition. Subsequently he served for one year as Professor of Mining at the University of California.

Obituary

Albert C. Einstein, better known as "Fred" Einstein to many old-timers all through the New Mexico mining section, died at his home in St. Louis in the last week of November, following a brief illness. Mr. Einstein was a son of William Einstein, a St. Louis capitalist and part owner of the Manhattan group of mining claims at Pinos Altos. The son, Fred, was manager of the Pacific mill and the old Aztec mill north of Silver City for several years and was widely known. Mr. Einstein was about 45 years of age and left this section about twenty years ago, engaging in business in St. Louis. He made a fortune out of acetylene lighting systems and was engaged in other large enterprises at the time of his death. Mr. Einstein at the time of his death was president of the Union League Club of St. Louis, and prominent in other civic and social organizations.

Societies

The Mining Engineering and Geological Society of the State College of Washington, affiliated student society of the American Institute of Mining Engineers, gave a luncheon in honor of Dr. Henry Mace Payne. Dr Payne gave an illustrated lecture on the thawing of frozen gravels to the society.

Engineers' Society of Western Pennsylvania held its regular monthly meeting at the society rooms, Oliver Building, Pittsburgh, on Tuesday, Dec 12, 1916. A paper on "Blast-Furnace and Steel Mill Power Plants" was presented by R. H. Rice and S. A. Moss, the reading of which was accompanied by the showing of a number of interesting and appropriate lantern slides.

American Institute of Mining Engineers, New York Section.—Second meeting of the season was held on Thursday, Dec. 14, 1916, at the Machinery Club, 50 Church St., New York. The meeting was preceded by a dinner, after which Raymond B. Fosdick spoke on the subject of "Policing a Big City." This is the last meeting of the calendar year, and was attended by a large number of resident and visiting engineers.

Mining and Metallurgical Society of America—The New York Section will hold a meeting at the Engineers' Club on Thursday, Dec. 21, at 8 p.m., preceded by the usual informal dinner at 6.30. The subject of discussion will be "How and to What Extent Have the Costs of Mining, Milling, Smelting and Refining Been Affected by Recent Conditions," and representatives of several branches of these industries are expected to report their experience.

American Chemical Society.—The third regular meeting of the session, which was to have been held jointly with the American Electrochemical Society and the Society of Chemical Industry, on Dec. 8, has, with their consent, been postponed. This meeting will be held in conjunction with the meeting of Section C of the American Association for the Advancement of Science, on Dec. 28, at the College of the City of New York, Professor Stieglitz, Chairman. Members having papers they wish to present should address Dr J. Stieglitz, University of Chicago, Chicago, Ill.

Mackay School of Mines—The Short Course for Prospectors at the Mackay School of Mines, University of Nevada, Reno, Nev., will be repeated this season. The course will begin on Jan. 8 and last until Feb. 2, thus coming at a somewhat earlier date than on preceding years. The object of changing the opening date has been to make the time most favorable for those wishing to attend, as it has been found in the past two sessions that prospectors like to return to their work about the middle of February, when conditions are likely to be sufficiently favorable, whereas during the month of January it is usually impossible to perform prospecting work.

Geological Society of America and American Paleontological Society will hold meetings in the Education Building, Albany, on Dec. 27, 28 and 29. The address of the president of the Geological Society, Dr. John M. Clarke, is on "The Philosophy of Geology and the Order of Research." That of the president of the Paleontological Society, Dr. Rudolf Ruedemann, is on "Persistent Paleontological Types." There will be public addresses by Dr. George Otis Smith, director of the U. S. Geological Survey, on "Geology and Public Service," and by Professor Richard S. Lull, of Yale University, on "The Pulse of Life." There will be symposia on "The Geology of Petroleum" and on "The Interpretation of Sedimentary Rocks."

American Institute of Mining Engineers, Columbia Section.—The sixth annual meeting of the Columbia Section, A. I. M. E., was held at Spokane, Wash., Nov. 25. With Stanly A. Easton, manager of the Bunker Hill & Sullivan Mining and Concentrating Co. in the chair, about 25 members and guests sat down to a six-course dinner, after which Mr. Easton addressed the meeting as retiring chairman. The secretary-treasurer followed with his report, which showed the membership to have increased during the year from 129 to 158. He also read several letters from members who were not able to attend and one from E. Jacobs, who found it impossible to attend, although it was an honored [illegible]. Election of officers then followed, resulting in the selection of Chairman, W. H. Linney, Spokane; Vice-Chairman, Oscar Lachmund, Greenwood, B. C.; Secretary-Treasurer, L. K. Armstrong, Spokane. These, with Stanly A. Easton, past chairman, and S. Shedd, Professor of Geology, Washington State College, Pullman, Wash., form the Executive Committee. J. C. [illegible], S. A. Easton and L. K. Armstrong, were appointed a committee on papers.

New Patents

United States patent specifications listed below may be obtained from "The Engineering and Mining Journal" at 25c. each. British patents are supplied at 40c. each.

Air Compressor. Chester A. Herle, Rochester, N. Y. (U. S. No. 1,207,1[illegible]; Dec. 5, 1916.)

Alloy—Tool Steel Alloy. Radclyffe Furness, Jenkintown, and Richard H. Patch, Philadelphia, Penn., assignors to Midvale Steel Co., Philadelphia, Penn. (U. S. Nos. 1,206,8[illegible]3; 1,206,8[illegible] and 1,206,902; Dec. 5, 1916.)

Briquets—Manufacture of Briquets of Coal, coke, turf, iron or other ores, or the like. Emil Kleinschmidt, Frankfort-on-the-Main, Germany. (U. S. No. 1,207,180; Dec. 5, 1916.)

Cage—Automatic Safety Mining Cage. George J. Newell, Goldfield, Nev., assignor of one-half to Johnathan H. Frisby, Tonopah, Nev. (U. S. No. 1,207,610; Dec. 5, 1916.)

Cages—Automatic Car Stop for Mine Cages. John A. Cushman, Terre Haute, Ind., assignor to Frank Prox Co., Terre Haute, Ind. (U. S. No. 1,207,681; Dec. 5, 1916.)

Casting Electrodes. Robert L. Whitehead, Perth Amboy, N. J., assignor to American Smelting and Refining Co., Maurer, N. J. (U. S. No. 1,206,961; Dec. 5, 1916.)

Dipper Buckets—Bail for Dipper Buckets. Ellison Edward Vanderhoef, Ruth, Nev., assignor to American Manganese Steel Co., Augusta, Me. (U. S. No. 1,207,245; Dec. 5, 1916.)

Dipper Buckets—Pulley-Block and Connection for Dipper Buckets. Ellison Edward Vanderhoef, Ruth, Nev., assignor to American Manganese Steel Co., Augusta, Me. (U. S. No. 1,207,211; Dec. 5, 1916.)

Drafting Instrument—Combined Protractor and T-Square. Ralph A. Rohrich, Cleveland, Ohio. (U. S. No. 1,207,328; Dec. 5, 1916.)

Drill—Rock-Drill Chuck. Benjamin Hastings, Cleveland, Ohio, assignor, by mesne assignments, to Sullivan Machinery Co., Boston, Mass. (U. S. No. 1,207,518; Dec. 5, 1916.)

Electrolytic Apparatus. Robert L. Whitehead, Perth Amboy, N. J., assignor to American Smelting and Refining Co., Maurer, N. J. (U. S. Nos. 1,206,963 and 1,206,965; Dec. 5, 1916.)

Electrolytic Recovery—Method of Electrolytically Recovering Metals. William A. Hussey, Oakland, Calif., assignor, by mesne assignments, one-half to James H. Alling and one-half to Francis M. Wright, San Francisco, Calif., (U. S. No. 1,297,-018; Dec. 5, 1916.)

Furnace Equipment—Rabble Arm and Rabble for Metallurgical Furnaces. Utley Wedge, Ardmore, Penn. (U. S. No. 1,206,960; Dec. 5, 1916.)

Assessments

Company	Delinq.	Sale	Amt.
Atlantic, Ida	Dec 9	Jan 9	$0.001
Beaver Copper, Utah	Dec 11	Dec [illegible]	0.005
Carbonate Keystone, Utah	Dec 14	Jan. 2	0.01
Century Gold, Utah	Dec 10	Jan 10	0.01
Challenge, Nev	Nov 29	Dec 20	0.05
Christmas, Utah	Nov 20	Dec 16	0.005
Con. Virginia, Nev	Dec 8	Dec 29	0.05
Eagle Mtn., Ida	Dec. [illegible]		0.001
East Hercules Ext., Ida	Jan. [illegible]	Feb. 2	0.0005
Ely-Gibraltar, Nev.	Dec. 15	Jan 10	0.0025
Emerald, Utah	Dec. 1[illegible]	Jan 13	[illegible]
Eureka, Ida	Dec. 9	Jan 9	0.001
Exchequer, Nev	Dec 5	Dec 27	[illegible]
Federal Ely, Nev	Dec 2	Dec 20	[illegible]
Four Timbers, Ida	Dec 2	Jan 2	0.002
Hector, Ida	Dec 2[illegible]	Jan 16	[illegible]
Idaho-Nevada, Idaho	Nov 1[illegible]	Dec 1[illegible]	[illegible]
Idora, Ida	Nov 24	Dec [illegible]	[illegible]
Imlay, Nev	Dec [illegible]	[illegible]	[illegible]
Iron King, Ida	Dec [illegible]	Jan [illegible]	[illegible]
Mayflower, Ida	Dec [illegible]	Jan [illegible]	[illegible]
Mexican G. & S., Nev	Nov 2[illegible]	Dec [illegible]	[illegible]
National Lead, Ida	Nov 2[illegible]	Dec [illegible]	[illegible]
Nevada Zinc, Nev	Nov 2[illegible]	[illegible]	[illegible]
New Hope, Ida	Dec. 1[illegible]	[illegible]	[illegible]
North Franklin, Ida	Dec [illegible]	[illegible]	[illegible]
O K Extension, Utah	[illegible]	[illegible]	[illegible]
Old Veteran, Ida	[illegible]	[illegible]	[illegible]
Paloma, Utah	[illegible]	[illegible]	[illegible]
[illegible] M. & S., Utah	[illegible]	[illegible]	[illegible]
Reindeer Queen, Ida	[illegible]	[illegible]	[illegible]
Sierra Nevada, Nev	[illegible]	[illegible]	[illegible]
Silver Moon, Ida	[illegible]	[illegible]	[illegible]
Silver Pick, Nev	[illegible]	[illegible]	[illegible]
[illegible], Ida	[illegible]	[illegible]	[illegible]
Tarbox, Mont	[illegible]	[illegible]	[illegible]
Tiberius, Ida	[illegible]	[illegible]	[illegible]
Wallace M. M. & R., Ida	[illegible]	[illegible]	[illegible]

The publication of this table will [illegible] after Dec. 30, 1916.

Editorial Correspondence

SAN FRANCISCO—Dec. 6

Damage from Water Infiltration in the Kern River oil fields is mostly caused by comparatively few wells, as shown by data collected by R. P. McLaughlin, oil and gas supervisor of the State Mining Bureau. During the first year of the operation of the department, the engineers were obliged to give most of their attention to the proper drilling of new wells. But the bureau now has an engineer, G. McGregor, employed exclusively in the Kern River field making a complete examination to determine the localities most seriously affected and offering the best opportunities for improving conditions. The opinion has for a long time obtained that little or no improvement could be expected. But one case is recently reported, showing the possibilities in the application of scientific attention to this problem. The Del Rey Oil Co., in coöperation with the bureau, plugged off the bottom water in one well and shut off the top water in another well. There are eight wells in the group; two were repaired, affecting results in four others. There was an increase in the production of five wells and decrease of water in five wells. The total production of the eight wells was increased from 135 bbl. to 207 bbl. daily, and the water was reduced from a daily flow of 1,750 bbl. to 121 bbl One well had no production prior to the repair, but produced 7 bbl. of oil, 5 bbl. of water daily, after the repair. Another well having a daily production of 10 bbl. of oil and 1,500 bbl. of water increased in oil production to 40 bbl. daily and the water declined to 15 bbl. a day. Operating costs were also reduced by dispensing with a compresor for handling water. The results have also benefitted adjoining and neighboring wells, and shaken the disbelief of the skeptics.

Restriction of Hydraulic Mining, by Federal and state laws, in counties and districts where streams may be permanently affected has been in operation for 33 years in California and all infringement of the law is speedily punished. But during all these years that the hydraulic miner has been denied the right to mine his gold, there has been no adequate remedy applied by the nation or the state. Large amounts of Federal and state money have been expended in reclamation of land for the benefit of the farmers and the restraining of flood waters, but no effort has been directed toward the double purpose of protecting the farmer and compensating the miner. Hundreds of hydraulic miners have been forever deprived of the gold in their lands, because they are either dead or in the almshouses through poverty entailed by the loss in the value of their property. If the money that has been expended uselessly in flood control had been devoted to the construction of dams and reservoirs for the conservation of water and impounding of tailings a large aggregate area of hydraulic-mining ground could have been reclaimed and the production of gold greatly increased, to say nothing of the saving of the fortunes of men as justly entitled to results of their investments and labors as are the farmers. But the state and the Federal Governments have left it to the hydraulic-mine owner to protect himself and build his own dams and reservoirs. It would have been a crime to destroy the land of the farmer; but apparently it was considered just to deprive the miner of the right to mine his gold without an effort to assist him. There are counties and districts in the state, of course, where hydraulic mining has not been interfered with, but the total production is so small and the number of operating mines so few that the industry is insignificant compared to the results of gold mining by other methods. In 1915 the total production of gold in California was 1,085,646.05 fine oz., valued at $22,442,296. Of this amount $420,770 was produced by 96 hydraulic mines, which amounts to 4.89% of the total placer gold. The dredges, drift mines and other placers produced $8,187,947 of an aggregate placer production of $8,608,617.

BUTTE—Dec. 7

Exploitation of Zinc Resources of the Butte camp has received a new impetus by the announcement that the Davis-Daly company is contemplating a vigorous development of its extensive holdings in the zinc section of the camp. Under the present energetic management a beginning has already been made and an agreement entered into with the Butte-Detroit company to handle at its Ophir mill the Davis-Daly zinc ores, now being extracted from the developments carried on in search of new bodies of copper ore. Davis-Daly owns about 400 acres of mineral ground under the city of Butte and surrounding territory, only five or six acres of which have been explored. Seventy per cent. of this area is in what is regarded as the zinc area of the district and it is in this territory that the company's chief energies will be expended in opening up its zinc resources that have lain unprospected these many years for want of a market and treating facilities. Should the expectations of the company be realized, Butte may see before long another important zinc producer added to the Butte & Superior, the Elm Orlu and the Anaconda company zinc mines, and, no doubt, new mills to handle the output.

An Important Copper Development was made recently by the Tuolumne company, which opened 10½ ft. of commercial ore in the Butte-Main Range group in the eastern section of the district. Much local excitement was created by the opening of this orebody and the possibilities it suggests for the eastern section of the Butte district. Manager Paul Gow has given out the following report: "The orebody which has been encountered at the end of the crosscut on the 700-ft. level of the Sinbad in the Spread Delight vein is believed to be a continuation of the Leonard ledge. As far as opened up to date it shows 10½ ft. of commercial ore and an assay of five samples taken clear across gives an average showing of 5.1% copper and 15 oz of silver to the ton. The orebody has been developed for a distance of 95 ft. and the foot wall has not yet been disclosed. The hanging-wall fissure of the Spread Delight vein is 20 ft. wide, 12 ft. of which is well mineralized and 4 ft. of it commercial ore. This is followed by a horse of altered granite 45 ft. wide containing a number of seams showing good copper values. To the south of this horse of granite, the vein fissure has been opened for a width of 30 ft. and mineralized throughout with 10½ ft. of commercial ore and the foot wall not in sight." The vein is supposed to traverse the Main Range group for 1,400 ft. and the westward continuation may cross the Colusa-Leonard group. Already plans are under way to crosscut on the 700-ft. level from the Colusa-Leonard shaft. In this same general district development work is carried on by the North Butte, the Anaconda, the Bullwhacker and other companies some of which have already reached the shipping stage. Altogether the prospects of adding materially to the copper resources of the camp by the work now being carried on in the eastern section are growing brighter every day.

DENVER—Dec. 7

Ohio & Colorado Smelting and Refining Co. has, during the past year, smelted at Salida an average of 386 tons of raw ore per day, according to a reported statement by E. H. Laws, the superintendent, before a luncheon of Salida business men. The gross furnace charge has averaged 510 tons daily. The products therefrom have averaged 42 tons of base bullion and 7.5 tons of leady copper matte. Most of the ore originates in Colorado, but some lead ore is imported from Idaho districts. The company is capitalized at $3,000,000. Last year it paid out in the purchase of ores $2,980,000, while the freight amounted to $445,000. Coke, manufactured at Trinidad and Crested Butte, cost $132,000. Coal, mined at Somerset and Crested Butte, cost $16,750. Limestone purchases amounted to $27,000. Electrical power was purchased for $25,750. Supplies and repairs are figured in at $56,500. The cost of shipping to and refining the products in Eastern works amounted to $272,000. The average payroll per month was $19,944, while salaries amounted to about $2,000. An average of 252 men was daily employed about the works and the average wage per shift was $2.534. The plant cost $965,000 and is assessed for taxation at $455,000.

LEADVILLE, COLO.—Dec. 8

Leadville Miners Get Wage Increase beginning Dec. 1. The disturbed labor situation, which has been a source of concern to the mine operators of the district for a period of several months was settled Dec. 5 when the large companies announced an increased pay schedule for their employes taking effect Dec. 1. Miners, trammers, shovelers and topmen who have been paid at the rate of $3.30 a shift have been raised 20c to $3.50 a shift, the lowest wage now being paid in the mines of the district. Timbermen, machine men, and expert workmen who have been receiving $3.85 a shift have been raised 15c. to $4 a shift. Hoist engineers, mechanics and others who have received $4.40 a shift have been raised 10c. to $4.50. The new schedule is a uniform increase of 50c. a shift to all mine employees above the scale of wages in force prior to last April. The action on the part of the mine operators followed a petition filed with the state industrial commission by the local miners' union, asking an investigation of laboring conditions in the district with a view to securing a raise in wages for the men. The commission was to have arrived in the district on Dec. 5, but owing to the absence of one of the body, it was stated that the date of investigation had been postponed to Dec. 15. The operators then got together and considered the wage question from all angles, finally coming to the conclusion that under existing conditions an increase was justified and it was announced to the men when issuing pay checks Dec. 5. The increase is to continue in force until further notice and is not stated to be based on the market price of any metal.

SALT LAKE CITY—Dec. 8

Statistics on Utah Mine Production in 1915 have been completed by Victor C. Heikes, of the U. S. Geological Survey. The total amount of ore produced was 10,451,445 short tons, as compared to 8,544,014 short tons in 1914. These ores carried: Gold—including small placer production—$3,609,109; silver, 12,313,205 fine oz.; copper, 187,671,188 lb.; lead, 199,967,437 lb.; zinc, 24,292,240 lb. The total value of the output was $55,105,070, as compared with a total value of $37,151,593 in 1914. The value of Utah's metal output from 1864 to 1915 is given at $727,558,498.

Salt Lake Valley Smelteries are running at capacity, as has been the case the greater part of the year. The United States Smelting Co. at Midvale is running five furnaces on lead ores. The American Smelting and Refining Co. at Murray has five or six furnaces treating lead ores. The Garfield Smelting Co. of the A. S. and R. operated four blast furnaces and five out of six reverberatories on copper ores. To this plant were added two more converters as well as 10 new Herreshoff roasters. The International at Tooele has five lead furnaces in blast, operating its lead plant at capacity; four out of the five copper reverberatory furnaces are in operation. Among other improvements, Cottrell apparatus has been installed taking all of the sintering plant (Dwight-Lloyd) gases, and also a separate Cottrell plant at the converters to treat all of the converter gases. Practically all of the camps in the surrounding country are making increased shipments and a large tonnage of ores is being received by the Valley smelters. The restrictions placed on certain classes of ores from Tintic and elsewhere in the middle of the year have been removed.

Garfield Chemical and Manufacturing Corporation, which has been building a new sulphuric-acid plant at Garfield, began warming up Dec. 1. The initial capacity will be 100 tons of sulphuric acid daily. The chamber process will be used, and gases from some of the new Herreshoff roasters of the Garfield smeltery will be utilized. The company is a separate corporation, however. The plant was built primarily to furnish acid for the new leaching plant of the Utah Copper Co., now in process of construction and expected to be completed about the middle of next year, June, 1917. Acid is also used in this section in flotation and in oil refining, and there is a probability that a large amount of it may be used in the future in the manufacture of fertilizer from phosphates, of which there are large high-grade deposits in Utah, southern Idaho and Wyoming. The new plant will produce three grades of sulphuric acid: 60° Bé., 66° Bé. and 98% sulphuric acid. It will be able to produce as high as 150 tons of acid daily, and provision has been made to further increase the capacity if desired. The buildings and plant are practically completed and regular production will begin about Dec 15.

MASON, NEV.—Dec. 5.

Resumption of Mason Valley Smeltery, recently ordered, has greatly stimulated the activity in this district, though several months may elapse before the reduction works at Thompson will actually be ready to begin smelting A contract is reported to have been entered into between the Mason Valley Mines Co. and the Bluestone Mining and Smelting Co., belonging to Captain Delamar, whereby the Bluestone is to ship 500 tons of ore per day to the Mason Valley smeltery by some time in April, increasing this tonnage to 1,000 tons per day by June. The Mason Valley company is preparing to mine 500 tons a day from its own mine near Mason by the middle of June. Surveys have been completed on a standard-gage Shay line, 2.2 mi. long, connecting the Bluestone mine with the main line of the Nevada Copper Belt R.R. at Mason, Nev. This line will be calculated to handle the tonnage, which is to be shipped from the Bluestone property. The Nevada-Douglas Consolidated Copper Co. has just started its leaching plant at Ludwig and is preparing to ship a considerable tonnage of ore to the Mason Valley smeltery. A portion of this ore will be produced from its mine at Ludwig, and some from the Western Nevada property near Mason. The Nevada-Douglas company is also considering the installation of a flotation plant at the Western Nevada, the ores of which consist mostly of iron and copper sulphides occurring in a siliceous gangue, and are amenable to concentration by oil flotation, and at least one ton of concentrates should be obtained from each four tons of ore treated. Besides these major properties, the smaller mines and prospects of the district are all making plans for increased activity as soon as an outlet for their ore is again available.

WALLACE, IDAHO—Dec. 6.

Increased Milling Facilities are required by the Morning mine at Mullan, owned by the Federal Mining and Smelting Co., and arrangements are being made to provide a total capacity of 2,000 tons per day. The Mammoth mill at Wallace, also owned by the Federal, 7 mi. from the mine, is being remodeled and a flotation plant added which will increase its capacity from 450 to 500 tons, the changes providing for the recovery of zinc as well as lead, the Morning now producing considerable zinc. The Morning is developed 1,000 ft. below the working tunnel, and the large ore reserves opened on every level have rendered larger milling capacity necessary, the Morning mill alone having a capacity of 1,500 tons. An addition is also being made to the sorting plant to correspond to the increased output. It is expected that the changes in the Mammoth mill will be completed by February.

Success Wins Apex Case against Alameda in the Idaho Supreme Court, which reversed the ruling of the district court. An appeal in the Alameda-Success case will be taken to the Federal court, according to a statement made by one of the directors of the Alameda company. Conforming to the decision in the lower court, a referee had been appointed to determine the value of the ore extracted by the Success company from Alameda ground and fix the amount to be paid by Success, the court holding that the Success had no extralateral rights extending into the Cardiff claim of the Alameda, and that the Alameda should be reimbursed for ore extracted. The referee found the amount due the Alameda to be $56,000 and had just submitted his findings to the district court for review when the supreme court handed down its decision reversing the judgment. Since the decision in the district court, the Alameda company has been reorganized and financed and a long crosscut is being driven for the purpose of working the ores which the supreme court now says belong to a large extent to the Success.

HOUGHTON, MICH.—Dec. 8

Bonus for Copper Miners who have worked steadily for the last six months will be paid by the Lake copper companies. Approximately 17,000 of the 25,000 employees of copper mines in the Lake Superior mining district will participate in the bonus distribution on the first pay day in January, 1917. This bonus was announced last summer. It is additional premium, over the regular increase in wages, of [illegible] for every day for every employee who worked from July 1 to Dec. 31. Employees who quit during that time do not participate, but an examination of the records indicates that the percentage of men who quit is insignificant. The bonus payment at the Wolverine and Mohawk mines will be made on Jan. 15, the regular pay day. At the Calumet & Hecla, La Salle, Ahmeek, Allouez, Kearsarge, North and South, old Osceola, Superior, Isle Royale, White Pine, Centennial, Hancock and Tamarack mines the bonus will be paid on Jan. 1[illegible]. The mills will pay the day before. At the Quincy mine and mill the bonus will be paid on the first pay day in January, and also at a number of the smaller mines where the system is in operation. It is generally assumed that all of the companies that operated under the bonus system for the six months closing the present year will soon make an announcement offering a similar bonus for the first six months of 1917, or for such period as the high price of copper is maintained.

Tamarack's Production for December and November will equal if not better its October record. The output for the last two months of 1916 can be estimated at 1,200,000 lb. The company is operating three shafts. No. 3 and No. 5 are furnishing a fair grade of conglomerate, and No. 2 is getting out nothing but amygdaloid, but it is profitable mining at present. No machinery has as yet been installed in the regrinding plant at the mills. This building was completed last summer and is to handle sands. It has been found impossible to secure delivery on the necessary machinery excepting at unusually high figures. While the property now is operating at a profit, costs are high and it is difficult to secure good miners for the work in the lower conglomerate formations where ventilation is not so good.

JOPLIN, MO.—Dec. 9

Strike of Shovelers at the Gibson mine in the West Joplin camp during the week was of short duration. Thirty-five men walked out on a demand for 12c. a can instead of 11c. Later they became convinced 11c. was fair and most of the men returned to work the next day.

Sarcoxie's Only Operating Mill was burned last week with a reported loss of $10,000. The mill, which was owned by the Flannery Zinc Co., was of 400 tons capacity and one of the best in the district, being equipped with three Diesel oil engines. Only two of these were injured, however, and these only to the extent of about $1,000 [illegible]. The remainder of the plant was a total loss. There was $1[illegible] insurance. The mill has been the only one operating in the [illegible] camp for months. About [illegible] men were employed and many of these already have gone to the Oklahoma field in search of work. Walter F. Fridley, manager of the plant, was away on his honeymoon at the time of the fire. [illegible] Flannery, of Pittsburgh, Penn., is principal owner of the property. It is expected the plant will be rebuilt though no definite word has been received.

The Boom in Baxter Springs Section was accentuated last week by the bringing in of another rich drill hole immediately south of the Town of Baxter Springs, Kan. In the last year the town has increased in population from 1,500 to 2,500 and indications point to an increase of another thousand in the next six months. When it was announced that the Southwest Missouri Railway Co. would extend its line from Galena to Baxter and that A. H. Rogers, president of the company, already had purchased considerable property in the new terminus of the Carthage-Joplin-Galena line, there was a rush to buy property. All during the last summer drilling operations tended to prove the extension of the Picher-Century-Cardin ore run toward Baxter, and now it has been proved right to the town limits. The latest strike shows a rich run of blende at a depth of only 110 ft.

WASHINGTON, D. C.—Dec. 9

Revision of the Mining Laws is to receive prompt attention by the committee on mines and mining of the House of Representatives, according to Dr. Martin D. Foster, the chairman of the committee. The matter first is to be considered by a subcommittee, consisting of Dr. Foster, Edward T. Taylor, of Colorado, Frank W. James, of Michigan; Courtenay W. Hamlin, of Missouri, and James Wickersham, of Alaska.

TORONTO—Dec. 8

Tax on Mining Claims will be increased by a recent ruling of the Ontario Railway and Municipal Board. A test case, brought by the Township of Tisdale in the Porcupine area against the Foley-O'Brien Mining Co., resulted in a decision upholding the municipality in assessing the mining lands on the same basis as farm lands, the valuation being $35 per acre. An appeal was taken to the Ontario Railway and Municipal Board and the decision of the judge was confirmed. As a result, mining lands that have been held idle by speculators for years, being subject to increased taxation, will either be worked by the owners or put on the market at reasonable prices.

The Mining News

ALASKA

MOTHER LODE COPPER MINES CO. (Kennecott)—Announces acquisition of Houghton-Alaska claims, 180 acres adjoining Mother Lode and Kennecott properties.

ALASKA GASTINEAU (Juneau)—Milled in November, 167,600 tons; heads, $1.13; extraction, 81.71%; tails, 20.7c. In October milled 158,000 tons; heads, $1.32.

ALASKA MINES CORPORATION (Nome)—Ellis E. Powell, Western managing director, quoted as saying that company will construct, in addition to dredges already ordered, a gigantic dredge—a "yard boat" with buckets of 27 cu.ft. capacity. The largest buckets now used on a gold dredge have approximately 17 cu.ft. capacity.

ALASKA MEXICAN (Treadwell)—Mill ran 17 days 20½ hr. by water power in October, crushing 12,635 tons for average yield of $1.18 per ton, or $14,776; operating expenses, $14,260; operating profit, $516; construction expenses, $5,045; estimated loss, $4,528; other income, $3,783. Amalgamation has been discontinued, gold now being collected entirely by concentration.

ALASKA UNITED (Treadwell)—In October, Ready Bullion mill crushed 24,374 tons and 700-Ft. Claim mill 21,360 tons for an average yield of $1.46 and $1.25 respectively, or $[illegible] and $[illegible]179. Ready Bullion operating expenses, $[illegible]; operating loss, $147; construction, $6,711; total operating loss, $6,858; net value of copper plates, $23,279; other income, $1,910. The operating expenses of 700-Ft. Claim section were $63,882; operating loss, $33,702; construction, $8,[illegible]; total operating loss, $42,293; net value of copper plates, $14,288; other income, $1,910.

ALASKA TREADWELL (Treadwell)—In October ran 150 stamps in the 300-stamp mill, crushing 26,362 tons for average yield of $2.15, or $55,699; operating expenses, $30,380; operating profit, $25,319; construction expenses, $16,735; net operating profit, $8,584; net value copper plates, $32,517; other income, $[illegible]; total profit, $52,623. Stock of broken ore decreased 16,107 tons. Central and combination development now included in "Construction Expenses" instead of "Operating Expenses" as heretofore in reports of all three Treadwell companies.

ARIZONA

Cochise County

SHATTUCK-ARIZONA (Bisbee)—November production was 1,535,723 lb. copper, 158,153 lb. lead, 22,531 oz. silver and 282.39 oz. gold. Eleven months' copper production, 16,742,124 lb.

Gila County

MIAMI (Miami)—November production, 4,968,-500 lb. copper. In October, 4,859,100 lb.

OLD DOMINION (Globe)—November copper output about 3,650,000 lb. In October, 3,200,000 lb.

INSPIRATION (Miami)—November copper output, 10,600,000 lb.; October production, 11,[illegible],000 lb. Daily mill capacity will be 18,000 tons on completion of two units now being installed.

Greenlee County

SHANNON (Clifton)—November copper output, 926,000 lb., as against 777,000 lb. in October. Grade of ore improved lately, especially in the Alaska.

Mohave County

BULLION GROUP of claims in Chloride sold by A. W. Wright to [illegible].

METALLIC ACCIDENT (Chloride)—Copper orebody being opened in this property recently acquired by Gus Holmes and [illegible].

TENNESSEE (Chloride)—Raise from 1,400 ft. to upper levels expected to [illegible], when working force will be [illegible].

Pima County

CREPIN GROUP, [illegible] smeltery, has been [illegible] F. C[illegible], of Salt Lake City, Utah, [illegible] Copper Co., a new corporation [illegible] at $1,[illegible] in $1 shares; [illegible] in treasury. Ore [illegible] copper.

BISBEE AJO COPPER AND DEVELOPMENT (Bisbee)—This Bisbee company [illegible] shaft [illegible] trict; shaft 100 ft. [illegible]. Machinery being installed. Edward Sweeney, Bisbee, president.

Yavapai County

PITTSBURGH-JEROME (Jerome)—Preparing to crosscut on 700 level; shaft now down [illegible] ft.

VERDE COMBINATION (Jerome)—This property, between Smith group and Copper Chief Extension, is being developed by tunnel.

VERDE APEX COPPER MINING CO. (Jerome)—Being refinanced, preparatory to development. J. E. Robinson, secretary, Prescott, Ariz. Property southeast of Verde King.

BIG JEROME COPPER CO. (Jerome)—Another new copper company floated by Los Angeles men. Harry E. Andrews, of Los Angeles "Times," vice-president. Property comprises about 610 acres adjacent to Pittsburgh-Jerome.

UNITED VERDE CONSOLIDATED COPPER CO. ([illegible])—E. M. Longyear Co.'s drilling crew and machines have arrived and will do 6,000 ft. of drilling by contract on the Mahurin tract; the Wilson company's contract for 2,000 ft. of drilling is on the United Verde Junior ground.

GADSDEN COPPER CO. [illegible] Delaware [illegible] $1[illegible] to take over the [illegible] & Ar[illegible] C. & A. [illegible] $100,000 [illegible] New, [illegible] L[illegible]

Yuma County

UNITED MINES CO. OF AR[illegible]

CALIFORNIA

Amador County

ONEIDA (Sutter Creek)—New orebody disclosed in 2,600 level; 20 stamps dropping. Rapidly resuming normal conditions.

KENNEDY (Jackson)—Men being added to underground force as rapidly as mine can be prepared to utilize their labor; deepening shaft again in progress; installation of three new Erie boilers interrupted by the labor strike has been resumed; Bent Bros., of Los Angeles, have comuleted raising of tailing dam to a total height of 50 ft.

Inyo County

TUNGSTEN MINES AND MILLS at Bishop are in steady operation The Tungsten Mines Co. and the Standard are employing about 120 men.

SILVER-LEAD ORE taken out by Thomas Tait and Edward Smith ready for shipment; discovery made about two months ago on eastern slope of White Mountain, 16 mi. from Big Pine. Ore said to run 40% lead and 12 to 16 oz. silver.

ALVARADO (Bishop)—Shipping ore disclosed in 70-ft. tunnel.

SANTA ROSA (Keeler)—Reported 100 tons high-grade zinc ore shipped weekly; more ready for shipment; hauled by motor truck over 26-mi. road to railroad at Keeler.

NOBLES (Round Valley)—Cooper Shapley has secured an option on this tungsten property and will immediately begin active exploration and examinaton. Property developed by opencuts. Numerous croppings exposed on hillside. Mill may be erected.

FIFTY ASSOCIATES SECURITIES CO. (Los Angeles)—Large body of talc being developed near line of Tonopah & Tidewater R.R. After stripping overburden, deposit will be bored with coal augers and blasted with black powder. Deposit extends into San Bernardino County.

Kern County

EAGLE HILL (Genesee)—New galena and blende orebody reported by W. W. Adams, operating under bond from G. H. Goodhue.

BIG FIFTY (Caliente)—Large vein of stibnite opened in porphyry dike. Shipping about 4 tons daily of 30% ore. F. W. Remy, of Los Angeles, consulting engineer.

Nevada County

GRASS VALLEY BOUNDARY (Grass Valley)—Company permitted to sell 75,000 shares at 35c. for development of the Oak Tree lode, near old Peabody mine.

ALLISON RANCH (Grass Valley)—Company has negotiated for property owned by Lewis and Henderson estates, embracing 53 acres, including the Great Eastern, New Idea and Golden Cycle claims. Has been stated that the Caribou vein apexes in this ground.

MOHEGAN (Nevada City)—Property on Gold Flat bonded to A. J. Burke, San Francisco. Pumping and hoisting plant at the Mount Auburn mine being installed here; electric power line from Pittsburgh mine will be constructed. J. C. Campbell is manager.

Placer County

IOWA HILL DISTRICT active from chrome developments. The Golden Streak gravel mine will be reopened by Colfax men. Tailings from the famous Big Dipper, Morning Star and Jupiter mines in Rose and Schwab Cañons will be worked by Chinese miners from Dutch Flat.

Plumas County

WALKER COPPER (Portola)—Mill crushing about 65 tons daily; concentrates hauled by team to Gulling, on the Boca & Loyalton R.R., for shipment to smeltery at Salt Lake. No decision reached regarding extension of railroad to the mine.

COPPER BONANZA (Portola)—This property of 12 claims, recently located near Walker mine by Bert G. Pershal and associates, is said to present fine copper showing and apparently in the same formation as the Walker and the Engel mines.

COLORADO

Boulder County

PRUSSIAN (Boulder)—Mine and mill started by Boulder men.

PRIMOS CHEMICAL CO. (Lakewood)—New schedule for tungsten ores announced: For ores running 40% tungsten or under, $10 per unit; 25c. additional per unit for over 40%. Renewal of leases announced and ore will be purchased on open market.

Chaffee County

TURRET COPPER MINING CO. (Turret)—Stated 12-ft. vein shipping ore opened on 200-ft. level. Some good-grade ore mined on upper levels. F. B. Radow, manager.

PARAMOUNT REDUCTION CO. (St. Elmo)—New custom milling plant nearing completion; equipped with crusher, ball mills, concentrating tables and flotation machine. Mixed sulphide ores from district will be treated about Jan. 1.

Gilpin County

BELDEN TUNNEL (Central City)—Lessees shipping ore to Polar Star mill.

GILPIN-EUREKA (Central City)—Shipping high-grade concentrates to Globe smeltery, Denver.

TWO BROTHERS (Russell Gulch)—Breaking of compressor necessitated shutting down of this property and Trio tunnel.

RARE METALS ORE CO. (Rollinsville)—Mill running three shifts on custom tungsten ore; making good recovery; capacity 75 tons per day. S. R. Tyler, superintendent. Company's own mine will soon be producing ore. Nelson Franklin, manager.

Jefferson County

GREAT WESTERN PORTLAND CEMENT CO. incorporated for $500,000; subsidiary of Cement Securities Co., Chas. Boettcher, president. Incorporators are: R. J. Morse, Clark M. Moore and Harry O. Wasmer, all of Denver. Plant to cost $750,000, to be built near Morrison. Chief field to be supplied will be Wyoming, South Dakota and northern Colorado.

Lake County

DERRY RANCH GOLD DREDGING (Leadville)—Dredge shut down on Dec. 8; cleanup for season approximately $130,000.

Ouray County

MOUNTAIN TOP (Ouray)—What is said to be the first complete underground mill in the world has been built in this property at a point 1,000 ft. in from portal of the tunnel. Capacity of plant is estimated at 50 tons and the cost $100,000. Equipment includes ore bins, crushers, concentrating tables, ball mill and flotation apparatus. Operators will no longer fear snowslides, which have hindered operations in the past.

San Juan County

NOVEMBER SHIPMENTS from Silverton were: Sunnyside, 28 cars; Gold King, 22; Silver Lake mill, 15; Iowa-Tiger, 14; Mayflower lease, Silver Ledge and St. Paul, 8 each; S: D & G lease and Congress, 7 each; Koehler tunnel, 5; Highland Mary, 4; Dives lease, Mears-Wilfley and Hamlet, 3 each; Kittimac and Atlantic lease, 2 each; Intersection, Davey Leasing Co., Gennessee, Carbon Lake, Jumbo lease, Averill and Vernon, 1 car each; and miscellaneous small shipments aggregating 13 cars; total, 159 cars. Producers shipping ore to Silver Lake custom mill were: Green Mountain, 24 cars; Davey Leasing Co., 18; Allen & Fattor and Congress, 4 each; Ben Butler, 1 car; total, 51 cars.

COMING WONDER (Silverton)—This Anvil Mt. property being developed by Nels Andrene and associates.

San Miguel County

NOVEMBER SHIPMENTS from Telluride were: Tomboy, 63 cars; Smuggler-Union, 33; Liberty Bell, 16; Anderson, 2; Carlson and King & Ferrell, 1 car each; total, 116 cars, mostly concentrates.

BUTTERFLY (Ophir)—Development being done by Jurich Leasing Co. Occasional mill runs made on ore produced from development.

TOMBOY (Telluride)—Mill ran 28 days, crushing 12,000 tons, yielding $37,000 in bullion and $59,000 in concentrates; operating expenses, $68,000.

Summit County

ORE DISCOVERIES made recently in New York, Baker, Roby properties on Gibson Hill and in Old Union and Ben Benson's lease on Washington mine.

SILVER BOWL (Kokomo) — Ore shipments started.

LITTLE EDITH (Breckenridge)—Lead ore opened in lower tunnel on Bald Mountain.

WELLINGTON (Breckenridge)—New shaft being sunk just below mill to explore Oro vein, opened in dredging operations and which has been good producer in distant part of property. Shaft to be sunk 100 ft., then crosscutting. Addition being built at mill to provide increased flotation capacity.

BOLIVAR MINING AND TUNNEL TRANSPORTATION CO. (Montezuma)—Stated Boston men will finance continued development and increase capacity of mill. Negotiations under way to bond several other properties in district. Engine and fan to ventilate No. 1 tunnel will be installed and driving resumed; tunnel will afford transportation and drainage facilities to several mines now practically inaccessible.

Teller County

DEXTER (Cripple Creek)—Lessees shipping high-grade ore.

ECLIPSE (Cripple Creek)—Regular shipments good-grade ore being made.

BLUE BIRD (Victor)—Lessees are hand-sorting and screening the dump and securing payable grade of milling ore.

BONANZA KING (Victor)—Being developed by Midget Bonanza Gold Mining and Milling Co. Electric hoist installed by lessees.

GREGORY (Cripple Creek)—Dump on Raven Hill being shipped by A. E. Carlton and associates. Aërial tramway built to transport material to railroad.

CRESSON (Cripple Creek)—Company reports October profits $154,476, with cash in bank $1,215,791, and 84 cars of ore in transit worth $75,000.

GOLD DOLLAR (Cripple Creek)—Rich strike made on 400-ft. level of Mable M. shaft by Hill & Coughlin, sublessees of Union Leasing Co. Ore is quartz and granite carrying calaverite; opened for distance of 20 ft.; assays $50 across width of 2½ ft.

IDAHO

Custer County

EMPIRE COPPER (Mackay)—The new interests, L. R. Eccles and associates, of Ogden, Utah, have assumed management of this property; will increase output to 700 tons daily and plan to erect new reduction plant in spring. Good body of sulphide ore encountered in Cossack tunnel, about 900 ft. below the Alberta tunnel. Manager Adkinson will drive raise from Cossack to Alberta tunnel and eliminate the use of the "Shay" railroad; two new compressor plants ordered, new laboratory also to be built. Company has been shipping 250 tons daily to Garfield (Utah) smeltery. Fred L. Vahrenkamp, managing director.

Shoshone County

BIG IT MINING AND MILLING CO. (Beeler)—New incorporation to develop group in Pine Creek section. C. M. Beeler, M. L. Pratt and C. R. Konkle interested.

HECLA (Wallace)—Addition to Hecla mill at Gem about completed, increasing capacity from 450 tons to about 700; company also negotiating for a lease on the Marsh 200-ton mill on Nine Mile Creek.

HUNTER (Mullan)—Preparations being made to sink from 1,200 level. Ore on this level rather disappointing, which led to thorough prospecting of ground below with diamond drill. Preparation to sink taken to mean that diamond drilling proved satisfactory. Main vein, lead-silver; parallel vein carries high silver but no lead. Attempts to treat ore from both veins in same mill proved unsuccessful; different flotation adjustments required to recover the lead and silver. Company considering building new mill next year for lead ore and transforming old mill into flotation plant for high-grade silver ore.

MICHIGAN

Copper

SUPERIOR (Houghton)—Sending out about 575 tons of rock daily.

ISLE ROYALE (Houghton)—Drifting south of No. 7 shaft. Foundations ready for new rockhouse at No. 7 shaft.

COPPER RANGE (Painesdale)—Has three diamond drills working in a tract south of the Globe; land under option from the St. Mary's company.

CENTENNIAL (Calumet)—No. 2 shaft has reached the 18th level. Drifting from No. 1 shaft past No. 2 shaft, north, the ground has shown good mineralization.

HOUGHTON (Houghton)—Discontinued northern drift on the 12th level, because of the excessive cost of operating same. Good rock being stoped on sixth level.

CHEROKEE (Houghton)—Vein crosscut, at a depth of about 120 ft., for 29 ft. One drill will continue operating in east drift; two drills will be kept on sinking.

NEW BALTIC (Houghton)—Owing to large amount of water, sinking is proceeding slowly; shaft down about 60 ft. Delay in part due to slow shipments of supplies.

ALLOUEZ (Allouez)—Contract let for five 4-ton electric locomotives for underground haulage on the 14th, 15th, 16th, 17th and 20th levels. The hauls will be approximately 2,000 ft. each.

KEWEENAW (Mandan)—Conditions somewhat improved. About 40 bbl. of "mineral" and two carloads of mass copper shipped to Quincy mill during recent week. Have men enough to supply rock for the mill to run all the day shift.

HANCOCK (Hancock)—Improved labor supply has resulted in increased tonnage. Winze from 49th to 53d level nearly completed, while that from 44th to 49th level has been completed.

SENECA COPPER CO. (Calumet)—Lewisohn Bros., of 11 Broadway, New York, and Tucker, Hayes & Bartholomew, of Boston, have formed this company with 250,000 shares to take over the old Seneca Mining Co., a subsidiary of Calumet & Hecla.

Iron

LAKE ANGELINE (Ishpeming)—Ore of fine grade uncovered by stripping. The shovel work being done by contract; owners are operating a dragline excavator. Expected to ship about 100,000 tons next year. It was believed ore was exhausted, mine having been sold at auction last year for $27,000. Cleveland-Cliffs Iron Co. were purchasers. Drills disclosed several bodies of ore close to surface. Ore always considered finest in district.

MINNESOTA

Messabi Range

OLIVER IRON MINING CO. (Chisholm)—Orders given to proceed with stripping work at Glen mine. Also on lands known as the Bliss and Burt property, which the Hartley mine encompasses. Means the removal of 1,000,000 cu.yd of overburden from Glen and 1,500,000 cu.yd from other property. Shovels and men transferred recently from Burt-Leonard pit to Glen. Two shovels to work two shifts. Six locomotives will be employed. Similar equipment will be at the other pit. These two mines together should ship 1,000,000 tons of ore next year.

MISSOURI-ARKANSAS

Joplin District

GRAND HAVEN (Joplin)—Being reopened by Asquith & Berlin, of Joplin. Recent drilling shows good ore southeast of mill.

R. L. McGEE (Duenweg)—Purchased Zogg land lease near Diamond and begun construction of small mill. Silicate mine, with operations at 80 ft.

BALTIC (Duenweg)—Owners recently leased ground to the superintendent on contract. Three carloads of concentrates made weekly since contract went into effect.

COAHUILA (Duenweg)—Again operating its No. 1 and No. 3 mills at Duenweg and No. 2 plant at Carthage, and making big weekly output. C. A. Smith, district manager, still on Mexican border as major in Missouri National Guard; R. C. Bean, acting manager.

Northern Arkansas

BEATTY (Kingdon Springs)—Sold by State Senator Killam, of Locust Grove, Okla., to Wade Luckett and associates, of Rush. Consideration $30,000. Property is blende producer only, which is unusual for Arkansas field. Good showing at 40 ft. Mill recently overhauled and put in good condition.

MONTANA

Granite County

NANCY HANKS-MONTANA MINING CO. (Garnet)—New organization to operate the old Nancy Hanks gold-copper mine. Property comprises 8 claims and main shaft is down 400 ft.; equipment capable of sinking shaft to 600 ft. J. E. Blanc, 90 Wall St., New York, president.

Silver Bow County

EAST BUTTE (Butte)—November copper output 1,648,000 lb. In October 1,650,000 lb. Copper production for 11 months, 17,101,540 lb.

BUTTE & SUPERIOR (Butte)—Mined in November 54,312 tons of ore and milled 53,880 tons, producing 14,300 tons of concentrates, assaying 53% in zinc. Recovery was 93.7%. Estimated amount of zinc in concentrates was 15,158,000 lb. No. 3 Shaft will be made ready for operation as soon as machinery arrives and is installed. About 500 ft. more work required to complete No. 2 shaft.

ANACONDA (Butte)—November production 25,500,000 lb. copper as against 31,500,000 lb.; decline chiefly due to severe cold spell early in November; total copper production for 11 months is about 307,900,000 lb. Company is defendant in suit brought by James A. Murray, who is endeavoring to establish title to the Iduna claim in the Kemper Addition to the City of Butte. Many mines closed two shifts Dec. 9, owing to shortage of railroad cars.

NEVADA

Elko County

LONG HIKE (Jarbidge)—E. A. Austin has taken charge of this group, reported under option through San Franciscans to the Guggenheims. Development reported to be highly satisfactory.

Esmeralda County

RED HILL FLORENCE MINING CO. (Goldfield)—Recently organized to merge and rehabilitate the Red Hill and Florence-American companies. Capitalization 2,500,000 shares, assessable. Adjoins Florence on the south.

FLORENCE (Goldfield)—As a result of friendly suit instituted by local creditor, Superintendent Clapp was appointed receiver. President Parker now in the East perfecting plans for refinancing. Future plans include sinking main shaft to shale with lateral development at that horizon.

Lyon County

BLUESTONE MINING AND SMELTING (Mason)—This Delamar property being reopened. A 1,200-ft. tramway and 2-mi. broad-gage spur will connect mine with the Copper Belt R. R.

Nye County

TONOPAH ORE PRODUCTION for week ended Dec. 2 was 9,747 tons, valued at $191,386, compared wtih 10,442 for week previous. Producers were: Tonopah Belmont, 2,937 tons; Tonopah Extension, 2,380; Tonopah Mining, 2,000; Jim Butler, 1,150; West End, 512; Rescue-Eula, 256; Halifax, 161; McNamara, 54; North Star, 53; miscellaneous, 244 tons.

CASH BOY (Tonopah)—As result of sinking in shaft of neighboring property, water is receding in winze from lower level; development to be resumed there.

LOUISIANA CONSOLIDATED (Tonopah and 120 Broadway, New York)—Has acquired the old Tybo lead and zinc mine near Reveille. Considerable ore between 300 and 400 levels. Shaft to be sunk 400 ft. Will install transmission line, electric hoist, compressor and drills. Walter E. Trent, president.

TEXAS

SULPHUR OPERATIONS are regarded as a possible outcome of the recent visit to Big Hill, Matagorda, by leading stockholders of the Gulf Sulphur Co. and other interests.

UTAH

Beaver County

WHITE CRYSTALS (Milford)—Car of ore ready for shipment.

ANTELOPE STAR (Milford)—East tunnel showing improvement; ore lead silver.

Juab County

EUREKA LILLY (Eureka)—Shaft down 810 ft.; iron coming in at bottom. Property adjoins Tintic Standard.

PLUTUS (Eureka)—At meeting in Provo, Dec. 8, Walter Fitch was elected president, Cecil Fitch vice-president, J. William Knight among directors. Control of Plutus acquired by Chief Consolidated. Place of business transferred from Provo to Salt Lake.

IRON BLOSSOM (Silver City)—Copper ore being developed on 1,200 level of north workings, and sinking from 1,300 in progress. Drift from south shaft on 1,700 is approximately 200 ft. from being directly under north shaft workings. When underneath these workings, raise will be driven to connect. Crosscutting on 1,700 also to be done to reach copper bearing fissure.

Salt Lake County

HAULAGE CONDITIONS from Alta and Little Cottonwood have improved since recent snowfall. Ore hauling by means of bob sleds is possible from now on, and shipments from the camp will be much increased over what has been possible since about Oct. 1. The South Hecla company has large tonnage accumulated ready for shipment, and lessees at the property also have ore ready. The Michigan Utah, Albion and Alta Consolidated have accumulations of ore.

ALBION (Alta)—Drift from Quincy tunnel level continues in ore. Material running 5 to 7% copper being saved.

OHIO COPPER (Bingham)—Time allowed stockholders for depositing stock with $1 a share for reorganization expires Dec. 15; New York Trust Co., depositary, 25 Broad St., New York.

MICHIGAN-UTAH (Alta)—Company has followed ore for 400 ft. from Lavinia tunnel to Copper Prince tunnel. Ore up to 8 ft. thick, carrying silver, lead and copper opened in latter tunnel. Lessees also mining ore.

EMMA COPPER (Alta)—Crosscut from second level of the shaft below Bay City tunnel reported to have cut ore carrying lead and silver. Crosscut being run for ore cut by diamond drill holes has not reached point where ore is expected.

WOODLAWN (Salt Lake)—Property in Big Cottonwood Cañon installing electric hoist and compressor. Buildings completed and supplies laid in for winter. Power to be taken from transmission line, running to Alta Tunnel and Transportation Co. W. J. Lawrence, manager.

UTAH METAL AND TUNNEL (Bingham)—Mill being increased from 225 tons daily to 300 tons. Expected to be ready by Feb. 1. New 100-ton flotation plant built to treat tailings from other mill—operating, and treating 60 tons daily. Report for nine months ended Oct. 1 shows gross value of ore mined, $1,262,752; other receipts, $37,161; total income of $1,299,913. Expenses were $732,167, leaving operating profit of $567,737. Dividend of $342,472 was paid Aug. 15.

WASATCH MINES (Alta)—New 5,000-ft. drainage and operating tunnel is in 800 ft., 500 ft. being in solid rock. First 300 ft. opencut work. Progress of about 10 ft. daily being made. Object is to unwater old Columbus Consolidated stopes, and develop property at depth. Large belt-driven compressor recently installed working well, and furnishing ample power. Company furnishes air to a number of Alta mines. Company's Flagstaff tunnel workings or 700 level being extended.

Summit County

COMSTOCK-CALIFORNIA (Park City)—Lessees at property in Thaynes Cañon making regular shipments.

KEYSTONE (Park City)—Sinking resumed and no further water troubles anticipated. Newton Dunyon, superintendent.

THREE KINGS (Park City)—Winze from 500 down 130 ft. Last 40 ft. in gray limestone. Some mineralization—lead and silver encountered. In brownish shaly limestone at bottom of winze. Drifting to southwest to be started here.

Tooele County

COPPEROPOLIS (Wendover)—Fifty-ton shipment of 10% copper ore carrying some silver and gold made from this property in Deep Creek section. Controlled by the Bambergers, of Salt Lake City.

WASHINGTON

Stevens County

MAGNESITE DEPOSITS reported in Colville Valley, near the town of Valley. Julius Fisk farm and the old U. S. marble quarry reported sold, owing to magnesite discoveries.

SECURITY COPPER (Chewelah)—Crosscutting started Dec. 1 toward No. 4 vein from 500-ft. level; shaft now 550 ft. deep. L. K. Armstrong, manager.

LOON LAKE-BLUE BIRD COPPER MINING CO. (Loon Lake)—New incorporation to develop Blue Bird and Dupont claims adjoining Loon Lake Copper Co. Andrew Laidlaw of Spokane interested.

UNITED COPPER (Chewelah)—The 250-ton mill, now equipped with flotation department, is making satisfactory recovery. Company resumed dividend payments last month after suspension of four years. Sinking of two-compartment shaft from 1,000-ft. to 1,500-ft. level recently authorized, diamond drilling having shown the ore 100 ft. below present workings. Conrad Wolfle, manager.

WISCONSIN

Zinc-Lead District

WICKS (Mineral Point)—Producing high-grade concentrates at its new London property, also operating the Senator mine, at Mifflin, under sublease.

FRONTIER MINING (Galena, Ill.)—After battling extra heavy water and lean ground for three years, company has opened important body of ore at Bird No. 2 shaft; another mill will be erected at Bull Moose No. 2.

CANADA

British Columbia

SMELTERY AT LADYSMITH formerly owned by Tyee Copper Co., reported purchased by New York men and is to be enlarged. W. J. Watson, formerly manager, is going to Ladysmith to remodel and start the plant.

CROW-FLEDGING (Ainsworth)—The 1,100-ft. crosscut tunnel struck the vein; being drifted on both ways.

COPPER BUTTE (Golden)—A 130-ft. tunnel has been driven to the vein and two small shipments of copper-silver ore made to Trail smeltery. Force of 9 men working; 16 horses packing ore to railway. B. Gass, of Seattle, in charge.

Ontario

DOME (South Porcupine)—During November milled 37,900 tons yielding $177,000; average value $4.67; working cost $2.88 per ton.

WRIGHT-HARGRAVES (Kirkland Lake)—Rich oreshoot showing tellurides and free gold reported in shaft at depth of 25 ft.

NEWRAY (Porcupine)—Manager Charlebois reports that test pit on west side near Plenaurum mine, at depth of 21 ft., gave assays of $36 per ton.

SCHUMACHER (Schumacher)—Production in November $18,295; working costs including sinking of new shaft, about $15,000. Shaft sunk to 200-ft. level where station is being cut.

KENABEEK (Kenabeek)—Vein, found at depth of 63 ft. in main shaft, has widened to 18 in. and shows good silver content. Five other veins have been encountered.

REAMSBOTTOM-EDWARDS CLAIMS in Langmuir Township acquired by Mond Nickel Co., of Coniston. Claims show small veins of niccolite but principal value is said to be in platinum content.

NATIONAL MINES (Cobalt)—Shaft on the King Edward, now under lease to this company, sunk to the contact at depth of 1,170 ft. Crosscutting started in the diabase just above the contact.

HARGRAVES (Cobalt)—Comprehensive development to be undertaken by Toronto, New York and Boston interests, which recently acquired control; due to discoveries in the Kerr Lake adjoining.

McINTYRE (Porcupine)—Following are terms on which the McIntyre Extension and Jupiter will be taken over by the McIntyre. Price of the Extension is 291,000 shares of McIntyre, equivalent to one share for every 3¼ shares of McIntyre Extension outstanding other than already owned by the McIntyre. For the Jupiter the price is 316,298 shares of McIntyre, equal to one share for every three of the Jupiter exclusive of those now held by the McIntyre. Proposition will be submitted to McIntyre shareholders at meeting on Dec. 28. It is proposed to issue $1,000,000 of stock to complete purchase making a total capitalization of $4,000,000; 8[illegible]17 shares to be retained in treasury.

MEXICO

ESPERANZA (El Oro, Mex.)—Milled in October, 15,675 tons; operating profit, £13,615.

CANANEA CONSOLIDATED (Cananea, Sonora)—November copper output 5,100,000 lb.; in October 6,030,000 lb.

CHILE

CHILE (Chuquicamata)—November copper production reported at 4,098,000 lb.; October, [illegible]12,000 lb.

BRADEN (Rancagua)—Output in November 4,419,000 lb. copper; October, 4,018,000 lb.

PERU

CERRO DE PASCO (Fundicion)—Copper output for November [illegible]700,000 lb.; October production approximately 6,000,000 lb.

JAPAN

COTTRELL PATENTS for electrostatic precipitation in Japan sold by Dr. F. G. Cottrell to syndicate of seven leading Japanese mining companies. Several plants being installed, including one at Ashio smeltery and at [illegible] cement works.

The Market Report

Metal Markets

NEW YORK—Dec. 13, 1916.

The markets had already become dull previous to Dec. 12. Lead was holding strong, but spelter was becoming increasingly weak. The German peace proposals on Dec. 12, and the accompanying slump in the stock market, produced a general shock which was felt in the metal business.

Copper, Tin, Lead and Zinc

Copper—Very little business was reported by producers, barring a few sales of round lots for delivery in the second half of 1917. This business was, bowever, sporadic and was taken at considerable discount from going prices. Early in the week a little business for second quarter of 1917, with some first quarter thrown in, was done at 33½c., r.t. Following that the market is quoted nominally at unchanged prices. The momentous news of Dec. 12 excited a good deal of concern without having much direct effect upon the market. This was but natural in view of the sold-out condition of the producers. The chief effect that was discernible was the offering of near-by copper at 34½c. Indirectly it was evident that those consumers who had decided to remain uncovered and take their chances were better assured of their position.

The action of the British government, Dec. 8, in taking complete control of the copper business in Great Britain is discussed in our editorial pages. On Dec. 11 we had news that business had ceased on the London Metal Exchange. The continuance of quotations, which are cabled over, has been rather mystifying in view of the other news. A possible explanation is that they are only nominal prices, but as to this we have not yet any exact information.

Copper Sheets—Base price for copper sheets remains at 42c. for hot rolled and 43 for cold rolled, as reported last week. Wire is on a base of 37c., f.o.b. mill.

Tin—This market was quiet and inclined to be a little weaker. At the beginning of the week spot was 43¾c., and futures, 54c.; at the close, the quotations were 42⅞ and 42c., respectively.

Lead—This market passed chiefly into the hands of speculators and dealers, producers being generally sold out for near-by supplies. Prices varied according to delivery offered, whether December, January or February. The volume of transactions during the week was manifestly small in view of the slight participation by the producers. There were some large inquiries in the market from the Orient and some smaller ones from South America. An interesting question is how much lead is in the hands of speculators. That there is a speculative position is rather indicated by the behavior of the market on Dec. 12, when it became decidedly unsettled, with sellers at 7¾c., whereas 8c. had previously been asked. The same condition prevailed on Dec. 13.

Spelter—The weakness in this metal continued, prices sliding off from day to day on free offerings to sell. Buyers were apathetic throughout. A few who had been showing some interest changed their minds on Dec. 12. First hands were more desirous of selling spelter than they had been in the previous week, blt although thero was a decided increase of bearishness, no sellers became aggressive. At the close of the week, December and first-quarter spelter was freely offered at 11c., no difference as to delivery.

Zinc Sheets—The price of zinc sheets remains based on $21 per 100 lb., f.o.b. Peru, Ill., less 8% discount, as reported last week.

Other Metals

..**Quicksilver**—Unchanged at $80, market steady. San Francisco reports by telegraph $78, demand fair.

Antimony—Market steady at 14¼@14½c., with fair business. January-February shipment from China quoted at 13@13½c., c.i.f., New York, duty unpaid.

Nickel—The price of nickel remains unchanged at 45@50c. per lb., electrolytic commanding a premium of 5c. per lb.

Aluminum—Quotations are at 64@65c. per lb. for No. 1 ingots at New York.

Gold, Silver and Platinum

NEW YORK—Dec. 6

Gold—Metal to the amount of $11,300,000 has been imported from Canada and deposited in assay office for account of J. P. Morgan & Co. This makes a total imported from all sources since January $559,300,000. The stock of gold coin and bullion in this country on Nov. 1, according to the report of the Secretary of the Treasury, was $2,700,136,976, an increase of $714,597,804 in sixteen months, and that the deposits in national banks Sept. 12, the date of the last bank call, were $11,362,341,000. The stock of gold is the largest that any country ever had.

Silver—Owing to limited offerings in the London market, and the large mintage requirements silver is showing an advancing tendency. Recent English advices by letter are to the effect that the India government finding difficulty in procuring silver on reasonable terms has planned to issue a very large sum in rupee paper.

Platinum—Market declined further, round lots being sold at $85 per oz. previous to Dec. 12. It is rather doubtful if that price could have been realized subsequently.

Palladium—Quoted at $70 per oz.

Zinc and Lead Ore Markets

Platteville, Wis., Dec. 9—Quotations for the district according to the following prices: Base price per 2,000-lb. ton for material assaying 60% zinc was $105@97 for premium ore, down to $95 for medium grades. Base price per 2,000-lb ton for material assaying 80% lead was $90. Shipments for the week ended Dec. 9 were: 3,300 tons of zinc ore, 183 tons of lead ore, and 770 tons of sulphur ore. For the year to date the figures are: 125,417 tons of zinc ore, 4,371 tons of lead ore, and 30,423 tons of sulphur ore. Shipped during the week to separating plants, 4,169 tons of zinc ore.

Joplin, Mo., Dec. 9—Price quotations per 2,000 lb.: Blende, high, $102.35; 60% zinc, premium ore, $100; medium, $95@80; low, $85; calamine per ton 40% zinc, $62.50@55. Average selling price, all grades of zinc, $91.40 per ton.

Lead, high price, $100; base, $98@95: Average selling price, all grades of lead, $87.84 per ton.

Shipments of the week: Blende, 8,931 tons; calamine, 726 tons; lead, 1,766 tons. Value, all ore the week, $1,037,830; 49 weeks, $35,766,610.

Purchase of one carload of lead by the Empire Zinc Co. sent the base price up to $98 for ore grading 80% metal content.

Sellers of zinc undertook to advance the market to $110 base this week, but nearly half the support was removed by the light demand, the large shipment being a reflex of last week's heavy purchases. Indications tonight are for a stronger demand around $95@100 base prices. The restriction of output from lack of electric power was assumed by sellers sufficient grounds for a higher ore price, but it went down instead of up. The electric power company is installing an additional steam auxiliary plant, but there is little prospect of its completion before Feb. 1. In the meantime low water has reduced power current to a minimum and the breaking of the steam turbines has crippled the present auxiliary plant until a new equipment can be installed.

Other Ores

Tungsten Ore—Market continues active at $18 per unit. Largest producer in this country reported to have advanced its price to $20 per unit. Europe continues to take ferro-tungsten which is quoted at $2.50 per lb. tungsten contained.

Iron Trade Review

NEW YORK—Dec. 13

The November pig-iron production did not come up to the remarkable rate of October. The total was 3,311,811 tons, or 110,394 tons a day, against 3,508,849 tons in the 31 days of October, or 113,189 tons per day. This record, however, exceeds that of any other month of the year aside from October.

It seems improbable that any relief of pig-iron stringency is to be expected from increased output. On the other hand, several furnaces have been blown out after long and hard campaigns and it is probable that others will follow. On Dec. 1, there were 322 furnaces in blast, with capacity of 108,127 tons a day, against 325 furnaces Nov. 1, producing at the rate of 109,022 tons per day.

Taken as a whole, the pig-iron market is not quite so feverish as it was a week or two ago, but there is no great slackening of demand and prices hold or continue to advance. Some buyers are holding off, however, even in view of the prospect for increased prices later.

The scarcity of semi-finished material, particularly sheet bars, is becoming serious. Many sheet mills are compelled to shut down for a day or two every week on account of inability to obtain bars. Buyers of sheet are also embarrased. Prices seem to be advancing, and five cents per pound seems to be the minimum for No. 28 black, while galvanized is selling freely at from $6.50 to $7.10. Some of the sheet-bar buyers charge that the shortage of that material is due largely to the use of a large tonnage for manufacturing shells.

The South seems to have been cleaned up rather completely on early iron and this fact has reduced the selling for export, though the inquiries from that direction are as heavy as ever. The opinion is voiced in the trade that foreign buyers will now begin to draw more heavily upon Virginia and northern districts where more metal for near-by shipments is available.

The shortage of cars for all services continues and is a factor of considerable importance in the iron industry as well as all other industrial ac-

SILVER AND STERLING EXCHANGE

Dec.	Sterling Exchange	Silver New York, Cents	Silver London, Pence	Dec.	Sterling, Exchange	Silver New York, Cents	Silver London, Pence
7	4.7550	75⅝	36⅛	11	4.7550	75½	36⅛
8	4.7550	75¼	36 15/16	12	4.7544	76	36⅜
9	4.7550	75¼	36	13	4.7550	76	36⅝

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine.

DAILY PRICES OF METALS IN NEW YORK

Dec.	Copper Electrolytic	Tin Spot.	Lead N. Y.	Lead St. L.	Zinc St. L.
7	33 @33½	43¾	7.63 @7.75	7.40 @7.60	11½ @11¾
8	*33 @33½	43½	7.63 @7.75	7.50 @7.70	11¼ @11½
9	*33 @33½	43½	7.65 @7.95	7.55 @7.75	11¼ @11½
11	*33 @33½	43¼	7.75 @8.00	7.65 @7.80	11⅛ @11¼
12	*33 @33½	43	7.63 @7.75	7.50 @7.63	10⅞ @11⅛
13	*33 @33½	42⅞	7.63 @7.75	7.50 @7.63	10⅞ @11⅛

*Nominal.

The above quotations are our appraisal of the average of the major market based on sales as made and reported by producers and agencies; and represent to the best of our judgment the prevailing values of the metals for the deliveries constituting the major markets, reduced to basis of New York, cash, except where St. Louis is the normal basing point.

The quotations for electrolytic copper are for cakes, ingots and wirebars. Electrolytic copper is commonly sold on "regular terms" (r.t.), including freight to the buyer's works and is subject to a discount for cash. The difference between the price delivered and the New York cash equivalent is at present about 0.25c. on domestic business. The price of electrolytic cathodes is 0.05 to 0.10c. below that of electrolytic. Quotations for spelter are for ordinary Prime Western brands. We quote New York price at 17c. per 100 lb. above St. Louis.

Some current freight rates on metals per 100 lb. are: St. Louis-New York 17c.; St. Louis-Chicago, 6.3c.; St. Louis-Pittsburgh, 13.1 cents.

LONDON

Dec.	Copper Standard Spot	Copper Standard 3 Mos.	Copper Electrolytic	Tin Spot	Tin 3 Mos.	Lead Spot	Zinc Spot
7	152	143	170	186½	188½	30½	58
8	151	142½	171	185¾	187¼	30½	58
9		. . . .	.		. .	.	.
11	148		168	185	186½	30½	58
12	145½	139½	168	184¾	186¾	30½	57
13	142½	136½	164	184¼	186	30½	57

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2,240 lb. For convenience in comparison of London prices, in pounds sterling per 2,240 lb., with American prices in cents per pound the following approximate ratios are given, reckoning exchange at 4.80. £15 = 3.21c.; £20 = 4.29c.; £30 = 6.43c.; £40 = 8.57c.; £60 = 12.85c. Variations, £1 = 0.21⅜ cents.

tivities. It has gone so far, in fact, that many of the large automobile factories are considering a suspension of manufacturing simply because they cannot get cars to distribute the products. It is said that there are automobiles valued at about ten million dollars stored in Detroit alone at this time, waiting an opportunity for shipment. The car service also affects Canada, many of the firms there not being able to secure rolling stock to move their products.

PITTSBURGH—Dec. 12

The transportation situation is the center of interest in the iron and steel trades, everything else being subsidiary. Germany's proposal of peace is considered interesting, but merely an incident. Car shortages have daily grown more pronounced, and finished material is accumulating at mills at a more rapid rate. At the Homestead Steel Works there is about 50,000 tons stocked, some of it rolled as early as last September, and all of it desired by customers. At other works there are smaller, but still important, tonnages stocked, chiefly bars, small shapes and plates. The mills were not designed to carry such stocks, and the limit will soon be reached, mills having to slow down because they can pile no more. The curtailment may be forced at another point, however, as blast furnaces are already short of coke and have lost some production this month. Transportation conditions are practically certain to grow worse, as real winter weather, the first of the season, is promised tonight. The Pennsylvania system has practically embargoed all freight, except coal and coke, destined to move through Pittsburgh east or west. The Erie R.R. has declared an embargo against the Pittsburgh & Lake Erie, which itself is in fair shape except as to some divisions in the coke region.

The Steel Corporation's record gain in November in unfilled tonnage, 1,400,282 tons, was caused chiefly by the following influences: Placing of the bulk of the sheet and tinplate contracts for the first half of 1917, buying of tubular goods at almost double the shipping rates, heavy buying of car material, orders for ship plates, buying of rails for 1918 and buying of shell steel for the second half of 1917. Relatively little of this business continues this month, and a small gain in unfilled tonnage, possibly even a loss, is to be expected for December.

Steel prices show a hardening tendency but have progressed farther into the nominal stage as the mills are accepting less and less business on open contracts, while in the case of steel for specific jobs the delivery influences the price. Railroad spikes have advanced sharply in the past fortnight, from 2.65c. to 3.40c. Black sheets are up $5 a ton to 4.50c. minimum, with 5c. obtained on several prompt lots, while galvanized are up to 6.25@6.50c.

Pig Iron—The rapid pace of price advancing has halted somewhat in the past week. About three weeks ago an excited buyer paid $30, valley, for a large block of basic for second half, when sales had been made shortly before at $25 for first half and $30 was then regarded by sellers as the established market, but in the past week a conservative buyer has been able to pick up 10,000 tons at a shade under $30, valley, some of it being at $29. Bessemer, however, has sold in some instances at $36, though $35 has not entirely disappeared. Foundry is strong, sales being often made at $31, while $30 is rather unusual and $32 is claimed to have been done. We quote: Bessemer, $35@37; basic, $30; foundry and malleable, $30@32; forge, $29@30, f.o.b. valley furnaces, 95c. higher delivered Pittsburgh.

Steel—Ordinary soft-steel billets can be sold for export at $55, Pittsburgh, but hardly at $60. It is claimed there are only limited offerings even at $60. Prompt sheet bars have brought $60@62 but there is no market for forward and consumers will have to depend on tonnages due them on long term contracts. Rods are $65@75 for soft and $85@90 for carbon.

Coke

Connellsville—After softening to $7.50 or possibly $7.25 the middle of last week spot furnace coke stiffened and brought $8 on Saturday, while yesterday and today sales could readily be made at $8 and $8.25 was obtained in several instances, with $8.50 reported as done. Car supplies were better last week than for two weeks preceding but are poor this week and still higher prices are expected before the end of the week. An inquiry for about 10,000 tons a month during 1917 appeared this morning, but sellers are reserved about quoting. Some are disposed to name $4 to $4.50 for first half and about $5 for second half. Foundry coke is unchanged. We quote: Spot furnace, $8@8.50; contract, $4@5; spot foundry, $9@10; contract, $5.50@6.50, per net ton at ovens.

"Car supply started off bravely this week on an 80% distribution, but dropped to 60% on both Tuesday and yesterday, indicating that the average for the week will not be up to last.

Ferroalloys

Ferromanganese—The market is firmer and somewhat more active, prompt usually bringing $165. Contract remains at $164 for imported and $165 for domestic.

STOCK QUOTATIONS

N. Y. EXCH.†	Dec. 12
Alaska Gold M	12
Alaska Juneau	7
Am.Sm.&Ref.,com	108
Am. Sm. & Ref., pf	114
Am. Sm. Sec., pf. A	97
Am. Sm. Sec., pf. B	92
Am. Zinc	50
Am. Zinc, pf.	75
Anaconda	87½
Batopilas Min	1¼
Bethlehem Steel	575
Bethlehem Steel, pf.	145
Butte & Superior	65½
Chile Cop	23¾
Chino	61
Colo.Fuel & Iron	49½
Crucible Steel	75¼
Dome Mines	20½
Federal M. & S.	16
Federal M. & S., pf	41½
Great Nor., ore ctf	39½
Greene Cananea	48
Homestake	132
Inspiration Con	62¼
International Nickel	43½
Kennecott	51¼
Lackawanna Steel.	97
Miami Copper	41½
Nat'l Lead, com.	62½
National Lead, pf	112
Nev. Consol.	28½
Ontario Min	6
Quicksilver	2½
Quicksilver, pf.	2½
Ray Con	29½
Republic I.&S.,com.	80½
Republic I. & S. pf.	113
Sloss-Sheffield	73
Tennessee Copper	‡21½
U. S. Steel, com	118
U. S. Steel, pf	121½
Utah Copper	113¼
Va. Iron C. & C.	‡62½

N. Y. CURB†	Dec. 12
Buffalo Mines	1 10
Butte & N. Y.	1½
Butte C. & Z	13¾
Caledonia	51
Can. Cop. Corpn	2
Cashboy	06
Cerro de Pasco	39
Con. Ariz. Sm	2
Con. Coppermines	3¾
Con. Nev.-Utah	‡ 25
Crystal Cop	.87½
First Nat. Cop	4
Florence	76
Goldfield Con.	63
Goldfield Merger.	07
Granite	50
Hecla Min	7¼
Howe Sound	7
Jerome Verde	1¼
Joplin Ore & Spel	40
Kerr Lake	5
Magma	42½
Majestic	87½
McKinley-Dar-Sa.	57
Mother Lode.	44
Nevada Hills	21
N. Y. & Hond	17
Nipissing Mines	9
Oro	‡ 03½
Ray Hercules	4¾
Rochester Mines	74
St. Joseph Lead.	17¼
Standard S. L	1¼
Stewart	31¼
Success	46
Tonopah	5
Tonopah Ex.	4½
Tribullion	31½
Troy Arizona	.63
United Zinc	5½
White Knob, pf.	2½
White Oaks	4
Yukon Gold	2¼

SAN FRAN.*	Dec. 12
Alta	03
Andes	18
Best & Belcher	06
Bullion	02
Caledonia	25
Challenge Con	05
Confidence	13
Cons. Imperial	‡ 01
Con. Virginia	13
Gould & Curry	03
Hale & Norcross	11
Jacket-Cr. Pt	03
Mexican	20
Occidental	65
Ophir	14
Overman	03
Savage	‡ 08
Seg Belcher	02
Sierra Nevada	20
Union Con	50
Utah Con	02
Belmont	4 90
Jim Butler	85
MacNamara	06
Midway	20
Mont.-Tonopah.	18
North Star	13
Rescue Eula	28
West End Con	70
Atlanta	10
Booth	11
C.O.D. Con	‡ 02
Comb. Frac	05
D'field B.B	05
D'field Daisy	06
Jumbo Extension	30
Round Mountain	‡ 37
Sandstorm Kendall	‡ 01
Silver Pick	27
Argo	06
Ariz. Central	08
Big Jim.	1 12
Lazy Boy	07
Nellie	30
Tom Reed	1 85
United Eastern	1 50
United Western	04

BOSTON EXCH.*	Dec. 12
Adventure	4¼
Ahmeek	114
Algomah	2½
Allouez	71
Ariz. Com., ctfs	11½
Bonanza	10
Butte-Ballaklava	2½
Calumet & Ariz	83
Calumet & Hecla	570
Centennial	22
Copper Range	70
Daly West	3
East Butte	16
Franklin	9½
Granby	‡107
Hancock	17
Hedley	21
Helvetia	‡ .75
Indiana	3½
Island Cr'k, com	66
Isle Royale	36
Keweenaw	5½
Lake	13
La Salle	5
Mason Valley	6½
Mass	15½
Mayflower	3
Michigan	3½
Mohawk	100
New Arcadian	5
New Idria	15½
North Butte	24
North Lake	2½
Ojibway	2½
Old Colony	2½
Old Dominion	74½
Osceola	92
Quincy	95½
St. Mary's M. L.	95
Santa Fe	2
Shannon	9
Shattuck-Ariz	31
So. Lake	6
So. Utah	40
Superior	14½
Superior & Bost.	6½
Tamarack	43½
Trinity	6½
Tuolumne	1¼
U. S. Smelting	70
U. S. Smelt'g, pf	52
Utah Apex	3¾
Utah Con	18
Utah Metal	6½
Victoria	6½
Winona	5
Wolverine	49
Wyandot	2

BOSTON CURB*	Dec. 12
Alaska Mines Corp.	90
Bingham Mines	9¾
Boston Ely	65
Boston & Mont	68
Butte & Lon'n Dev	56
Calaveras	5½
Calumet-Corbin	01
Chief Con	2¾
Cortez	25
Crown Reserve	40
Davis-Daly	‡6½
Eagle & Blue Bell	1½
Houghton Copper	1½
Iron Cap Cop., pf	19½
Mexican Metals	45
Mines of America	2
Mojave Tungsten	2
Nat. Zinc & Lead	.81
Nevada-Douglas	1¼
New Baltic	3
New Cornelia	17½
Ohio Copper	1½
Oneco	86
Rex Cons	50
Rilla	06
United Verde Ext	39

SALT LAKE*	Dec. 12
Big Four	1 10
Black Jack	05
Cardiff	7 25
Colorado Mining	16
Crown Point	05
Daly-Judge	8 00
Emma Cop	2 50
Empire Copper	1 50
Gold Chain	17
Grand Central	59
Iron Blossom	1 35
Lower Mammoth	06½
May Day	10
Opohongo	‡ 01½
Prince Con	1 32
Seven Troughs	‡ 03
Silver-King Coal'n	3 30
Silver King Con	4 55
Sioux Con	12
So. Hecla	1 30
Uncle Sam	06
Wilbert	09
Yankee	20

TORONTO*	Dec. 12
Bailey	08
Beaver Con	45
Chambers Ferland	17
Coniagas	5 50
La Rose	56
Peterson Lake	18
Right of Way	[illegible]
Seneca Superior	‡ [illegible]
T. & Hudson Bay	72 00
Temiskaming	63
Wettlaufer-Lor	19
Dome Exten	[illegible]
Dome Lake	[illegible]
Foley O'Brien	70
Hollinger	6 85
Jupiter	30
McIntyre	1 84
Newray	1 29
Porcu. Crown	68
Vipond	[illegible]
West Dome	34

STOCK QUOTATIONS—Continued

COLO. SPRINGS	Dec. 12
Cresson Con	7 70
Doctor Jack Pot	10
Elkton Con	12
El Paso	41
Findlay	06½
Gold Sovereign	06½
Golden Cycle	2 55
Granite	62
Isabella	21
Mary McKinney	25
Portland	2 00
Vindicator	1 25

LONDON	Nov. [illegible]		
Alaska [illegible]	£0	[illegible]	[illegible]
Alaska Treadwell	2	15	0
Burma Corp	1	10	6
Cam & Motor	0	10	6
Camp Bird	0	6	6
El Oro	0	7	6
Esperanza	0	10	0
Mexico Mines	4	12	0
[illegible] pfd	0	12	0
Oroville	0	10	0
Santa Gert'dis	0	9	6
Tomboy	1	1	[illegible]

* Bid prices. † Closing prices. ‡ Last Quotations.

MONTHLY AVERAGE PRICES OF METALS

Silver	New York			London		
	1914	1915	1916	1914	1915	1916
January	57.572	48.855	56.775	26.553	22.731	26.960
February	57.506	48.477	56.755	26.573	22.753	26.975
March	58.067	50.241	57.935	26.788	23.708	27.597
April	58.519	50.250	64.415	26.958	23.709	30.662
May	58.175	49.915	74.269	26.704	23.570	35.477
June	56.471	49.034	65.024	25.948	23.267	31.060
July	54.678	47.519	62.940	25.219	22.597	30.000
August	54.344	47.163	66.083	25.979	22.780	31.498
September	53.290	48.680	68.515	24.260	23.591	32.584
October	50.654	49.385	67.855	24.199	23.925	32.361
November	49.082	51.714	71.604	22.703	25.094	34.192
Dec	49.375	54.971		22.900	26.373	
Year	54.811	49.684		25.314	23.675	

New York quotations cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

Copper	New York		London			
	Electrolytic		Standard		Electrolytic	
	1915	1916	1915	1916	1915	1916
Jan	13.641	24.008	60.756	88.083	65.719	116.167
Feb	14.394	26.440	63.494	102.667	*	133.167
Mar	14.787	26.310	66.152	107.714	*	136.000
April	16.811	27.895	75.096	124.319	*	137.389
May	18.506	28.625	77.600	135.457	*	152.522
June	19.477	26.601	82.574	112.432	95.333	137.455
July	18.796	23.865	76.011	95.119	91.409	125.500
Aug	16.941	26.120	68.673	110.283	82.44[illegible]	126.304
Sept	17.502	28.855	68.915	113.905	85.250	134.071
Oct	17.686	27.193	72.601	122.750	88.000	142.523
Nov	18.627	30.625	77.744	134.659	93.273	155.432
Dec	20.133		80.773		100.430	
Year	17.275		72.532			

Tin	New York		London	
	1915	1916	1915	1916
January	34.260	41.825	156.550	175.548
February	37.415	42.717	176.925	181.107
March	48.426	50.741	180.141	193.609
April	47.884	51.230	166.225	199.736
May	38.790	49.125	162.675	196.511
June	40.288	42.231	167.636	179.466
July	37.423	38.510	167.080	168.357
August	34.389	38.565	151.440	169.870
September	33.125	38.834	152.625	171.345
October	33.080	41.241	151.554	179.307
November	39.224	44.109	167.670	186.932
December	38.779		167.000	
Av. year	38.590		163.960	

Lead	New York		St. Louis		London	
	1915	1916	1915	1916	1915	1916
January	3.729	5.921	3.548	5.826	18.606	31.167
February	3.827	6.246	3.718	6.164	19.122	31.988
March	4.053	7.130	3.997	7.375	21.883	34.440
April	4.221	7.630	4.112	7.655	21.094	34.368
May	4.274	7.463	4.182	7.332	20.347	32.967
June	5.932	6.936	5.836	6.749	25.170	31.011
July	5.659	6.352	5.531	6.185	24.611	28.137
August	4.656	6.244	4.520	6.088	21.946	29.734
September	4.610	6.810	4.490	6.699	23.151	30.786
October	4.600	7.000	4.499	6.898	23.994	30.716
November	5.155	7.042	5.078	6.945	26.278	30.500
December	5.355		5.266		28.807	
Year	4.673		4.567		22.917	

Spelter	New York		St. Louis		London	
	1915	1916	1915	1916	1915	1916
Jan	6.386	16.915	6.211	16.745	30.844	89.810
Feb	8.436	18.420	8.255	18.260	39.819	97.762
Mar	8.541	16.846	8.360	16.676	44.141	95.048
April	10.012	16.695	9.837	16.525	49.888	99.056
May	14.781	14.276	14.610	14.106	68.100	94.217
June	21.208	11.752	21.038	11.582	100.614	68.591
July	19.026	8.925	18.856	8.755	97.250	50.750
Aug	12.781	8.730	12.611	8.560	67.786	51.587
Sept	13.440	8.990	13.270	8.820	67.841	52.095
Oct	12.800	9.82[illegible]	12.596	9.65[illegible]	66.[illegible]	54.1[illegible]9
Nov	15.962	11.[illegible]	15.792	11.4[illegible]	88.[illegible]	56.0[illegible]3
Dec	15.391		15.221		89.[illegible]	
Year	13.230		13.054		67.[illegible]	

New York and St. Louis quotations cents per pound. London, pounds sterling per long ton. * Not reported.

Pig Iron, Pitts.	Bessemer‡		Basic‡		Foundry‡	
	1915	1916	1915	1916	1915	1916
January	$14.[illegible]	$21.60	$1[illegible]	[illegible]	[illegible]	[illegible]
February	14.[illegible]	[illegible].16	1[illegible]	[illegible]	[illegible]	[illegible]
March	14.[illegible]	[illegible].81	1[illegible]	[illegible]	[illegible]	[illegible].45
April	14.[illegible]	[illegible].65	[illegible]	[illegible]	[illegible]	[illegible].15
May	14.[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
June	14.[illegible]	21.95	[illegible]	[illegible]	[illegible]	[illegible]
July	14.[illegible]	21.95	[illegible]	[illegible]	[illegible]	[illegible].21
August	1[illegible].01	21.95	[illegible]	[illegible]	[illegible]	[illegible]
September	16.86	22.88	[illegible]	[illegible]	[illegible]	[illegible]
October	1[illegible]	24.[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
November	17.57	29.12	[illegible]	[illegible]	17.[illegible]	[illegible]
December	[illegible].97		[illegible]		[illegible]	
Year	$15.82		[illegible]		[illegible]	

‡ As reported by W. P. [illegible] & [illegible]

Mining Companies—United States

Name of Company and Situation		Shares		Dividends		
		Issued	Par	Total	Latest	Amt.
Acacia, g	Colo..	1,438,989	$ 1	$ 122,004	Jan. '11	$0 01
Ahmeek, c..	Mich..	200,000	25	5,750,000	Oct '16	4 00
Alaska Mexican, g........	Alas	180,000	5	3,507,381	Nov. '15	0 10
Alaska Treadwell, g	Alas	200,000	25	15,785,000	May '16	0 50
Alaska United, g	Alas	180,200	5	2,045,270	Feb. '16	0 30
Allouez, c..	Mich.	100,000	25	800,000	Oct '16	2 50
Am. Sm. & Ref., com .	U. S.	501,080	100	31,337,653	Sept. '16	1 50
Am. Sm. & Ref., pf	U. S.	500,000	100	57,431,386	Sept. '16	1 75
Am. Smelters, pf A ..	U. S.	166,498	100	11,683,535	Oct. '16	1 50
Am. Smelters, pf. B....	U. S.	300,000	100	17,010,000	Oct. '16	1 25
Am. Zinc, Lead & Sm..	U. S.	228,120	25	1,108,820	Apr. '13	0 50
Anaconda, c.....	Mont.	2,331,250	50	115,891,875	Nov. '16	2 00
Argonaut, g.	Calif..	200,000	5	1,760,000	Sept. '16	0 10
Arizona Copper, com .	Ariz...	1,519,896	1 20	18,470,646	July '16	0 36
Arizona Copper "A," pf	Ariz..	160,000	1 20	247,795	Apr. '16	
Arizona Copper, pf......	Ariz...	1,266,120	1 20	1,994,720	Nov. '16	
Baltic, c...	Mich..	100,000	25	7,950,000	Dec. '13	2 00
Barnes-King, c.	Mont.	400,000	5	60,000	June '16	0 075
Bingham N. H., c....	Utah..	228,689	5	960,493	Dec. '15	0 05
Bonanza Dev., g	Colo..	300,000	1	1,425,000	Oct. '11	0 20
Brunswick, g...	Calif...	395,287	1	203,315	Sept. '15	0 06
Bunker Hill Con., g....	Calif....	200,000	1	876,000	Nov. '16	0 02½
Bunker Hill & Sul., l.s.	Ida..	327,000	10	18,326,250	Nov. '16	0 50
Butte-Alex Scott, c.....	Mont.	79,311	10	1,054,119	Apr. '16	10 50
Butte-Ballaklava, c.	Mont.	250,000	10	125,000	Aug. '10	0 50
Butte & Superior, z..	Mont.	290,197	10	13,196,755	Sept. '16	6 25
Caledonia, l.s c	Ida..	2,605,000	1	1,716,331	Nov. '16	0 03
Calumet & Arizona, c.	Ariz..	641,602	10	26,949,457	Sept. '16	2 00
Calumet & Hecla, c..	Mich....	100,000	25	134,250,000	Sept. '16	20 00
Camp Bird, g.s...	Colo..	1,100,051	5	10,917,116	July '16	0 17
Cardiff, l.z...	Utah...	500,000	1	375,000	Sept. '16	0 25
Centen'l-Eur., l.s g.c	Utah..	100,000	5	4,150,000	Apr. '16	1 00
Center Creek, l.z........	Mo..	100,000	10	595,000	July '16	0 15
Champion, c.	Mich..	100,000	25	17,320,000	Nov. '16	6 40
Chief Consolidated, s.g.l.	Utah...	880,676	1	527,518	Nov. '16	0 05
Chino, c...	New Mex	869,980	5	11,700,380	Sept. '16	2 25
Cliff, g	Utah...	300,000	1	90,000	Jan. '13	0 10
Cliff, g	Alas	100,000	1	210,000	Oct. '13	0 01
Colo. Gold Dredging..	Colo..	100,000	10	775,000	Feb. '16	1 00
Colorado, l.s.g..	Utah..	1,000,000	0 20	2,570,000	Dec. '12	0 03
Commercial Gold ..	Ore...	1,666,000	1	230,490	May '16	0 00½
Cons. Inter. Callahan l.z	Ida..	464,990	10	4,649,900	Sept. '16	1 50
Continental, z.l.....	Mo..	22,000	25	583,000	July '16	1 00
Copper Range, c......	Mich...	394,001	25	17,729,756	Sept. '16	2 50
Cresson Con	Colo..	1,220,000	1	3,916,163	Nov. '16	0 10
Daly West, s.l.....	Utah...	180,000	20	6,606,000	Jan. '13	0 15
Doctor Jackpot, g......	Colo..	3,000,000	0 10	113,255	Oct. '16	0 01
Doe Run, l.......	Mo..	65,749	100	3,550,969	Dec. '13	0 76
Eagle & Blue Bell, g.s.l	Utah...	893,146	1	491,230	July '16	0 05
Elkton Con., g	Colo..	2,500,000	1	3,579,460	May '15	0 02
El Paso, g	Colo..	490,000	5	1,707,545	Feb. '14	0 10
Ernestine, g s..	N.M.	300,000	5	150,000	July '15	0 10
Fed. M. & S., com...	Idaho...	60,000	100	2,708,750	Jan. '09	1 50
Fed. M. & S., pf.. ..	Idaho..	120,000	100	12,936,795	Sept. '16	1 00
Florence, g......	Nev.....	1,050,000	1	840,000	Apr. '11	0 10
Fremont Con., g.....	Calif.	200,000	2 50	258,000	Oct. '14	0 02
Frontier, z...	Wis..	1,250	100	146,202	Nov. '13	2 00
Gemini-Key'ne, l.g.s.....	Utah...	5,000	100	2,330,000	June '16	5 00
General Dev.	U. S.	120,000	25	3,503,917	Sept. '16	1.50
Gold Chain, g ..	Utah ...	1,000,000	1	130,000	May '13	0.03
Gold Dollar Con........	Colo..	2,500,000	0 10	100,000	Dec. '12	0.00½
Gold King Con., g..	Colo..	1,000,000	1	1,417,319	Nov. '15	0.01
Golden Cycle, g	Colo..	1,500,000	1	7,638,300	Nov. '16	0.02
Golden Star, g........	Ariz..	400,000	5	140,000	Mar. '10	0 05
Goldfield Con., g........	Nev.....	3,559,148	10	28,999,832	Oct. '15	0 10
Good Springs Anchor, s.	Nev.....	550,000	1	108,785	May '16	0 01
Grand Central, g	Utah...	500,000	1	1,653,250	Oct. '16	0.04
Granite, g........	Colo..	1,650,000	1	286,500	Dec. '12	0 01
Hazel, g..	Cal..	900,000	1	971,000	Dec. '13	0 01
Hecla, l.s.	Idaho...	1,000,000	0 25	5,155,000	Nov. '16	0.15
Hercules, l.s......	Idaho...	1,000,000	1	12,600,500	Sept. '16	0.30
Homestake, g	S. D..	251,160	100	40,687,702	Nov. '16	0 65
Horn Silver, l.s.z........	Utah...	400,000	25	5,682,000	June '16	0 05
Inspiration, c	Ariz..	1,181,967	20	6,184,117	Oct. '16	2.00
Inter'l Nickel, com......	U. S.	1,673,384	25	33,451,414	Sept. '16	1 50
Inter'l Nickel, pfd	U. S...	89,126	100	5,882,102	Nov. '16	1 50
Iowa, g.s.l .	Colo....	1,666,667	1	270,167	Dec. '15	0.00½
Iowa-Tiger, g.s..	Colo..	3,000	1	25,179	Dec. '15	1 00
Iron Blossom, s.l.g...	Utah...	1,000,000	0 10	2,850,000	Nov. '16	0 10
Iron Silver, s.l.g.	Colo...	500,000	20	4,950,000	Dec. '14	0 10
Jamison, g...	Cal...	390,000	10	386,100	Dec. '15	0 01
Jerry Johnson, g.....	Colo..	2,500,000	0 10	187,500	Nov. '14	0 01
Jim Butler-Tonopah, g.s.	Nev.....	1,718,021	1	515,406	Aug. '16	0 10
Judge M. & S., s.l .	Utah...	480,000	1	1,470,000	Oct. '16	0 25
Jumbo Extension, g ...	Nev....	1,550,000	1	685,000	June '16	0 05
Kendall, g.	Mont.	500,000	5	1,555,000	Apr. '16	0 10
Kennecott Cop., c	Alas	2,780,583		11,121,848	Sept. '16	1 50
Kennedy, g	Cal..	100,000	100	1,831,001	Apr. '10	0 03
Klar Piquette, z.l...	Wis..	20,000	1	259,000	Apr. '13	0 50
Knob Hill, g.	Wash.	1,000,000	1	70,000	Oct. '13	0 00½
Liberty Bell, g........	Colo..	133,551	5	1,752,795	Sept. '15	0 20
Little Bell, l.s..	Utah...	300,000	1	90,000	Apr. '16	0 05
Magma, c........	Ariz....	240,000	5	600,000	Sept. '16	0 50
Mammoth, g.s.c..	Utah...	400,000	2 50	2,380,000	Sept '16	0 05
Mary McKinney, g.	Colo..	1,309,252	1	1,182,398	Oct. '16	0 01
May Day, g.s.l..	Utah...	800,000	0 25	284,000	May '16	0 02
Mexican, g.s	Nev.....	201,600	2 50	161,910	June '14	0 75
Miami, c........	Ariz.....	747,114	5	9,695,783	Nov. '16	1.50
Modoc, g.s........	Colo..	500,000	1	275,000	Dec. '11	0 01
Mohawk, c.......	Mich...	100,000	25	5,575,000	Aug. '16	10 00
Monarch-Mad'a, g.s.l..	Colo..	1,000,000	1	40,000	May '11	0 01
Montana-Tonop., s.g....	Nev..	921,865	1	488,588	Dec. '12	0 10
Mountain, c.......	Cal..	250,000	25	4,216,250	May '08	0 44
National, g........	Nev....	750,000	1	570,000	May '11	0.10
National Lead, com.....	N. Y...	206,554	100	9,655,216	Sept. '16	1.00
National Lead, pf.......	N. Y...	243,676	100	32,632,551	Sept. '16	1.75
Nevada Con., c.........	Nev.....	1,999,457	5	24,474,937	Sept. '16	1.00
New Idria, q...........	Cal..	100,000	5	2,130,000	Oct. '16	1.00
North Butte, c.........	Mont.	430,000	15	13,567,000	Oct. '16	0.75
North Star, g...........	Cal..	250,000	10	4,962,040	Sept. '16	0.20
Old Dominion, (holding)	Ariz.....	293,353	25	9,813,978	Sept. '16	3.00
Old Domin'n. M. & Sm	Ariz..	162,000	25	7,857,000	Sept '16	3 00

Corrected to December 1, 1916.

Mining Companies—United States—(*Continued*)

Name of Company and Situation		Shares		Dividends		
		Issued	Par	Total	Latest	Amt
Ophir, s.g ...	Nev.	201,600	$3	2,068,360	Jan. '12	$0 10
Opohongo, g s l	Utah.	898,978	0 25	80,907	Jan. '13	0 02
Oroville Dredging	Cal..	686,538	5	2,107,215	Sept. '16	0 12
Osceola, c	Mich.	96,150	25	14,487,275	Oct. '16	5 00
Pacific Mines Corpn., g	Calif.	642,000	1	269,640	Nov. '16	0 01
Parrot, c	Mont	229,850	10	7,871,839	July '15	1 63
Pearl Con., g	Wash.	1,909,711	0 05	181,422	Dec. '10	0 02
Pharmacist, g	Colo..	1,500,000	1	87,500	Feb. '10	0 00½
Phelps, Dodge & Co .	U. S	450,000	100	54,671,527	Sept. '16	8 00
Pioneer, g	Alas	5,000,000	1	2,041,526	Oct. '11	0 03
Pittsburgh-Idaho, l .	Ida .	809,407	1	252,483	Oct. '16	0 04½
Pittsburg Silver Peak, g	Nev..	2,790,000	1	771,200	July '14	0 02
Portland, g	Colo..	3,000,000	1	10,537,000	Oct. '16	0 03
Prince Con	Nev. ..	1,000,000	2	325,000	Oct. '16	0 02½
Quilp	Wash.	1,500,000	1	67,500	Feb. '12	0 01
Quincy, c .	Mich ..	110,000	25	22,987,500	Sept. '16	4 00
Ray, c... ..	Ariz..	1,577,179	10	7,353,921	Sept. '16	0 75
Reorg. Booth, g	Nev..	1,000,000	1	500,000	July '16	0 10
Republic, g	Wash.	1,000,000	1	170,000	Nov. '12	0 01½
Rochester, l z	Mo..	4,900	100	190,846	July '12	0 50
Round Mountain, g....	Nev..	1,266,591	1	363,365	Aug. '13	0 04
Seven Troughs Coal., g.	Nev..	1,443,077	1	246,419	Apr. '16	0 02½
St. Joseph, l	Mo..	1,409,466	10	12,029,681	Sept. '16	0 75
Shannon, c . ..	Ariz..	300,000	10	900,000	Nov. '16	0 50
Shattuck Arizona, c	Ariz..	350,000	10	4,637,500	Oct. '16	1 25
Silver King Coalition, l s.	Utah. ..	1,250,000	5	14,335,885	Oct. '16	0 15
Silver King Con., l.s..	Utah...	637,582	1	1,006,331	Oct. '16	0 10
Sioux Con., s.l.g .	Utah...	745,389	1	872,097	July '11	0 04
Skidoo, g .	Cal... ..	1,000,000	5	365,000	Oct. '14	0 01
Snowstorm, c g...	Ida ..	1,500,000	1	1,192,103	Oct. '13	0.02
Socorro, g.. ...	N. M	377,342	5	233,802	Sept. '16	0 05
South Eureka, g	Calif. .	299,981	1	722,870	May '16	0 07
Standard Con., g.s...	Cal..	178,394	10	5,274,407	Nov. '13	0 25
Stewart, s.l......	Ida .	1,238,362	1	2,012,314	Dec. '15	0.05
Stratton's Ind., g .	Colo..	1,000,000	0 60	618,625	Jan. '16	0 04
Success, z	Ida .	1,500,000	1	1,125,000	July '16	0.03
Superior & Pitts., c	Ariz..	1,499,792	10	10,318,569	Dec. '15	0 38
Tennessee, c.	Tenn....	200,000	25	5,206,250	Apr. '16	0 75
Tomboy, g.s.	Colo..	310,000	4 85	3,862,485	June '16	0 24
Tom Reed, g	Ariz..	909,555	1	2,528,648	Oct. '15	0 01
Tonopah Belm't, s.g..	Nev..	1,500,000	1	8,393,035	Oct. '16	0 12½
Tonopah Ext., g s	Nev..	1,272,801	1	1,591,747	Oct. '16	0 15
Tonopah of Nev., s.g..	Nev .	1,000,000	1	13,600,000	Oct. '16	0 15
Trimountain, c.	Mich.	100,000	25	1,450,000	Dec. '13	2 00
Tuolumne, c	Mont....	2,500,000	1	520,000	May '13	0 10
Uncle Sam, g.s.l.	Utah...	500,000	1	495,000	Sept. '11	0 05
United Cop. Min., c....	Wash.	1,000,000	1	40,000	Nov. '12	0 01
United Globe, c.	Ariz..	23,000	100	3,749,000	Sept. '16	18 00
U. S. Steel Corp., com...	U. S.. ..	5,083,025	100	246,504,807	Sept. '16	2 25
U. S. Steel Corp., pf .	U. S	3,602,811	100	420,732,690	Nov. '16.	1 75
U. S. S., R. & M., com	U.S.-Mex.	351,115	50	7,679,024	Oct. '16	1 00
U. S. S., R. & M., pf	U.S.-Mex.	486,350	50	18,497,915	Oct. '16	0 87½
United Verde, c..	Ariz..	300,000	100	39,997,000	Nov. '16	1 50
Utah, s.l.....	Utah. ..	100,000	10	281,860	Dec. '10	0 02
Utah, c.....	Utah...	1,624,490	10	46,530,062	Sept. '16	3 00
Utah Con., c...	Utah...	300,000	5	9,825,000	Sept. '16	0 75
Valley View, g.......	Colo..	1,000,000	1	240,000	Dec. '10	0 04
Victoria, g.s.l...	Utah...	250,000	1	207,500	Mar. '10	0 04
Vindicator Con., g.	Colo..	1,500,000	1	3,532,500	Oct. '16	0 06
Wasp No. 2, g ..	S. D .	500,000	1	649,466	May '16	0 02½
Wellington Mines, g.....	Colo..	10,000,000	1	1,250,000	Oct. '16	0.02
Wolverine, c	Mich....	60,000	25	9,120,000	Oct. '16	6 00
Yak, s.l.......	Colo..	1,000,000	1	2,127,685	June '16	0 07
Yankee Con., g.s..	Utah...	1,000,000	1	167,500	Jan. '13	0 01
Yellow Aster, g.....	Cal..	100,000	10	1,205,789	Nov. '16	0.05
Yellow Pine, l.z.s.......	Nev..	1,000,000	1	1,793,008	Nov. '16	0 10
Yukon Gold, g	Alas	3,500,000	5	8,370,610	Sept. '16	0 07½

Canadian, Mexican and Central American Companies

Ajuchitlan, g.s.	Mex.	50,000	$ 5	$ 212,500	Oct. '12	$0 25
Amparo, g.s	Mex.	2,000,000	1	2,060,883	Nov. '16	0 05
B. C. Copper...	B. C...	591,709	5	615,399	Jan. '13	0 15
Beaver Con., s.	Ont...	2,000,000	1	649,912	Apr. '16	0 03
Buffalo, s....	Ont.....	1,000,000	1	2,787,000	July '14	0 05
Canadian Goldfields, g...	B. C...	600,000	0.10	290,000	July '14	0 001¼
Chontalpan, g.s.l z ..	Mex.	7,000	25	61,250	May '14	0 75
Cobalt Townsite, s.....	Ont..	45,000	1	1,042,259	May '14	0.10
Coniagas, s....	Ont..	800,000	5	8,440,000	Nov. '16	0 25
Con. M. & S. Co. of Can.	B. C.	337,100	25	2,949,626	Oct. '16	2 50
Crown Reserve, s...	Ont..	1,999,957	1	6,102,408	July '15	0 02
Dome Mines, s	Ont..	400,000	10	1,000,000	Sept. '16	0 50
Dos Estrellas, g s..	Mex...	300,000	0 50	10,335,000	Dec. '13	1 50
El Oro, g.s...	Mex. ..	1,147,500	4 85	8,947,260	July '13	0 24
Esperanza, s g.	Mex....	455,000	4 85	12,013,882	July '15	0 24
Granby, s.l.c...	B. C......	149,985	100	6,875,259	Nov. '16	2 00
Greene Cananea.	Mex.	488,414	100	7,792,856	Nov. '16	2 00
Greene Con., c ..	Mex....	1,000,000	10	12,044,400	May '16	1 00
Guanajuato D., pf., s....	Mex.	10,000	1000	214,356	Jan. '10	3 00
Hedley Gold.	B. C...	120,000	10	2,003,520	Sept. '16	0 50
Hollinger, g...	Ont..	4,800,000	5	6,090,000	Nov. '16	0 05
Kerr Lake, s.	Ont..	600,000	5	6,570,000	Sept. '16	0 25
La Rose Con., s	Ont..	1,498,627	5	5,686,845	Oct. '16	0 05
Le Roi No. 2, g.	B. C...	120,000	24.30	1,566,450	Mar. '16	0 30
Lucky Tiger Com., g.	Mex.	715,337	10	3,649,673	Oct. '16	0 09
McK.-Dar. Sav. s...	Ont..	2,247,692	1	4,810,056	Oct. '16	0 03
Mines Co. of Am. (new)	Mex.	862,658	10	4,958,600	July '13	0 12½
N. Y. & Hond. Ros., g	C. A...	200,000	10	4,190,000	Oct. '16	0 50
Nipissing. s.	Ont..	1,200,000	5	14,940,000	Oct. '16	0 25
Penoles, s.l.g..	Mex....	80,000	25	6,361,688	June '13	1 25
Pinguico, pf., s.	Mex....	20,000	100	840,000	Oct. '13	3 00
Right of Way Mns., s.	Ont..	1,685,500	1	569,042	Sept. '16	0 00½
Rio Plata, s	Mex....	374,518	5	345,745	Feb. '13	0 05
San Rafael, g.s.	Mex....	2,400	25	1,442,380	Jan. '14	0 50
San Toy, g.s	Mex....	5,750,000	1	530,000	July '13	0 01
Seneca-Superior..	Ont... .	478,884	1	1,555,873	Oct. '16	0.20
Sorpresa, g.s.	Mex.....	19,200	20	3,979,240	Jan. '11	34.00
Stand'd Silver-Lead.	B. C......	2,000,000	1	2,350,000	Nov. '16	0 02½
Temiskaming, s.......	Ont.....	2,500,000	1	1,684,156	Nov. '16	0 03
Tem. & Hud. Bay, s	Ont......	7,761	1	1,940,250	Nov. '14	3 00
Trethewey, s...	Ont...	1,000,000	1	1,061,998	July '14	0 05
Wettlaufer-Lorrain, s	Ont.	1,416,590	1	637,465	Oct. '13	0 05

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Barytes Mining in Georgia

By Arthur C. Vivian

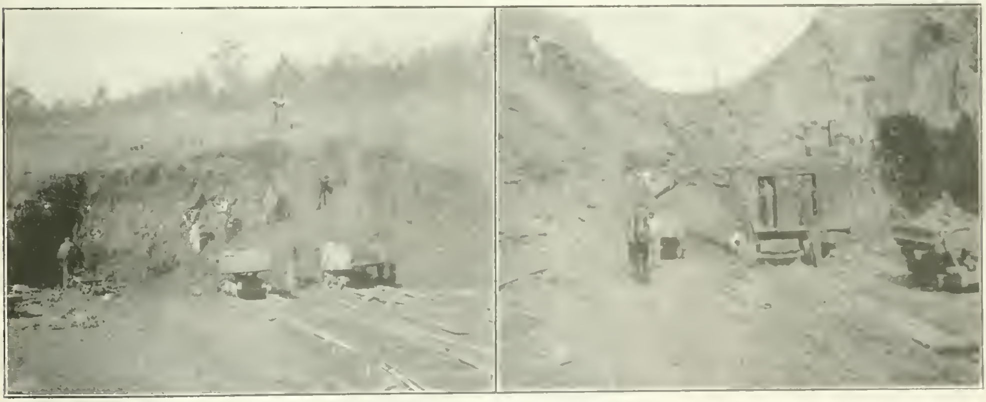
SYNOPSIS—Deposits of barytes in the Cartersville district of Georgia were first exploited commercially in 1908, one small mine being worked. Since 1914, owing to stoppage of foreign supplies, the district has experienced a boom. Seven mines are now in operation and others being equipped. Mineral occurs as nodules in residual clays. Prospecting is conducted by small circular wells sunk by hand, and mining is by pick and shovel, or steam shovel, in opencuts. Ore-dressing process is simple, on account of the low market price of product.

Among the many mineral products requiring a readjustment of market conditions because of the present European struggle, is barytes. The supplies for consumption in this country have formerly been obtained almost exclusively from Europe. The reason that the American supply—probably ample for many years to come—has not been utilized to a greater extent is because in normal times a slightly higher grade of the material can be imported at a slightly lower cost than that of mining and manufacturing the domestic product. This is true partly because of the cheap labor in Europe, but particularly because of the low water-freight rates to our eastern ports, the principal market points for the material.

Extensive deposits of barytes have long been known to exist in the vicinity of Cartersville, Bartow County, Ga., but no attempt was made to work them until in 1908 Walter Satterfield secured a contract to supply the needs of a chemical firm and inaugurated mining on a comparatively small scale. This operation has continued uninterruptedly to the present time, but no other individuals ventured to enter the business locally until after the creation of the new demand in 1914. Then developments came rapidly, and at present there are seven operating mines in the district and several more are in process of equipment.

The significant geological feature of the district is the Cartersville fault, one of the major thrust faults of the Appalachian system. Striking northeast-southwest, it separates the Paleozoic sediments to the northwest from the older crystalline rocks to the southeast. The outstanding topographical feature is a range of rugged hills, which range roughly conforms in position to the neighborhood of the fault line. This ridge is prominent geographically, as it looms up before the observer from all points to the east or west, and it is also prominent economically, as it forms the locus of the mineral wealth of Bartow County. Deposits of iron, manganese, barytes and ocher are found along it for a distance of about 15 miles.

The deposits of barytes occur northwest of the fault in a deep mantle of residual clays derived from the decay of the quartzites, limestones and shales of the Paleozoic sediments. They are generally found along the crests or slopes of the ridges and are of irregular extent and outline, necessitating rather close prospecting. The barytes occurs as rounded masses of varying sizes, ranging from minute grains up to large boulders, irregularly distributed through the clays. Except for clay [illegible] barytes



METHODS OF MINING BARYTES NEAR CARTERSVILLE, GA.

within the mass and what might be termed potholes on its surface, the material is pure and assays of the cleaned product are said to show 98 to 99% of BaSO$_4$. The mode of occurrence in nodules suggests precipitation from solution as the origin of these ores, although they have been called residual by some geologists.

The method of prospecting for barytes and similar deposits in clay in this district is simple, cheap and reliable.

PROSPECTING FOR BARYTES NEAR CARTERSVILLE, GA.

A circular well, of uniform diameter throughout its depth, is sunk in the clays by hand digging with pick and shovel, the material being hoisted by a hand-operated windlass. The size of the well employed depends upon the skill of the man sinking it; and inexperienced men find difficulty in making wells less than 3 ft. in diameter, but more experienced well diggers can make them as small as 28 in. in diameter. It is of advantage to carry the well as small as possible because of the smaller amount of material to be removed and the higher speed in gaining depth. These wells can be carried as deep as desired, as later mining is by surface pit work and it is not generally desirable to prospect deeper than 40 or 50 ft.; though in certain instances wells have been sunk to depths of 100 ft. and more. In this method of prospecting, all the material from a uniform section of ground is removed and exposed to view, so that a better method could hardly be desired. The cost of this work varies between about 50c. and 35c. per ft. of depth, depending upon labor conditions, and the contract method is generally employed.

The accompanying photograph shows the top of one of these wells and the man who dug it. In this case the well is 28 in. in diameter and 31 ft. deep. It was in good barytes-bearing ground, as shown by the pile of that material in the foreground.

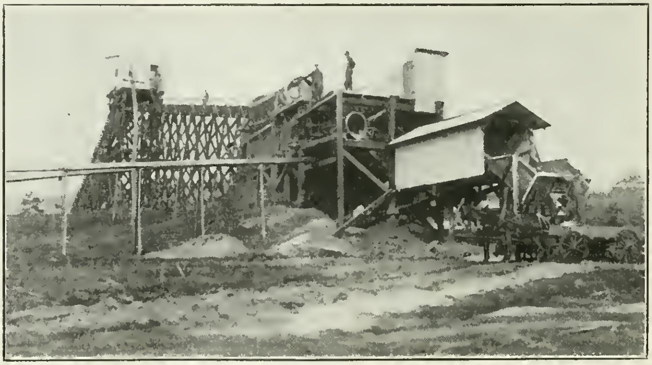
The mining is done in surface cuts either by handwork with pick and shovel or by a small steam shovel. It is usual to begin operations by hand and to install the steam shovel later. The most-used type of shovel is the one in which the whole body rotates upon a center, as this is more convenient in the small pits than other types; but its weakness appears in the extraordinary strains on some of its parts as a consequence of its weight being pivoted at one point.

The material handled is soft and does not require much blasting, but the ground is loosened ahead of the workmen by springing and blasting churn-drill holes sunk by hand. Haulage is generally done by mules if the entrance to the pit is approximately level, or by small hoist engines in the case of inclines.

DRESSING ORE BY LOG WASHERS AND JIGS

The time-honored log washer is universally used to separate the mineral from its inclosing clay. This treatment is preceded and followed by hand picking, and usually the small washed material which passes a ¾-in. screen is jigged in ordinary plunger-type machines. The whole process is extremely simple. The material is dumped from the mine cars on a coarse grizzly, which serves the purposes of regulating the feed to the washer, giving an opportunity to remove by hand large pieces of waste and breaking up the material so that the water will do its work more rapidly. Water then conveys the material to a coarse trommel; the undersize from this goes to the washer, and the oversize is picked for the removal of waste and compact balls of gumbo clay, which would simply roll around in the washer and impair its efficiency. The washer is followed by another trommel, with ¾-in. openings, which removes the undersize material for jig treatment, while the oversize is hand-picked for the removal of iron ore and other foreign matter.

The jigs are usually of several compartments, but the feed to them is not sized; so that each compartment is expected to handle all sizes from ¾-in. down. The waste removed is principally quartz pebbles with some iron and manganese ore. Frequently no jigging is employed, in which case the opening on the last trommel is made about ⅜ in. and the undersize from this is flushed to a waste dump, the idea being to remove by this means all the small waste that cannot be hand-picked; the oversize material being further cleaned by hand.



INCLINE FROM SHOVEL PIT, HOIST, ORE-DRESSING PLANT AND SHIPPING BINS AT BARYTES MINE NEAR CARTERSVILLE, GA.

The natural criticism of the milling process is its crudeness, and no doubt much better results could be easily obtained by a little closer attention to details. Operators in this district, however, are used to handling low-priced minerals which occur in small and irregular deposits, so that efficiency in ore-dressing is always sacrificed to low plant costs.

Refining Barytes by Acid Treatment

The rather novel procedure of turning a flour mill and its equipment into a metallurgical plant is offered in the recent inauguration of barytes-refining in this locality. An old mill that had been idle for several years was utilized, and its steel rolls, stone grinders and bucket elevators were made use of without any alteration. It was only necessary to place coarse crushers, log washers and leaching tanks to complete the plant. The process is simply to crush the material and run it through a washer to remove the clay set free by crushing, recrush in rolls and the stone grinders and treat the resulting fine material with sulphuric acid in leaching tanks for the removal of iron and other impurities.

⁂

Oxidation of Nickel-Steel

A note contributed by Dr. J. E. Stead at the recent meeting of the British Association discussed the peculiar properties of the scale which forms on nickel-steel. According to Dr. Stead, says *Iron Age*, Dec. 7, 1916, the scale is completely removed from ordinary iron or steel when it is rolled after heating. With nickel-steel, however, the scale remains hard on the surface, particularly if the metal has been heated for a long time, in which case the scale is very thick. With a short period of heating the scale is less adherent.

In searching for an explanation of these phenomena, Dr. Stead found, on making a section through the metal, that the scale and steel were locked together, points of the steel penetrating into the scale. An examination of a 25% nickel-steel ignition tube of a gas engine disclosed the metal on the outside to be completely oxidized, while an intermediate portion between the oxidized metal and the outer portion consisted of small and unoxidized metal crystals [illegible] through the scale. The unoxidized portions were [illegible]. The metallic part magnetically separated from the scale [illegible] contained 75% nickel instead of 25%, the amount in the original composition of the metal.

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Damascus Steel from Mount Lebanon Iron Ore

By J. [illegible] Kittock Bowen

In the ancient history of the Near East, and in particular that of Palestine, the City of Damascus was at one time famous for possessing an iron and steel industry whose principal product was the manufacture of Damascus swords that were known the world over for the strength and quality of their blades. Since fighting, rather than mining, was one of the chief pursuits of the world at that time, it is understandable that the remembrance of the quality of the swords remains in history, while all record of the source of the ore from which they were made has been lost completely. There are a number of theories and a number of places which lay claim to having been the areas from which this iron came, and among these are the deposits on the sides of Mount Lebanon, Palestine, which must have been operated many, many years ago.

MOUNT LEBANON LIMONITE DEPOSITS AND SYRIAN PROSPECTORS

These iron deposits exist upon the lower slopes of Mount Lebanon, about 20 mi. from the port of Beirut, Syria. They cannot be reached directly by rail, although there is a railway line that winds around the mountain. The easiest means of access is by mule-back. In general, the geological structure of the district is sedimentary and is intermixed with large masses of white limestone. The [illegible] jected to the passage of [illegible] out [illegible] the Lebanon [illegible] of large masses of [illegible] in the [illegible]

[illegible]

ing limestone and without any connection to one another or any certainty in regard to size or continuity. Some of the holes visited would not contain 10 tons, while others would have held 200, although the only ore then visible amounted to a few remaining bunches left against the walls of the cave.

Here and there are a few untouched bunches of ore which might, if prospected, have developed perhaps a few additional hundreds of tons, but in general the possibility of ore in quantity is extremely disappointing when viewed from the standard of modern requirements. Still it is evident that the ore was worked in the distant past, and while present-day requirements could not possibly be met, it is quite reasonable to suppose that a fair-sized steel trade could have been supported many centuries ago. Tradition in the countryside has it that the deposits were once the scene of important activities, and so little has knowledge of modern developments in the steel industry, or any other industry for that matter, penetrated into the minds of the Syrians, that they are still in the attitude of hoping, and will continue to hope, that these deposits will sometime be operated. Plenty of men have been to see them, for the ores possess two interesting features that attract capital—the quality and the situation are good.

Transportation Facilities Were Favorable

As the scarcity of iron ore increases, 20 mi. from a fair seaport is nothing to feel discouraged about, especially as the grade for the entire distance is in favor of the load. Furthermore, the port of Beirut is at the end of the Mediterannean, not very much farther in regard to shipping distance than Greece or elsewhere in the East. Coal cargoes could have gone out to Egypt and ore could have been brought back, which would have formed a convenient round of shipment. The general situation promised cheap working, labor was plentiful and did not command high wages, and the actual mining and transportation conditions would have been as good as those existing at other deposits now being worked. About the only drawback was the attitude of the official classes and the uncertainty about the concessions granted to operate. Syria as part of Turkey is liable to much uncertainty as to what you have and what you hold. If the income to all the officials all along the line is not sufficient according to their eyes, your concessions are apt to be rescinded and presented to another party who has promised a little more side pay. There is a refreshing spontaneity about such proceedings that adds a zest to mining life, leaving aside the question that it also adds to the mining operations a sort of overhead cost not commonly reckoned with in more civilized countries. The best rule to follow is to bribe a big official and bribe high, trusting to the fact that the big man will keep the multiplicity of small officialdom in order for the sake of his own pocket. I suppose this official attitude is responsible for the native habit of never paying for anything that can be gotten by other means, which results in the natives becoming past masters of the art of begging.

The ore is a true limonite and is mechanically of good condition. This is due to the large percentage of lime present having become crystallized in the process of formation, resulting in a binding together of the ore into solid blocks. When broken, the faces thus exposed are almost capable of reflection from the crystallized lime. The quantity of silica is small, and the ore, when treated with acid, goes into solution with a rapid effervescence, leaving almost no residue. From the mode of their occurence the ores might be expected to be low in sulphur, pholsphorous, manganese and magnesia. An analysis of this character makes the ore attractive from the ironmaster's point of view, and for certain processes it is ideal. To appreciate its qualities, an analysis of ore is given with which comparison can be made: Iron, 58.47%; silica, 1.63%; phosphorous, 0.02%; moisture, 2%; alumina, 2.01%; lime, 8.73%; manganese, 0.73%; and sulphur, 0.01%.

From the ancient ironmasters' standpoint such ores would be much more valuable, since the appliances for and the knowledge of the methods of removing impurities was then small. This Lebanon ore contains but few impurities to be gotten rid of and moreover contains within itself a flux that would greatly aid in its reduction, both of these conditions enabling the old steel makers with their primitive means to produce a high grade of iron, which might easily have acquired a wondrous fame at such times.

Remembering that Damascus is not so far from the Lebanon hills, it is quite within the limits of imagination to assume that these ancient deposits could have been the original iron ores from which the metal afterward wrought into the famous blades was derived. They are certainly interesting as historical curiosities, although worthless as ore deposits from a present-day commercial standpoint.

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Utilization of Etna Lava

According to S. Pagliani, in *Annali Chim. Appl.*, 1916, VI, 157-62, through *Journ. Soc. Chem. Ind.*, Mount Etna lava has been used for some years with good results in an Italian works, for the construction of apparatus for the concentration of sulphuric acid, Glover and Gay Lussac towers, condensing towers for hydrochloric acid, and other plants in which Volvic lava or analogous material is usually employed. Not all specimens of the lava are suitable for such purposes, but large quantities of material of satisfactory quality are available in the quarries.

Analyses of samples of the lava deposited at different epochs (from 122 B.C. to 1910) show that the maximum, minimum and average values for the percentages of the various constituents are as follows: SiO_2, 51.89, 16.25, 49.13; Al_2O_3, 22.67, 15.91, 19.84; Fe_2O_3, 19.32, 9.13, 14.47; CaO + MgO, 17.18, 11.60, 13.38; Na_2O + K_2O, 8.41, 2.12, 5.81%. The porosity of a sample of the lava, as measured by the weight of water absorbed per 100 parts of material, was found to be 0.48, as compared with 0.74 for granite.

⁂

Precious and Semiprecious Stones and Graphite are the only mineral products of any importance in Ceylon according to a recent statement in "Commerce Reports" of the Department of Commerce. The market for stones was poor, owing largely to the cessation of tourist trade. Prices were generally kept up, nevertheless, production being curtailed. Graphite, recovered quickly from the slump of 1914. The exports rose from 284,562 cwt. of 112 lb. in 1914 to 436,351 cwt. in 1915. During the first half of the year the graphite industry was quiet, but with the removal of the embargo on exports to America prices rose quickly and reached $438 per ton for ordinary lumps. The United States, the United Kingdom, and Russia took most of the increased exports.

Efficiency of Compressed-Air Installations—II

By Theodore Simons*

SYNOPSIS—The avoidable losses in the transmission and use of compressed air are considered, the most common being due to leaks in the pipe lines.

Fifteenth Loss—Probably the greatest of the avoidable losses in compressed-air installations and the one most frequently met with is that due to leaks in the pipe lines. That leaks do not receive more attention on the part of operators appears to be chiefly because of their failure to realize the startling magnitude of losses due even to seemingly insignificant leaks if permitted to do their wasteful work for any length of time, and to the further fact that not sufficient surveillance is exercised in the use of compressed air for underground drilling and ventilating purposes, the valves in underground branch pipes being frequently left wide open without serving any useful purpose.

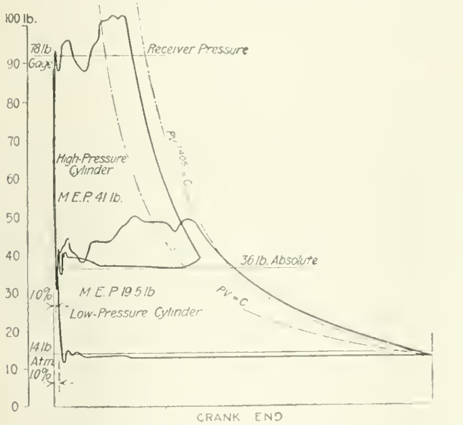

FIG. 1. COMBINED INDICATOR DIAGRAM OF 2-STAGE COMPRESSOR

Knowing the approximate area of a leak or the combined area of a number of leaks and the normal pressure of the air within the pipe, the volume V_a of escaping air, expressed in cu.ft. of free air per minute may be obtained very closely from the following equation:

$$V_a = 72.4\,A\sqrt{\frac{p(p+p_a)}{p_a}}\ \textit{cu.ft. per min.} \qquad (27)$$

in which p = gage pressure of air within the pipe in pounds per square inch, p_a = atmospheric pressure in pounds per square inch and A = area of leaks in square inches.

Example: Air under a pressure of 80 lb. gage escapes from various leaks in a pipe line, having a combined area of ½ sq.in. What is the quantity of escaping air and loss expressed in hp., with atm. pressure 14.7 lb.

$$V_a = 72.4 \times 0.5\sqrt{\frac{80(80+14.7)}{14.7}}$$

$$= 820\ \textit{cu.ft. of free air per min.} \qquad (28)$$

To compress in one stage 820 cu.ft. of free air per minute to 80 lb. gage and deliver it into the receiver requires (from equation 1)

$$W_n = 1{,}320{,}000\ \textit{ft.-lb.} = 131\ \textit{hp. (theoretical)} \qquad (29)$$

Adding 15%, as before, we get

$$\textit{Actual hp.} = 151 \qquad (30)$$

The enormous loss shown to be due to seemingly insignificant leaks gives an inkling as to what will happen when leaks of far greater extent are permitted to do their nefarious work without being given the least attention.

Sixteenth Loss—Extremely wasteful in consumption of power are branch pipes that are too small for the volume of air they are supposed to transmit without extra loss of pressure. The frequency with which branch pipes are improperly dimensioned indicates that this feature of a plant is given but scant attention.

To the uninitiated the statement that it takes practically two 5-in. pipes to carry the same volume of compressed air, during the same time and without extra loss of pressure, that one 6-in. pipe can carry seems rather extravagant. To the engineer who is conversant with the subject, an attempt to transmit the capacity of one 6-in. pipe, for instance, in two 3-in. pipes seems still more extravagant from the point of view of loss entailed. Yet such are the conditions one often meets with even in plants installed under otherwise efficient supervision. They are among the principal causes of the constant cry for more air and for higher pressures on the part of the drill-runner and hence for more compressors, to the gratification of the manufacturers. No one seems to think of making the branch pipes larger.

The problem of calculating branch-pipe diameters is identical with that of the main pipe, and the dimensions are or should be determined by the same rules. But it seems that though the main pipe may have been properly calculated by the engineer, the branch-pipe problem is usually left to the practical pipe-fitter, with the results stated.

Example: From a 6-in. main at a point 1,200 ft. from the intake terminal, a branch pipe is to be taken off to furnish 75-lb. air to operate three 3¼-in. piston drills 600 ft. from the point of take-off. What should be the dimensions of the branch pipe?

To solve the problem intelligently, it is necessary to know as accurately as possible the air pressure in the main pipe at the point of take-off. A pressure gage is the proper apparatus to use for this purpose. If this is not practicable or if the branch pipe is to be planned simultaneously with the main pipe, the pressure at the point of take-off must be calculated from the given data. For our problem we will assume that the pressure is 80 lb. gage.

Three 3¼-inch piston drills using 75-lb. air require 360 cu.ft. of free air per minute.

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*Professor of mining engineering, Mining Dept., University of Montana, Butte, Mont.

Applying the Rix-Johnson formula, the minimum diameter of the branch pipe should be

$$D = \sqrt[5]{\frac{V^2 L}{2{,}000(P_1^2 - P_2^2)}} \qquad (31)$$

in which $V = 360$, $L = 600$, $P_1 = 80 + 14.7$, $P_2 = 75 + 14.7$; whence $D = 2\frac{1}{2}$ in.

A pipe smaller than that would supply neither the required quantity nor the required pressure, yet quite likely one would find a 1-in. pipe used for the purpose.

The intelligent planning of a net of branch pipes is a problem far more difficult and intricate than that of the main pipe. It should be intrusted to the most competent expert in that line of work and not be left to the discretion of the pipe-fitter.

Seventeenth Loss—Poor alignment both in the horizontal and vertical position of the pipe line, requiring frequent bends, causes losses far greater than is commonly realized. Five elbows, for instance, with a radius of 18 in., in a 6-in. pipe line create an extra frictional resistance equal to that of an additional 20 ft. of the straight pipe. This points to the advantage of avoiding bends even at an extra expense of laying the pipe.

Inasmuch as engines using compressed air as motive power are, in principle, the reverse of a compressor, the avoidable losses in the use of compressed air are analogous to those encountered in its production. Neglect of care on the part of the attendent is the usual cause of such losses, provided, of course, that the engine is adapted to the work it is to perform.

INCREASING THE MECHANICAL EFFICIENCY OF INSTALLATIONS

The most important means at our command for increasing the mechanical efficiency of air compression, and therefore of a complete system, is so-called stage compression.

The initial cost of a two- or multi-stage compressor is considerably more than that of a single-stage machine and therefore only warranted when the operations are of a more or less permanent character. But when once installed and operated with the required care, the saving of energy will soon pay for the extra cost of the machine.

The theoretical work of two-stage compression and delivery is

$$W_n = 2\,\frac{144 n P_a V_a}{n - 1}\left[\left(\frac{P_2}{P_a}\right)^{\frac{n-1}{2n}} - 1\right] ft.\text{-}lb. \qquad (32)$$

in which P_a and P_2 are initial and final absolute pressures and V_a, volume of free air in cubic feet to be compressed.

To compress to 80 lb. gage, the pound of 80° F. air at sea level ($V_a = 13.593$ cu.ft.) would require

$$W_n = 61{,}100\ ft.\text{-}lb.\ (theoretical) \qquad (33)$$

and

$$W_n = 70{,}600\ ft.\text{-}lb.\ (actual) \qquad (34)$$

This represents a 14% saving in compression power alone (see equation 4).

The volume V_2 into which the pound of air is compressed by two-stage compression, assuming perfect intercooling, is

$$V_2 = V_a\left(\frac{P_a}{P_2}\right)^{\frac{n+1}{2n}} = 13.593\left(\frac{14.7}{94.7}\right)^{0.855} = 2.76\ cu.ft. \qquad (35)$$

The theoretical temperature of the compressed air will be

$$T_2 = T_a\left(\frac{P_2}{P_a}\right)^{\frac{n-1}{2n}} = 541\left(\frac{94.7}{14.7}\right)^{0.144} = 710°\ absolute$$
$$= 249°\ F. \qquad (36)$$

If we allow it to cool down to initial outside temperature (62° F.), its pressure will fall to

$$P'_2 = P_2\frac{T'_2}{T_2} = 94.7\frac{523}{710} = 70\ lb.\ absolute \qquad (37)$$

We may then assume a volume of 2.76 cu.ft. of air at an absolute pressure of 70 lb. entering the pipe line. With the same size of pipe as before, the friction loss will be somewhat less, say 4 lb. The loss is accompanied by an increase in volume.

$$V_3 = V_2\frac{P'_2}{P_3} = 2.76\frac{70}{66} = 2.93\ cu.ft. \qquad (38)$$

Thus we have to operate the air engine a volume of 2.93 cu.ft. of air at an absolute pressure of 66 lb.

Using it expansively, down to 16.5 lb. abs., and applying equation 10, we can perform work

$$W_n = 33{,}900\ ft.\text{-}lb.\ (theoretical)$$

and

$$W'_n = 28{,}800\ ft.\text{-}lb.\ (actual) \qquad (39)$$

Hence, efficiency of whole system:

$$E = \frac{28{,}800}{70{,}600} = 41\% \qquad (40)$$

This increase in mechanical efficiency of the whole installation has been accomplished not by a greater, but by a lesser expenditure of energy. Two-stage compression would therefore appear to offer a vast advantage over single-stage compression.

Granting perfect conditions, it does. But it is here where the engineer will have occasion to observe great discrepancies in existing plants. He will frequently find that instead of saving power, the two-stage compressor consumes more power than the single-stage compressor, owing either to faulty construction or to neglect on the part of the operator. Such conditions are illustrated in the combined indicator diagram, Fig. 1, taken from a two-stage compressor in actual operation.

Two-stage compressors giving cards such as shown fail to realize a saving of power over single-stage compressors usually through one or the other of the following defects:

1. Cylinders not properly proportioned for prevailing compression ratio. In the case illustrated the high-pressure cylinder seems to be too small, throwing too much of the compression work upon the low-pressure cylinder.
2. Intercooler too small or inefficient. The theoretical saving of power is based on perfect cooling of the air between cylinders. Failure on the part of the intercooler to do this will increase work in the high-pressure cylinder.
3. Valve areas too small and air passages restricted. Restricted inlet-valve area in low-pressure cylinder increases the work to be done and reduces the compressor efficiency. Restrictions in high-pressure inlet and low-pressure discharge valves and in the intercooler produce an excessive discharge pressure from low-pressure cylinder to intercooler and a depression in the suction line of high-pressure indicator cards. The result is a great overlap in the developed diagram where the high- and low-pressure cards come together. Pressure losses also pro-

duce an unequal distribution of the work in the two cylinders.

In the case illustrated the terminal pressure in the low-pressure cylinder should have been 36 lb. abs. The diagram shows that the discharge valves of the low-pressure cylinder did not open until the pressure had reached nearly 50 lb. abs., indicating a large waste of energy.

Under (2) it is stated that the theoretical saving of power is based on perfect intercooling. This means that cooling water must be provided sufficient to abstract all the heat generated by compression in the low-pressure cylinder. When an unlimited supply of water is available, this is quite possible. But more often water is scarce and expensive and must therefore be used over and over again. Usually it is pumped to a so-called cooling tower and returned to the compressor by gravity. This, evidently, entails an extra expense that must be taken into account when planning the installation.

Before deciding on the kind and size of the compressor, one must be sure that the necessary quantity of water for either method is available, else the most perfect machine will fail to show the saving of energy that is expected. It is here that the engineer again has occasion to meet with many imperfections. Though the intercooler and the pipe leading to it may be of ample dimensions, the required amount of water is often lacking, resulting in conditions such as shown in the indicator card.

QUANTITY OF COOLING WATER REQUIRED

It may be asked, What is the required quantity of water? The answer is self-evident when it is remembered that 1 B.t.u. will raise the temperature of 1 lb. of water 1° F. Hence the number of pounds W of water necessary to abstract a certain number of B.t.u.'s from a substance is equal to this number of B.t.u.'s, assuming that the water's temperature is not to be raised more than 1° F.

$$W = w(t_1 - t)s \text{ lb.} \qquad (11)$$

in which w = pounds of air to be cooled, t_1 = its temperature in degrees F. after compression, t = its initial temperature and s = specific heat of air at constant pressure = 0.2375.

When water is scarce, one has to be contented with a saving of energy somewhat less than the theoretical. It is then customary to allow an increase in the temperature of the cooling water amounting to from 10° to 25°. In actual practice some of the compression heat is dissipated by radiation, so that the amount of water required becomes still less. For rough estimates the minimum number of gallons G of cooling water required per minute in a 2-stage compressor may be found from the following formula:

$$G = 0.0001\, C(t_1 - t) \qquad (12)$$

in which C = free air in cubic feet per minute being compressed, and t and t_1 = theoretical temperatures in degrees F. before and after compression. Theoretical temperatures of compressed air for two-stage compression are found in the bulletins of compressor builders, or they may be computed from equation 36.

The transmission efficiency of a pipe line evidently is the ratio of the energy residing in the air at the discharge end of the pipe to the energy residing in the air at the intake end, assuming the temperatures to be practically the same at both terminals. For the same size pipe, the efficiency can be materially increased by increasing the intake pressure. In this connection it is well to remember that the required power to compress is not directly proportional to the end pressure. To compress 100 cu.ft. of free air per minute in two stages to 60 lb. gage requires 12.10 hp. To compress it to 180 lb., which is three times as much, requires only 20.8 hp., which is less than twice the former horsepower. This feature may be taken advantage of in planning the transmission as well as the use of compressed air.

EFFICIENCY INCREASED BY REHEATING

The most effective means of increasing the potential energy of a quantity of compressed air is the reheating of the air before use in the air engines. While not applied as frequently as it might be, the saving that can be effected by this method is being realized more and more by operators.

At the compressor plant of the Anaconda Copper Mining Co. at Butte which supplies air to the company's hoisting engines, an ingenious system was devised by the builders of the plant, the Nordberg Manufacturing Co., which contributes materially to the efficiency of the whole installation, although involving a considerable increase in the original and maintenance cost of the plant. It consists essentially of a number of receivers or expansion tanks which are placed 210 ft. below the compressor plant and are connected to a large water reservoir near the compressor building and a little above the latter's floor level. Thus a uniform hydrostatic head equivalent to 90 lb. pressure is maintained on these receivers, the entire capacity of which can be used at full normal pressure, the air being displaced by the water as it is required. When the combined demand of all hoisting engines exceeds the supply from the compressor plant, the excess air is drawn from the expansion tanks and water runs down from the reservoir into these tanks to take the place of the air. When, on the other hand, the supply exceeds the demand, the surplus air is forced into the tanks, and in turn forces the water back into the reservoir on the hill.

Since the energy residing in a quantity of compressed air depends on its pressure as well as on its volume, it stands to reason that by increasing either one or both we can increase this energy. The process known as reheating consists in forcing the compressed air upon arrival at the point of use through suitable vessels that present large areas of highly heated surfaces to the air which, while passing over them in thin sheets, becomes itself heated and therefore expands into a larger volume, practically under constant pressure.

In practice air is reheated to temperatures as high as 300° F. The volume, and therefore the energy of a certain quantity (weight) of air, is thereby increased from 30 to 50% over that it possessed before entering the reheater. Higher temperatures are not advisable, as the lubricant in the air engine is then apt to [illegible], causing severe cutting action on the valves, rods and stuffing-boxes.

To accomplish the results stated, there must, of course, be an expenditure of fuel or other heat-generating energy (electricity). However, if coal is the fuel, as it is in most of the large reheating plants now in operation, only about one-eighth (theoretical) is used of the amount that would be originally required to compress air so that it could develop power equal to that developed by the reheated air. To illustrate: To produce an extra cubic foot of 75-lb. air by a steam-driven compressor would require 474 B.t.u.'s. while by reheating. 2 cu.ft. of 75-lb. air can be made out of one by an expenditure of only 58 B.t.u.'s. This does not take into account the efficiency of the reheater.

The possibilities of reheating, particularly for underground work, where its introduction meets with various difficulties, offer a vast and profitable field to the inventor—a field that has by no means been explored as much as it deserves.

EFFICIENCY INCREASED BY OPERATING DETAILS

The plant as a whole should, in the first instance, be placed in charge of a competent man and a staff especially trained for the work. Pressure gages should be inserted at frequent intervals in the pipe line, or provisions made to insert them for taking readings, especially at the junctions of branch pipes. These readings should be systematically recorded so that abnormal discrepancies may be followed up to their source and remedied as soon as discovered. The use of air should receive strict supervision, and, if possible, the quantities used should be frequently measured by means of reliable air meters. Willful waste of air should make the offender liable to discharge.

Such, in general, is the procedure adopted by the larger operators in the Butte and other camps who have found out that it pays to provide facilities for observing and recording the performance of all machinery and appliances constituting their compressed-air systems.

There are numberless other means that will suggest themselves to the intelligent and conscientious supervisor for improving this branch of the service and for avoiding losses that without such supervision are bound to occur with steadily increasing magnitude.

Acid-Resisting Iron Apparatus

According to N. Swindin in *Chem. Trade Journ.*, 1916, LIX, 323-4, through *Journ. Soc. Chem. Ind.*, the general design of plant in which acid-resisting iron alloys are used is similar to that where steel is employed, except that due allowance is made for the greater liability of the alloys to fracture from the action of internal stresses. Unequal cooling being the chief source of trouble in this respect, the thickness of the castings should be as uniform as possible and the presence of relatively large masses of metal (for example, at the junction of two or more walls of the apparatus) avoided. Although parts with flanges and ground or machined faces are obtainable and sometimes indispensable, plain spigot and socket joints should be used wherever possible; pipe apparatus of the kind under discussion is seldom subjected to high pressures, and excellent cements to withstand every kind of acid liquid or gas are now available for making such joints quite tight.

As in the case of other metals used for pans, etc., the most reliable form of casting for acid-resisting iron alloys is a hollow sphere or portion thereof; flat surfaces should be avoided wherever possible and, if unavoidable, should not be larger than 18 in. square. The very shallow pans used for concentration purposes are ribbed and corrugated, thus providing an increased surface for heat transmission and overcoming foundry troubles by breaking up flat surfaces. The advantages of the iron alloys over earthenware, etc., are most apparent in nitric-acid plants, chiefly as regards the great reduction in size and increase in efficiency of the condensing apparatus. For denitrating sulphuric acid, towers made of iron alloys are very successful, but being slightly attacked by weak (although not by strong) sulphuric acid, cascade basins and pans of these alloys can be employed only in the lower part of the run if iron-free acid is required.

New Steel Mill in Chile

There has recently been developed in Santiago a steel industry on a small scale, using as raw material the old iron formerly exported to Europe, says *Commerce Reports*, of the United States Department of Commerce, Washington, D. C. The high price of steel after the outbreak of the European War led to the domestic manufacture of this article through the efforts of an engineer, Mateo Vucetich, and a capitalist, Bernardo Granello. Great difficulty was experienced at first in finding skilled workmen, until Spaniards were secured from Bilbao, where the steel industry is developed. Chileans were taken on as apprentices, and the force now employed numbers about 100, not including those who collect the old iron. A special foundry had to be built for making the needed machinery, which was turned out after European models, as was also the refining furnace. Chilean coal is being used, which is another item of economy.

The products of the mill include bars, plates, angles, tees, construction steel for concrete buildings, carriage parts, bolts, nuts, nails, horseshoes, tires, etc. The Chilean steel sells for 20% less than the imported steel. A fair quality has been obtained, and the operating difficulties encountered at first are now being overcome. The demand for steel in Chile is large and increasing, which assures an immediate market for all that can be produced at the Santiago mill.

Siam's Imports of Mineral Oil

With imports amounting to 8,349,257 gal., the United States Department of Commerce reports that Siam's purchases of foreign mineral oil in the year ended Mar. 31, 1916, were only slightly larger than in the preceding fiscal twelve-month, as the following table discloses:

Articles and Countries Whence Imported	1914–15 Gallons	1915–16 Gallons
Kerosene	6,167,674	5,792,615
United States	1,897,960	1,494,360
Netherlands Indies	4,269,714	4,298,255
Gasoline	334,804	294,430
United States	23,944	31,968
Netherlands Indies	310,860	262,462
Liquid fuel	1,166,910	1,882,588
Netherlands Indies	907,892	1,685,972
Singapore	259,018	196,616
Lubricating-oil	396,948	379,624
United States	151,481	156,681
India	22,365	....
Netherlands Indies	91,926	116,369
Singapore	53,498	94,345
United Kingdom	76,038	11,990
Grand total	8,066,336	8,349,257

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British Imports of Manganese Ore in October were 38,360 gross tons against 42,389 tons in September and 60,931 tons in October, 1915. The total for the 10 months to Nov. 1, 1916, was 386,754 tons against 270,745 tons to Nov. 1, 1915. The receipts for the 10 months this year are at the rate of 42,973 tons per month against 30,083 tons per month for the same period in 1915. Imports of manganese ore into the United States to Oct. 1, 1916, were 469,222 tons—exceeding the British receipts.

Chart for Determining Heat Loss in Flue Gases

An interesting and valuable diagram has been prepared by H. F. Hutzel and published in *Power*, Dec. 12, 1916. As shown it affords a simple means for determining the heat loss in flue gases. This chart is based upon the following formulas:

$$W = \frac{4 \times CO_2 + O_2 + 700}{3(CO_2 + CO)} \times \frac{C}{100} \qquad (1)$$

in which W represents the pounds of flue gases per pound of coal burned and C represents the percentage of carbon in coal. CO_2, O_2 and CO represent, respectively, the percentages by volume of carbon dioxide, oxygen and carbon monoxide found in the flue gases.

$$H = W \times 0.24(T - t) \qquad (2)$$

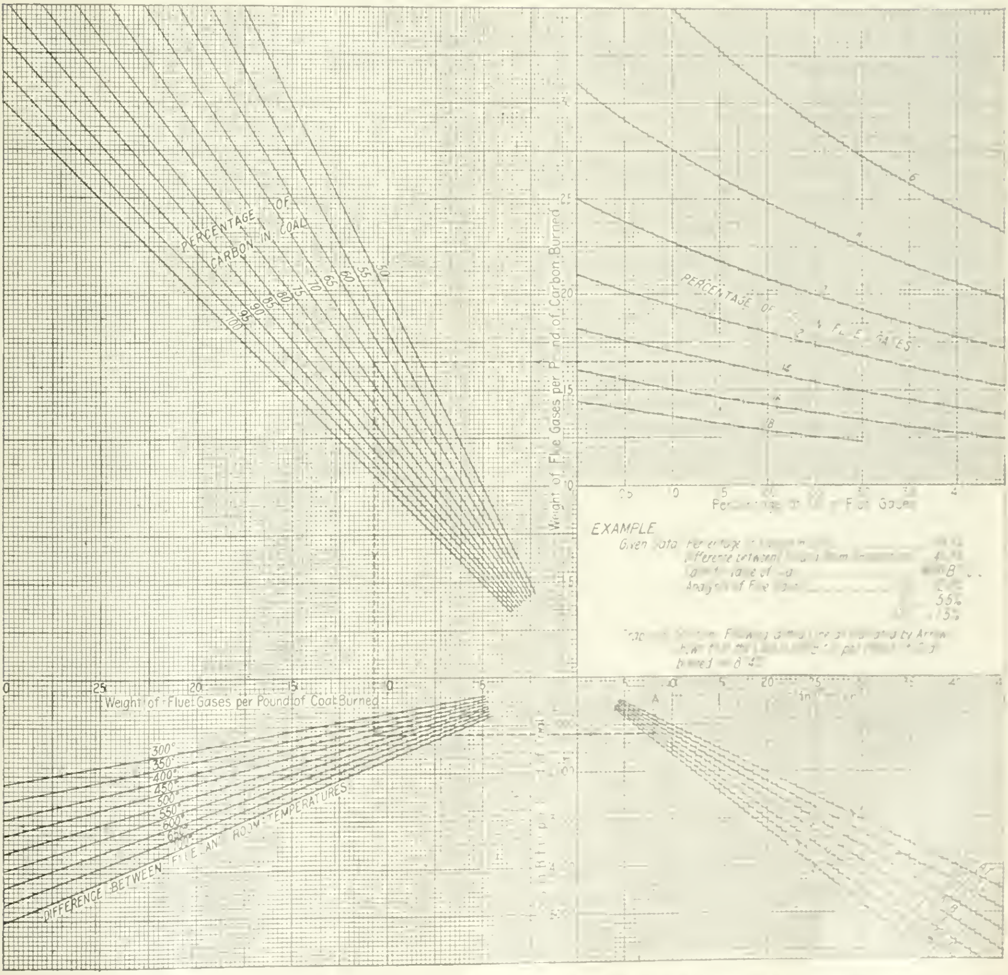
in which H represents the heat lost in B.t.u. per pound of coal burned and $(T - t)$ represents the difference in temperatures between the flue gases and room.

$$P = \frac{H}{k} \qquad (3)$$

in which P represents the loss in per cent and k represents the calorific value per pound of coal as fired.

Since the percentage of oxygen is an indication of the amount of excess air that is being supplied to the furnace it would naturally be supposed that the abscissas of the chart should represent O instead of CO_2. The reason for having abscissas represent CO_2 rather than O is as follows:

In the formula given for determining the weight of flue gases, it will be observed that there are three variables; namely CO_2, O and CO, which vary as the state of combustion varies. With these variables almost an infinite number of combinations might be formed.



COMBUSTION OF COAL IN BOILER FURNACES. CHART FOR DETERMINING HEAT [illegible] therefore making it almost impossible to produce a chart for determining flue-gas losses that would cover all cases.

In order that the accompanying chart might be made to cover any example, I have made an assumption that is neither theoretically nor practically correct, yet the error introduced is so small as not to affect the accuracy of the readings on the chart more than a fraction of one per cent. The assumption made is that the sum of the percentages of CO_2, O and CO, as indicated by the flue-gas analysis, is 21% for all samples. This sum might be somewhat less, owing to hydrocarbons in the fuel, but even then should not total less than 19%. In case of the presence of CO, the sum might be more than 21%, but seldom does it exceed this amount. That the assumption made might introduce as small an error as possible, the percentage of oxygen as shown in equation (1) was determined by subtracting the sum of the percentages of CO_2 and CO from 21. From the formula it will be observed that the numerator for any analysis will be much greater than the denominator. Therefore, even though the percentage of oxygen as determined by the foregoing method is incorrect by a small percentage, the value of W will hardly differ from the true value. On the other hand, should the value of CO have been determined as that of the oxygen, any slight error might effect an appreciable error in W, since the CO appears in the denominator.

Protection of the American Tungsten Industry

In a leaflet which it is distributing, the Colorado Metal Mining Association sets forth the facts which it thinks indicate the necessity for a protective duty on tungsten ore and manufactured products. It says that prior to 1914 the United States produced practically one-half of the tungsten consumed in this country, the imports coming chiefly from Australia, Portugal, South America and later from Burma. The price per unit varied from $2 in 1900, when the first lot of ore was sold, to $11 per unit in 1907, when the largest output was made. Since tungsten mining in the United States actively began, in 1900, output and price for the ore in this country have invariably decreased with the opening of new fields in foreign countries, and at the same time the imports were largely increased. For some time prior to the outbreak of the European War the output of the Burma fields, together with that of Portugal and Australia, depressed the American market and a price of about $6 per unit prevailed.

In January, 1915, the prevailing price in the Boulder field was $5.60 per unit for a 60% product; in December the price had reached $50, and in March, 1916, in one instance at least, upward of $100 per unit was paid for ore containing 60% WO_3. In 1915 the total production of this country, as given by the United States Geological Survey, was 2,165 tons of 60% product—only a little greater than the 1910 output, when the average price per unit was $8 and the production 1,821 tons.

According to a report by Frank L. Hess, of the Geological Survey, during the first six months of 1916 Colorado marketed 1,505 tons of tungsten ore and concentrates valued at $3,638,000; California, 984 tons, valued at $3,005,000; Nevada, 461 tons, valued at $1,432,000; and Arizona, 175 tons worth $565,000. Smaller quantities were mined in Alaska, Connecticut, Idaho, Missouri, New Mexico, South Dakota, Utah and Washington. It is obvious from the foregoing that with remunerative prices for the ore the mines of this country are capable of a production equal to any demand that might be made upon them, and if worked to full capacity, mining activity would be largely increased in Colorado, California, Nevada and Arizona and doubtless new and important discoveries would follow in other states.

The price paid for tungsten-bearing ores in the United States is, generally speaking, determined by the offerings of foreign ore. This ore is mined under cheap labor conditions and at a price far below that for which it can be produced at a profit here. A comparison of conditions under which tungsten is mined here and in foreign countries is of interest at this time. In Burma most of the ore comes from alluvial deposits worked on contract by natives who earn about 48c. per day. Considering the fact that ocean transportation from foreign fields to New York is in most instances less than by rail from the tungsten mines of the country to the same point, it is obvious, in an industry where labor is so large a factor in the cost of production, that the tungsten miner of the United States cannot compete with the coolie labor in Burma, the bushman in Australia, the underpaid miner of Portugal or the Indian of Peru or Bolivia.

Another phase of this subject to which the tungsten miners of the United States would direct attention is the relation of this industry to the campaign of preparedness now under way in this country. Consistent reasonable protection for the industry, with due regard for all of the interests involved is the only policy that can adequately meet the requirements of the future and establish tungsten mining as a permanent industry.

Bauxite Brick Linings

Bauxite brick for furnace linings is discussed by W. C. Phalen in a United States Geological report on "Bauxite and Aluminum in 1915," concerning which *Iron Age*, Dec. 7, 1916, says: "The purer the material used the more refractory the brick. The addition of bauxite to refractory clays not only increases their alumina content, but also their refractoriness. The two kinds of brick in common use, made by hydrous oxide of aluminum, contain 56 and 77% of alumina respectively. The lower-percentage brick are used as fireclay brick, but will withstand higher heat. Those containing the higher percentage have been used as a substitute for magnesite brick for open-hearth and other furnaces. Mr. Phalen cites an instance where bauxite brick were used in the port end of a furnace, forming a bulkhead for that particular furnace for 365 heats, after which a new roof was put on. The opposite port of magnesite brick is reported to have been in a worse condition."

Victoria Mineral Output, 1915

The mineral output of Victoria, Australia, during 1915, according to the Secretary of Mines, was valued at £1,737,158, a decrease of £349,025 from the preceding year. The gold produced (329,068 oz.) was valued at £1,397,793. Other items, in descending order of value were: Coal 588,104 long tons; antimony ore, 11,113; tin ore, 95.5; silver, 11,687 oz.; diatomaceous earth, 274 long tons; wolfram, 14.5; gypsum, 690; brown coal, 2,864; magnesite, 189; kaolin, 402; and manganese ore, 97.

West Coast Travel Observations

By A. P. Rogers*

SYNOPSIS—Travel on the West Coast away from the tourist routes involves many hardships, unsanitary conditions and culinary disappointments. The great mass of the natives are ruled by a small aristocracy actuated mainly by ideals of bygone centuries. All these West Coast countries are jealous of, and fear one another. Better acquaintance with the United States is being cultivated, however, and each feels that closer relations with that country may help protect it from its neighbors.

South America is our latest hobby; the papers are full of the immense opportunities and markets for trade lying open to us there; financial and Government commissions are making trips there, one after the other, while tourists in shoals have been flocking over the same routes this past year; and finally, mining engineers and representatives of capital are as thick as bees everywhere. But what sort of a place is this "West Coast Country," as it is called; and especially, what are the people like. Ask most of these visitors the latter question, and you will not get a really satisfactory answer—except possibly from those who have stayed there awhile. Why? Because they skip and fly around over the same old trails at topmost speed and, lacking the comforts of home, they are indisposed to remain long enough in one place to really get to know the people or study the country. But it is too big a subject to comprehend in any other way.

United States Travelers Bias Opinion

Up to very recent times South America has been a kind of hazy myth to the average person—not unlike the mountains of the moon or the canals of Mars—and mention of the West Coast Country is more than likely to bring only a blank stare. We are so self-centered here at home, each with his own local interests, that we have not had time to focus on anything else, and only now are we learning that there are real neighbors to the south of us who have their everyday life just as we have ours. Only comparatively few of them, however, know as much about us as we do about them; and they judge us, as they must, through the visitors we send them—good, bad and indifferent. This is not only deplorable, but it is not right and it is high time we became better acquainted.

The West Coast comprises five different countries, but the term here is more strictly applicable to only three of them—Chile, Peru and Bolivia; and the last-named has today no coast line at all. It is always included in the term, however, as there was a time, some 40 years ago, when Bolivia did own a most important, if uninviting-looking, bit of seacoast—before Chile conquered it—where have since been developed fabulously rich deposits of copper, nitrate, borax and other minerals. Think how we should feel if we had lost a country containing one copper deposit alone rich enough to pay our national debts, and you will have the same qualms the Bolivians have who put through that transaction. You will also understand why these countries are now crying out against any more sales of national resources, except at absurdly extravagant figures, to the little understood "Yankee." The inhabitants are impressionistic people, extremely sensitive, and secretly afraid of where they will land in the end with all these deals; hence it is desirable for us to allay their fears as much as we can. We must live up to the doctrine of "live and let live," but they in turn must learn to work and get over the idea that it is a disgrace to soil their hands with labor.

While the South Americans regard us in this rather awesome way, they realize the advantages to accrue to them from investments in their countries and are constantly emphasizing the fact of a lack of local capital (and brains) for the developments needed everywhere. They are also slowly learning that an honest, stable government, with fair and just laws, is the primary requisite for a torrent of new settlers and all the capital they can use. It takes time, however, to educate sparsely settled countries, where the customs are centuries old, to a new condition of affairs, and we must not expect them to accomplish everything in a day. It should be sufficiently encouraging now for us to know that we are liked and that a better acquaintance would be welcomed throughout that whole vast continent.

Lack of Good Harbors Handicaps Travel

The West Coast Country—referring to Peru, Chile and Bolivia—as the average tourist sees it in sailing southward, is a barren waste of desert mountains rising from the sea from 1,000 to 3,000 ft. in height, giving occasional glimpses of the great snow-capped peaks of the Cordilleras behind, when the clouds permit a view. The so-called ports, where the boats stop nearly every day, are nothing but open roadsteads, a few of them having piers to which the steamships cannot approach, and are such desolate-looking places there is no temptation to go ashore. Callao and Valparaiso are the only exceptions to this rule, as they are better situated, and with close connections to the capitals of their countries are naturally the important places no visitor ever misses. South of Valparaiso the appearance of the coast changes to one more like that of British Columbia, but only comparatively few tourists take this southern trip.

At nearly every one of the smaller ports from Peru southward, there are short lines of railroad extending back into the interior valleys, most of which terminate at the foot of the towering Cordilleras—a mighty natural wall. From Callao, Mollendo, Arica and Antofagasta, however, the lines have been extended over the mountains to the great central plateau between the western and eastern ranges of the Andes, and then branch out into longitudinal lines both north and south. This central plateau country is a most extraordinary region from 10,000 to [illegible] ft. high and over [illegible] mi. long in Peru and Bolivia, having a climate [illegible] at variance with that usually encountered in the tropics. There is a rainy season and a dry season, it is true, but in other respects the climate is more temperate than tropical on account of the altitude, especially toward the south. Before the Spanish conquest this plateau was the home of the ancient Inca Indian civilization, numbering some [illegible] souls.

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*Mining engineer, No. 60 Broadway, New York City.

In Peru the soil is extremely rich and generally well watered, but in Bolivia water is always scarce and much of the country is a desert. A great variety of crops are raised by the Indians for sale in the markets, although potatoes and corn are their own staple diet. Sheep, goats, mules and cattle are also raised everywhere, and this is the real home of the famous llama, a curious, stupid beast, but the most useful animal the Indians possess.

The ancient Inca towns on the plateau are slowly being renovated for the reception of tourists, and the trip from one to the other can now be made comfortably in trains provided the traveler can stand the altitude. It is a bit trying at first, but one soon becomes accustomed to it, and a little asperin is a very efficacious remedy for the mountain sickness, called "seroche."

Covering some 150 mi. of the plateau between Peru and Bolivia is the famous Titicaca Lake, the highest body of navigable water in the world, from which the Desaguadero River flows in a very winding course to the south over 200 mi. and empties into Lake Poopo. This lake is only about 14 meters lower in elevation than Titicaca and has no outlet. The whole region was evidently once a great inland sea, and the present lakes are all that remain of it. Bounding the plateau country on the east is the main range of the Andes Mountains, rising into towering snow-capped peaks, while beyond them the country rapidly drops away and changes into the tropical jungle region of the Amazon basin, fever-ridden and unhealthy. A huge slice of southern Bolivia lies just outside this category and on the Rio Plata watershed, but it is such a wilderness that it plays no part in the life of today.

Northern Chile contains the great Atacama desert, where it hardly ever rains; and south of that lies the beautiful central Chile valley, reminding one of California, with the overpowering Andes behind; while still farther south the country is full of wonderful lakes and heavily wooded mountains and has a wet climate, similar to the British Columbia coast. Almost every variety of country known to man lies in this 3,000 mi. of West Coast region. Of it all, however, probably the most beautiful part is that in central Chile, from Santiago south to the lake country. And, to my mind, the richest in mineral resources in all South America is the forbidding desert region of northern Chile and southwestern Bolivia. As it is also a trying and dangerous region to travel in, where false steps are fatal to the trifler, it pays to be wary of it.

Wornout Ideals Actuate Ruling Classes

With this sketchy outline of the West Coast Country, upon which no end of descriptive books have been written, I prefer to leave it and get at the people, as it has been well said that "men are what make a state, without regard to their environment." To understand them better, however, it is necessary to repeat a little history. These people are all descended from the original Spanish adventurers and conquerors, mixed in greater or less proportion with the subjugated Inca and other Indian inhabitants. The proportion of Indian blood shows plainly in the characteristics of the people in the different countries, and I believe that explains the leading position held by Chile, where there was less mingling of the races. The Inca Indian of Peru, especially, was nothing but a slave, little better than an animal. From what I have read, the Spanish conquerors were probably a curious mixture of marvelously energetic adventurers and bloodthirsty, cruel villains, who balked at nothing to attain their end. The combination of the two races, as seen today, is better than what might be expected.

Each country had its own struggle for independence, followed by internal jealousies and revolutions, and then came the inevitable boundary disputes over the nitrate deposits when they were discovered, culminating in 1879 in the short but bitter war between Chile on one side and Peru and Bolivia on the other. By absolutely routing her neighbors, Chile took from Bolivia her seacoast around Antofagasta in consideration for an insignificant payment and from Peru the valuable provinces of Tarapaca and Tacna, with the inevitable result of an endless feud. Since then each country has had numerous revolutions of greater or lesser importance until the present day. You may say that revolutions are wrong and out of date in this enlightened age, but what can one expect when one considers the ancestors of these people. Time alone will cure the situation, helped by the proper immigration all the West Coast is calling for, and by universal education—especially the latter. There are far too many illiterate peons to make a real republic anywhere, and unless a change is brought about, there always will be the fear of another such condition as exists in Mexico just now. In Bolivia, for example, with a total population of less than some of our larger cities, over 90% of the inhabitants are illiterate Indians, many of them savages.

Labor Conditions Approximate Slavery

The great plateau region is divided into large "haciendas" owned by the ruling class, a small element, who pass the laws. Each of these haciendas has a certain number of Indians who live on the land and do the agricultural work—to all intents and purposes nothing more than slaves. They are always reckoned as an asset and are quoted as such in any transfer of ownership, in other words, they go with the land and are obliged to supply so much produce every year to the owner. They are a densely ignorant, servile race and lead a dreary life with no pleasures in it, unless an occasional drunken orgy or a weird tune played by a lonely sheep herder on a reed flute can be classed as such. Naturally, the more educated owner of the land spends mightly little time among these "children," and he takes good care to see that all land taxes are kept at their lowest possible figure. He prefers to see the government taxes raised in some other way—by monopolies on salt, matches or tobacco, or by taxing the exports from the mines, many of which are owned by foreigners. Any suggestion that he should be more heavily taxed and forced to divide his land holdings among the actual tillers of the soil, or that the Indian peon should be educated, by compulsion if necessary, meets with an astounded refusal. And yet the need for such a course is most pressing in Bolivia today to start an improvement in the country. The members of the luckily born, small upper-crust class, should recognize that their position is one of trust, to be conceded and maintained only on condition that they will also work or lose their rights. It is the same trouble as that in Mexico and in all the other Latin-American republics, where manual labor or drudgery of any kind is considered impossible for the gentleman, provided someone will support him or he can get something for nothing by gambling or some other gentlemanly accomplishment.

In Chile the original tribes were never subjugated by the Spaniards, but the wealth of the country is vested in the owners of large haciendas just the same, worked in a dreadfully inefficient manner by the peon class, called "rotos" locally. These peons have some Spanish blood in them and are more intelligent than the Bolivian Indians, having some slight education, but the same principle obtains among the upper classes. To my mind the "roto" is the hope of Chile, as he is a worker, aggressive, and is slowly becoming more temperate. The army should probably be thanked for that. Obligatory military service is universal in all these countries—under German instructors until the war began—but Peru and Bolivia are too poor to support the full classes every year, and a few months' training is all that many a man gets.

CURRENCY AND EXCHANGE IN DEPLORABLE SHAPE

Notwithstanding that the Chileans are more progressive and wealthy than their northern neighbors, their currency and exchange is in a deplorable condition. No gold is in circulation, and the paper money is worth only one-sixth as much as ours. Exchange fluctuates at a lively rate and affords a substantial living to those who know the game. While there is sufficient gold on deposit to give a value of 11 pence to the peso today, the exchange hovers around 8½ pence, for which the large landowners may be blamed. Owning the country and paying their workmen in pesos while they receive gold for their products, naturally they do everything to keep the rate of exchange down. With so many English houses established there, imports have been maintained in spite of the war. In Bolivia, on the other hand, where the Germans have hitherto controlled the importing business, the imports stopped long ago, and with heavy exports of tin, copper and other metals, the landowners could not control the exchange at all. In Peru the same condition prevails and exchange is very high, although in neither country is any gold in circulation at the present time.

GREATEST WEALTH OF PERU AGRICULTURAL

Peru, while containing many profitable gold, silver, copper, coal and oil deposits, has its greatest wealth in agricultural resources. Great sugar and cotton estates are owned by the leading families, and in the higher country, products suitable for those temperatures are raised, but all under similar conditions to those found in Bolivia and Chile. Transportation is even more difficult in many places here than in Bolivia, as the country is cut up by immense cañons and high mountains, so that long intercommunicating lines of railroad are difficult and expensive to construct. It is related that a traveler who was riding over the mountains in northern Peru, where one goes up one range and down another with no apparent end, became weary and remarked: "It is said that the Lord made heaven and earth in six days, but this must have been a late Saturday night's job"; and he was not far wrong.

To the traveler from the North, perhaps the most striking things impressed on his memory are the filth and outrageous food he finds everywhere. Except in Lima, Valparaiso or Santiago, the hotel accommodations are inexcusable and even in these places they are only passable. It is a constant fight to obtain fairly clean, sanitary arrangements, and in such places as Cuzco it seems almost a hopeless task. The doctrine that "cleanliness is next to Godliness" is dreadfully hard to spread, but I am optimistic enough to hope that they will learn in time. The prevailing idea of a different dish is to throw a lot of grease, garlic, vegetables and meat of any kind into a dirty pot of water and heat it over a smoky fire. It is perhaps unjust to represent this as an unvarying custom among all classes, but it is the memory of such which the average traveler, through Peru and Bolivia especially, will bear away with him. The tantalizing part of it is that everything necessary is produced in abundance, and only a little knowledge of the culinary art is required to live as well as anywhere.

I have told many Chileans that all they need are proper roads and good hotels to draw a host of tourists to their lovely country, but they merely smile and say they lack the money to build them. From Panama south the traveler is always surprised to find how cool and smooth it is, and with faster ships and fewer stops the time could be reduced tremendously.

AMUSING PERSONAL TRAITS AND CUSTOMS

The Spanish-American loves to sit around and talk with his friends. It makes no difference whether he has anything to talk about or not, he will talk just the same. It affords a chance for a glass of beer, or some other beverage. He is always seeking tranquility for his thoughts, especially on any business deal, and it is useless, or worse than that, to try to hurry him.

His pleasures or recreations as we know them, are most noticeable by their absence. It is surprising to see what simple amusements interest the crowds in every city. The English game of football is quite popular, and billiards is played by all natives, but beyond that they do not go, preferring a stroll round and round the plaza, to see and to be seen, while the band plays in the evening.

In Chile there is enough wealth to support a summer colony at Viña del Mar on the coast near Valparaiso, where the favorite amusement is to go to the "Playa," or beach, late every afternoon and stroll about. Pretty faces and the latest frocks are daily on exhibition, and it is an attractive sight, but I am afraid we Americans want more action in a steady routine. Then, on Sundays, there is always horse-racing at beautifully laid-out courses in Viña and Santiago. This sport is very popular and much better than the ugly bullfights held in Lima.

Latin-American people are most hospitable and courteous to every visitor in their homes, but as many of them speak very little English, it is desirable for us to do our part. The average American, when he finds himself not understood, acts as if his listener were deaf and tries yelling for a change, much to the latter's amusement. Spanish should be taught in all our schools if we are to help the cause.

I have tried to mention a few of the characteristics of these West Coast people, who are kindly disposed and would like to know us better, with a hope that our acquaintance may progress. The troublous times in Europe emphasize the necessity of it. If nothing else does, such immense wealth of natural resources awaiting somebody's brains and capital should stir Americans to an effort [illegible]. It is unfortunate that Argentina, Uruguay, Paraguay, Chile, Bolivia and Peru are not all one country, as they are of [illegible] the same general stock and should be combined into one government. These countries are something like a large family, each [illegible] [illegible] the achievements of its [illegible] neighbor, so that our position, provided we send them proper representatives who speak the language, will be a very advantageous one. We are so far away they do not really fear any colonial desires by us, and they feel we can protect them from one another.

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Zinc Mining at Broken Hill*

The average number of men employed in the mines in the Broken Hill field during 1915 is estimated at 5,315, compared with 7,855 during the previous year. Many of the mines attempted only maintenance work underground and repairs to or installations of new machinery on the surface.

The Broken Hill Junction Co. mined 1,100 tons of crude sulphide ore averaging 15% lead, 10% zinc and 12 oz. silver per ton.

The British Broken Hill Proprietary mined only carbonates in the upper mine levels—1,883 tons of ore containing 595 tons of lead and 11,298 oz. silver. Broken Hill Proprietary, Block 14, produced principally from development 8,916 tons of carbonate containing 2,396 tons of lead, 124,664 oz. silver, in addition to which 986 tons of sulphide ore was stacked on the dump. Broken Hill Proprietary, operated on a reduced scale owing to the war. The mills handled 189,046 tons of crude ore, producing 33,036 tons of lead concentrates, while the handling of old dumps and tailings by the regrinding plant produced from 164,511 tons of ore, a total of 4,491 tons of lead concentrates.

Broken Hill South Silver Mining Co., operated under war-restricted conditions and with a total shutdown of 55 days. The mill treated 294,530 tons of ore assaying 11.7% lead, 7.5 oz. silver and 14% zinc, from which was produced 55,619 tons of concentrates assaying 60.6% lead, 23% silver, and 9.8% zinc. The tailings delivered for treatment to the Amalgamated Zinc plant totaled 181,924 tons assaying 3.1% lead, 3.4 oz. silver, and 17.2% zinc. The recovery was 77.6% lead and 58% silver. On the 1,270-ft. level the orebody was developed for a width of 105 ft., averaging for this whole distance 14.3% lead, 8.6 oz. silver and 14.8% zinc. Ore reserves now total 3,350,000 tons.

Zinc Corporation, Ltd., installed new machinery, improved ventilation, and did considerable development work, including three diamond-drill holes. Sulphide Corporation, in spite of war conditions, maintained the normal ore production, the total output being 242,043 tons. Amalgamated Zinc operated intermittently. North Broken Hill produced 258,213 tons of ore from the mine and treated 261,939 tons assaying 15.9% lead, 7.45 oz. silver and 12.95% zinc, producing 52.800 tons of concentrates assaying 61.2% lead, 20.9 oz. silver and 8.9% zinc. The recovery of the metals was thus 77.6% lead, 56.6% silver and 13.7% zinc.

During the year the Broken Hill Associated Smelters, Ltd., purchased the Broken Hill Proprietary Co.'s smelting and refining works at Port Pirie. The new company was formed by four of the leading mining companies of Broken Hill: Broken Hill Proprietary Co., North Broken Hill, Ltd., Broken Hill South Silver Mining Co., and the Zinc Corporation, Ltd. One of the objects of the new company is to extend the smelting industry in Australia and to enable the mines of the associated companies to be independent of foreign smelters, who, up to the present, have controlled a large portion of the trade. At present the output from these mines is regulated by the capacity of the smelteries, which is considerably below the average production of the mines. Steps are, however, being taken to enlarge the plant to cope with the requirements of these mines. The benefit to this field by the purchase should be far-reaching.

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*Abstract from Mineral Report of the Department of Mines, New South Wales, for the year 1915.

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World's Shaft-Sinking Record

By A. Cooper Key*

A new world's record in shaft sinking—252 ft. in 31 days—has been created by the Crown Mines in its new No. 14 shaft, situated in the southern portion of the property in what is known as the Bovysers Reserve on the South African Rand. In the 30 days of September and on the first day of October, this shaft was sunk 246 ft. and 6 ft. respectively, totaling 252 ft.

The shaft is circular, similar to that sunk some time ago at the New Modderfontein, of 21 ft. 6 in. diameter before and 20 ft. after bricking.

The sinking was done with the aid of 30 natives, working 90 shifts. Five Ingersoll-Rand machines were used per shift. To break the 9,120 tons of rock excavated, 67 cases of gelatin were consumed. This rock was hoisted in a 3-ton bucket, the hoisting being done by one steam engine connected with two boilers.

The previous sinking record was made by the Modder Deep Levels in April, 1912, when 231 ft. was sunk in one of the twin shafts. This shaft had three compartments, two measuring 5x6 ft. and one 6x6 ft. The Modder Deep beat the record created a month earlier in the southeast shaft of the Modder Government Gold Mining Areas by the narrow margin of a foot. This, in turn, was an advance from the 213 ft. of the Modder Deep constituting the previous record. Previously the best record was that of the Brakpan Mines, made as far back as July, 1907.

It may be pointed out that the Government Areas shafts are longer than that being sunk at the Crown Mines, measuring 45x10 ft. before timbering. This portion of the shaft was sunk through 155 ft. of quartzite and 78 ft. of shale. About one-third of the distance was sunk in the formation known as the Kimberley shale, in which almost all of the previous records had been made. The Crown Mines record was accomplished while sinking entirely in quartzite.

The 1912 records, now surpassed, were made at a depth of about 2,000 to 2,500 ft., whereas the total depth of the Crown Mines new shaft is not far from 1,000 ft. It is being sunk to strike the main reef at a depth of about 4,500 ft. If it goes to this full distance, and the dip of dikes has yet to be revealed, it will be the deepest shaft in the Rand, surpassing the Jupiter and Village Deep shafts, which are 3,900 ft., and City Deep (eastern), which is 3,800 ft. deep.

During the first six months of sinking not a single accident occurred, Ivor Rees, the mine overseer, being a keen observer of safety-first rules.

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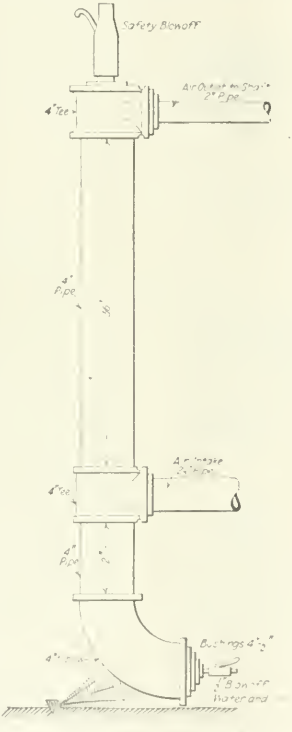
*Mining engineer, 71 Permanent Building, Johannesburg, South Africa.

Details of Practical Mining

Oil and Water Separator for Compressed-Air Line

By J. F. Kellock Brown*

In any remote prospecting operation an oil and water separator such as that illustrated will be found to be a useful and handy piece of apparatus. The use and care of compressors on such work is not scientific, the men available for the work are ignorant, and so it frequently happens that oil troubles develop in the machine underground. When you add to that the freezing due to moisture in the air, the value of any kind of apparatus that will help to mitigate these drawbacks is apparent. A separator should of course go along with every compressor, but we all know what prospecting outfits are—there is always something that should be there but never is sent, and a separator on the air line is one of the things frequently conspicuous by its absence. Usually there is nothing available from which to make one. This at least was the case on the work where the separator described was used. Its construction will readily be understood from the illustration, pipe and fittings being all that is required. The air intake from the compressor was a 2-in. line and the outlet 2½ in. The separator itself consisted of 4-in. pipe with the necessary tees and elbows to suit. Above the air exit the 4-in. tee was bushed down to hold a 2-in. safety valve, while the foot of the separator, which ended in an elbow, was also bushed down to hold a ½-in. turn-cock taken from an air drill. By watching and keeping the lower space clear of the collected moisture and oil that came over from the compressor, a great improvement in the quality of the air was obtained.



DETAILS OF WATER SEPARATOR

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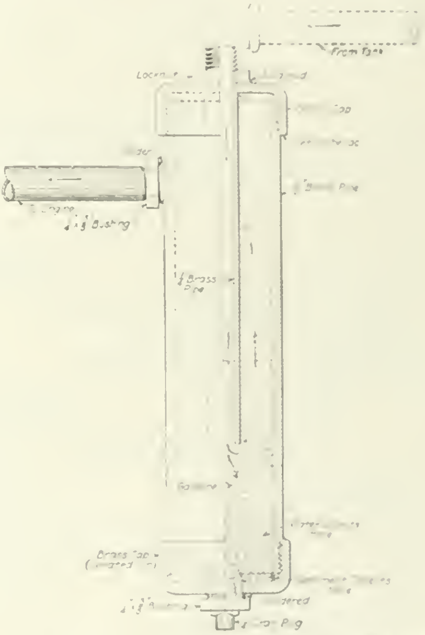
*Mining engineer, 247 Esplanade, Sydney, N. S.

Separator for Gasoline Line

A water separator shown in the accompanying sketch and described by H. H. Parker in *Power* for Dec. 19, 1916, has been used for about seven years in the fuel line of a marine-type heavy-duty oil engine to remove the water, etc., that sometimes gets into the tanks as well as sediment contained in the fuel oil, which is not strained. No water, dirt or sediment from tank scale ever gets to the carbureter, even when the mixture is "riled up" in a seaway. The separator should prove satisfactory on any gasoline or kerosene engine.



SEDIMENT-SETTLING CHAMBER IN OIL-SUPPLY LINE

The construction is fairly simple. In this type the body is made of 1½-in. brass pipe with two brass caps, the lower one being sweated on while the upper one is [illegible] so that it may be removed. The upper cap is drilled and tapped for ¼-in. brass pipe, having a running thread on the upper end. It is threaded up through the cap and has a locknut on the outside, so [illegible] the bearing surface of the threads, and the [illegible] together. This forms a connection for the feed pipe from the tank. This ¼-in. pipe should extend to within about 2 in. of the bottom of the large pipe. The lower cap is drilled and tapped for a ⅜-in. bushing which is sweated in and a ¼-in. drain plug is screwed into it. On the side of the large pipe near the top another bushing is screwed in and soldered, thus making a connection for the fuel pipe to the carburetor.

In operation the water and sediment settle to the bottom, while the clean fuel rises to the outlet pipe. The separator, of course, may be made any size: the larger it is the more dirt and water can be allowed to collect before draining.

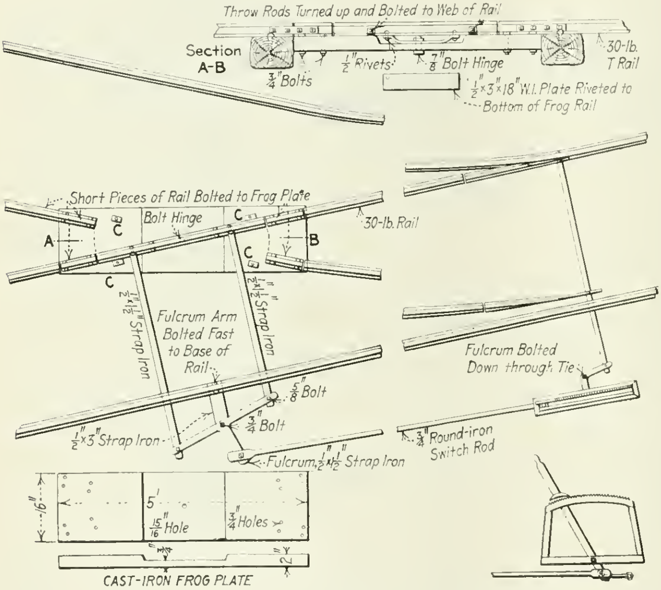
⁂

A Frogless Switch

A frogless switch was described by Le Baron Smith in *Coal Age*, Nov. 18, 1916, and a brief description is presented herewith.

The switch is adapted particularly for use on main electric haulage roads, at partings which must be frequently traversed by mine locomotives.

It is a well-known fact that much trouble is experienced at these points in the maintenance and upkeep of switches, using ordinary frogs, owing to the locomotive wheels becoming grooved at certain times to a depth, which while not justifying a change of wheels, often causes a broken frog or a derailment, entailing delay and expense.


Throw Rods Turned up and Bolted to Web of Rail
Section A-B
$\frac{3}{4}$" Bolts
$\frac{1}{2}$" Rivets
$\frac{7}{8}$" Bolt Hinge
30-lb. T Rail
$\frac{1}{2}$"×3"×18" W.I. Plate Riveted to Bottom of Frog Rail
Short Pieces of Rail Bolted to Frog Plate
Bolt Hinge
C
C
C
C
A
B
30-lb. Rail
$\frac{1}{2}$"×1$\frac{1}{2}$" Strap Iron
$\frac{1}{2}$"×1$\frac{1}{2}$" Strap Iron
Fulcrum Arm Bolted Fast to Base of Rail
$\frac{5}{8}$" Bolt
$\frac{3}{4}$" Bolt
$\frac{1}{2}$"×3" Strap Iron
Fulcrum, $\frac{1}{2}$"×1$\frac{1}{2}$" Strap Iron
Fulcrum Bolted Down through Tie
$\frac{3}{4}$" Round-iron Switch Rod
16"
5'
$\frac{15}{16}$" Hole
$\frac{3}{4}$" Holes
$\frac{3}{4}$"
2"
CAST-IRON FROG PLATE

PARTING SWITCH WELL ADAPTED FOR USE OF ELECTRIC HAULAGE ROADS

In the accompanying drawing it will be seen that the frog is replaced by a pivotal rail, arranged at the juncture of the convergent rails of the main and branch tracks. This pivoted rail is connected by two bridle bars and a throw rod to the same switch lever which operates the latches. When the switch lever is thrown to one side, setting the latches for the branch track, the pivotal rail forms a part of the branch track, and when the switch is reversed for the main track, it becomes a part of the main track. The drawing shows it in the latter position.

The pivotal, or swinging, rail section is fastened to an iron baseplate, having a depression in the center which allows room for the pivot hinge. Four short pieces of rail are bolted to the plate, one at each corner, their angle of convergence forming what would ordinarily be termed the angle of the frog. Each of these rail sections is drilled for fishplates, to connect with the abutting rails. The baseplate is also well spiked to the ties, making the whole solid and rigid. Small plates *C* are bolted to the base, to limit the throw of the swinging rail and insure its proper alignment with the connecting rails.

This switch is located at the main parting near the bottom of the shaft, at the juncture of the loaded and empty tracks. It is always set for the loaded trips coming out, the brakemen on the empty trips opening and closing it as they go in. It has been in continuous operation for two years, with a daily average of 60 to 70 motor trips (about 1,300 cars) passing over it, has not cost one cent for repairs and has given perfect satisfaction. The motormen are much in favor of it, there being no jar or jumping of the locomotive in passing over it when the wheels are worn, as is the case in running over the ordinary frog.

The switch, which is patented by W. R. Ross, trackman at the Morrisdale No. 1 shaft, has many points of merit, but unfortunately has never been brought before the mining fraternity, or received any publicity whatever.

⁂

To Mark a Brown Print White

As to what solution would mark a vandyke white, Edward Godfrey says the following in *Engineering News*, Dec. 14, 1916: I wanted to know this myself a short time ago, so I went into the laboratory and tried soda, ammonia carbonates, acids and peroxide, but could find no single solution that would bleach out the brown. In drawing lines with the pen, however, I discovered that at the intersection of some of them the print turned white. A mixture of the solutions which made these lines was made and a clear white surface was left under brush or pen. The two substances are hydrochloric acid and peroxide of hydrogen. No treatment seemed to be needed after applying the solution.

⁂

An Isolated Gas Plant

A plant for the generation of illuminating gas is being manufactured by the Tirrill Gas Machine Lighting Co., 103 Park Ave., New York. The plant consists of a generator, exhaust blower, air pump and the necessary piping. Its use in small isolated plants should prove advantageous where an electric lighting system is not feasible. A surface plant, illuminated by gas, is safer and more efficient than one depending on the uncertainty of oil lamps.

⁂

Owing to the possibility of nitroglycerin leakage from dynamite, due to its improper storage, there is danger in making any use of empty dynamite boxes. They should be burned without being knocked to pieces or split, as the wood having absorbed nitroglycerin is likely to be explosive They should not be burned in a stove, as serious accidents have been known to happen from this cause

Details of Milling and Smelting

Effect of Arsenic on Brass

The question of the extent to which arsenic is detrimental to brass was taken up by C. H. Mathewson and E. M. Thalheimer in a paper before the autumn meeting of the British Institute of Metals in London in September. According to *Iron Age*, Nov. 30, 1916, the authors gave the results of experiments on the annealing of three arsenical brasses containing 62.5% of copper low and high in arsenic (0.024%, and 0.120% respectively) and 61% of copper, high in arsenic (0.139%).

In the mechanical tests made after annealing and quenching at various temperatures between 450 and 750° C., the arsenical brass was found superior throughout in elongation and strength. Thus, when quenched at 550° C. the arsenical brass gave a tensile strength of 49,400 lb. per sq.in., with an elongation of 77.5% in 2 in., while the corresponding figures for the other alloy were 48,300 lb. per sq.in. and 71.25% respectively. On the other hand, the contraction of area of the arsenical brass, after annealing at a high temperature followed by quenching, was a little the lower of the two; and in all cases the arsenical brass was the better under conditions of less sudden cooling. The alloy with the smaller percentage of copper was less sensitive than the higher alloy to variations in the rate of cooling.

The authors consider that, given proper annealing, arsenical brass is stronger and more ductile than that from electrolytic copper and that it will stand severe hot and cold working. For brass containing 60% of copper and intended for cold working, they recommend that annealing at temperatures above a moderate red heat should be followed by cooling at the rate of about 20° C. per min., down to a temperature approximating 450° C. Still slower cooling (50° C. per min.) is advised when the proportion of copper is higher, quenching in running water being permissible when the temperature has fallen to about 550° C.; but if the cooling is effected more quickly than the first-named rate, it should proceed until 450° C. or an even lower temperature is attained. The results of the tests are set out in a number of tables and curves.

In discussing the paper Dr. Hudson rather doubted that the results would establish complete confidence in arsenical brass, for though it was shown to give material with good tensile properties, other tests, such as the drop test, were required. The banded structure was not infrequent in copper-zinc alloys and probably depended on the size of section rolled. The prevention of zinc diffusion by the arsenic was an effect which seemed to be produced by impurities generally, nickel having a similar effect in copper-zinc-nickel alloys.

Mr. Murray regretted that the authors had not used standard alloys free from arsenic. Manufacturers at present are compelled to use brass of doubtful origin, frequently containing arsenic from mixed grades of scrap copper. He himself had found that sheets with 0.03% arsenic gave better tensile results in practice than pure metal; but the results of an increase in arsenic content, due to scrap returns, had taught him to have nothing to do with arsenic. As a rapid method of detecting the presence of arsenic in brass, he had found the Muntzmetal fracture test very satisfactory, cold worked specimens in particular exhibiting a characteristic yellow fracture all over.

Professor Turner emphasized the desirability of employing shock or alternating tests and wished that the authors had tried a wider range of specimens, with an arsenic content from zero upward.

Dr. W. Rosenhain pointed out an analogy between the effects of arsenic in brass and those of phosphorus on the diffusion or solution of carbon in steel, and also drew attention to the fact that when lead and arsenic were present together they gave results differing from those produced by either singly. He thought the authors' temperature determinations were not accurate and that they had built too largely on insufficient foundations. Professor Huntington said that work on the lines adopted by the authors was very badly needed and that numerous experiments ought to be carried out with material containing small quantities of impurities.

*

Increasing Ball Mill Capacity

In a Western milling plant where a Hardinge ball mill was used to reduce the size of ore after coarse rolls, it became necessary to install a second mill to increase the grinding capacity. The feed to the first mill entered the scoop-box at right angles to the direction of rotation of the mill, as shown in Fig. 1. When the second unit was installed, owing to the restricted floor space available, the feed launder conducted the feed to the scoop-box as shown in Fig. 2. It immediately became apparent that the grinding capacity of the plant was considerably more than doubled, and [illegible] [illegible] [illegible] [illegible] mill alone had sufficient [illegible] to supply the rest of the plant. As the two conditions were identical in all other respects and each received the same kind of feed, it was evident that the difference in grinding capacity was due to the difference in direction of feed-flow to the scoops.

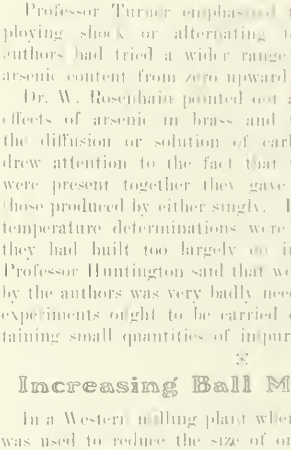


FIG 1

FIG 2

FIGS. 1 AND 2. SHOWING INCREASED CAPACITY WITH CHANGE OF LAUNDER.

The feed to the second mill flowed into the box at a considerable velocity and straight into the scoop mouth as it moved on that portion of its revolution through the feed, consequently more ore was actually forced into this mill than into the first, and a greater grinding capacity was the result.

Of course there would necessarily be a limit to the increase in grinding capacity of the mill with increase of feed, but the indisputable fact that such an increase took place in this instance suggests that possibly, on account of insufficient crowding, some other mills are not operating at capacity and that perhaps some experiments along this line would be profitable.

Some Notes on Lead Smelting at Tooele, Utah

The sintering equipment at the International Smelting Co.'s works at Tooele, Utah, comprises 10 Dwight & Lloyd sintering machines, each 42x264 in. As installed, these machines had a pallet travel of 13 in. per min., the tonnage per machine-day varying from 90 to 120 tons, average sulphur content of the charge was 14.6%; average sulphur content of sinter, 5.2%. The physical condition of the product was good.

Several attempts to increase the tonnage by increasing the speed of pallet travel to a maximum of 18 in. per min. were accompanied by poor sinter and high sulphurs. In spite of this experience an attempt was made with what was considered a maximum pallet travel, or 27 in. per min., with results that were highly satisfactory both as to quality and quantity of sinter. This speed is now maintained, the average tonnage per machine-day is 223, and at times runs up to 245 tons. The sulphur content of the feed is 11.8%, and of the product 3.18%. The average sulphur in the feed for the first six months of 1916 was 11.47%, and of the sinter produced, 2.88%. Referring to the tonnage per machine-day, this is gross tonnage; 18.84% of this tonnage is screened out of the sinter as fines and returned to the receiving bins of the sinter plant. These screenings are obtained by the sinter dropping from the end of the machine on a ½-in. grizzly and is for the most part dust, analyzing approximately 7% sulphur.

Greater Furnace Efficiency Obtained with Double-Tier Jackets

In the lead department of this works, there are five blast furnaces, each 51x180 in. at the tuyeres. Each furnace has 25 tuyeres, 4 in. in diameter. The depth from charge floor to tuyeres is 24 ft. 8 in.; from charge floor to bottom of crucible, 30 ft. Experiments with various widths of furnaces varying from 45 to 60 in. have been tried, with the final result that a width of 54 in. has been adopted as standard. Four of the five furnaces have two tiers of jackets; the fifth will be changed to this construction when the opportunity offers. The upper tier of jackets is placed vertically, as it was found that if the bosh of the lower jacket was continued, the crusts were not so readily removed.

The first installation of upper jackets at this plant was in 1913. The following data referring to the installation of the upper tier of jackets may be of interest: Volume of water passing through jackets in gallons per minute per furnace-day, 159; increase of temperature of water passing through upper tier of jackets, 11.3° F.; average cost of each barring down of a furnace and repairs to brickwork—double tier of jackets $284.67, single tier of jackets $607; average time occupied in each barring down and repairing brickwork—double tier of jackets 2.57 days, single tier of jackets 4.59 days; reduction in tonnage efficiency due to time lost per year—double tier of jackets 1,659.3 tons, single tier of jackets 2,268 tons.

Tuyere in Back End Jacket Decreased Crusts

Another feature of blast-furnace construction is the addition of a tuyere in the center of the back-end jacket. By bushing the two tuyeres on each side jacket, immediately adjacent to the end jacket to one-half their original diameter, the effect of the end tuyeres is noticeable in decreased formation of crust.

The International smeltery was probably the first lead plant to discard the bedding of ores, so long considered necessary in lead-smelting practice. This was accomplished by the application of weighing hoppers under each bin and some minor modification of standard equipment. The new system was adopted on the suggestion of Henry N. Thomson, then superintendent of the Tooele plant, but now metallurgist for the United Verde Copper Co. at Clarkdale, Ariz. Mr. Thomson had seen the weighing hoppers in use at the copper smeltery of the Old Dominion company at Globe, Ariz., and decided to try them for making up the lead-furnace charges at the International smeltery. The mechanical details were worked out by L. T. Sicka, mechanical superintendent at the Tooele works. The installation of this system of making up the charges dispensed with a horde of chargewheelers, whose places have always been exceedingly difficult to fill during periods of scarce labor.

The tonnage per furnace-day averages approximately 300 tons of gross charge. No slag shells are returned, which practice was established in 1915. There is, however, included in this gross tonnage the secondaries resulting from the repairs to forehearths. Automatic sampling of a large volume of slag and slag shells over a considerable period gave the results shown in the accompanying table. After figuring handling and smelting cost together with the recoverable metal in the slag shells, it was apparent that there was no economy in resmelting. With the removal of slag shells from the charge, the coke percentage dropped from 12.92% to 10.76%. The furnaces are operated with double forehearths, the resultant slag assaying as follows: Pb 1.17%, Cu 0.23%, Ag 0.37 oz., Au. 0.001 oz., SiO_2 30.93%, FeO + MnO 38.87, CaO 15.22, ZnO 7.93%.

ANALYSES OF SLAG AND SLAG SHELLS AT TOOELE LEAD SMELTERY

	Pb, %	Cu, %	Ag, Oz.	Au, Oz.
Original slag....	1.1	0.28	0.31	Trace
Slag shells....	1.4	0.62	0.70	Trace
Original slag....	0.7	0.20	0.38	0.005
Slag shells....	1.2	0.39	0.85	0.005

The converting of the leady copper, described by O. M. Kuchs,[1] is still in satisfactory operation, treating a lead matte of the following composition: Pb 15.7%, Cu 10.2%, Ag 19.3 oz., Au 0.05 oz., and giving a fume assaying: Pb 58.8%, Cu 0.67%, Ag 4.78 oz., Au 0.012 oz. The recovery of lead in the form of fume is approximately 97%.

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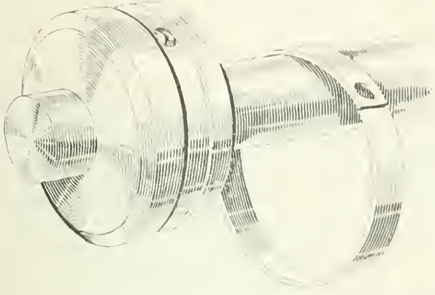
[1] "Trans. A. I. M. E.," Vol. 49.

Kinks for the Mine Shop

Safety Collar

By J. E. Cooley*

An easily made safety collar that can be used on the end of shafting, etc., is shown in the accompanying illustration. It consists of a round cast-iron collar having a groove in the center, in which is placed a loose-fitting flat steel spring. A hole is made in the spring through which to insert a screwdriver. The hole is turned away from the screw after the screw is tightened. The spring serves as a guard for the screw, and at the same time it will instantly stop if anything comes in contact with it.



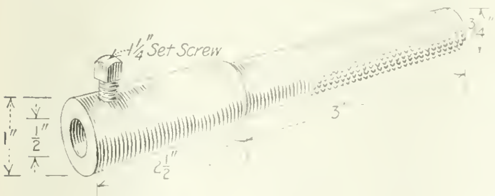
THE SAFETY COLLAR

⁂

Holder for Grinding Tool Bits

By Herbert M. Darling†

With ordinary care the average tool holder should last almost indefinitely; but in most shops one finds tool holders that show abuse at the hands of the men using them. The worst abuse probably is caused by the common practice of grinding the high-speed tool bits when they are in place in the holder. While grinding in this way the operator will usually strike the holder itself against the emery wheel, and after this has been done enough times the head of the tool holder will be badly ground, especially right under the tool seat.



THE TOOL BIT HOLDER

The operator can hardly be blamed for this. If he attempts to hold the high-speed bit in his fingers while grinding, he cannot apply the necessary pressure to grind it quickly without it becoming unpleasantly hot.

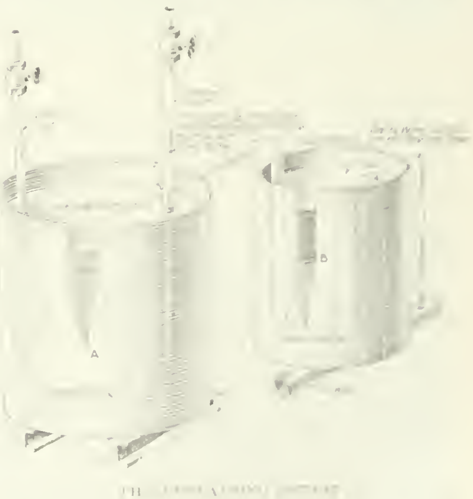
To overcome this trouble I use a holder, as shown in the illustration, which will hold tools up to ⅜ in. square. This holder can be made in a few minutes from an odd piece of machine steel by an apprentice. In use the tool to be ground is inserted in the ½-in. hole and secured by the setscrew. It can then be ground in a businesslike manner without loss of time or the danger of burning the fingers or marring a tool holder.

⁂

Method of Reclaiming Mineral Cutting Oil

By P. G. Little*

In shops which have automatic lathes and screw machines it is necessary to use a large quantity of cutting oil on the work, and in most shops of this kind the oil that is carried away on the finished parts and washed off is wasted. The sketch shows an arrangement for washing the parts and reclaiming the oil. This method has been adopted in a large machine shop with several automatic machines. About 25 gal. of oil formerly wasted is reclaimed every week at this factory, and the reclaimed oil is used on drilling and similar work.



THE [illegible]

As shown in the sketch, the tank A is filled with a solution of soda and water for cleansing purposes and is filled with a [illegible]. The parts to be washed are placed in a wire basket and dipped into the solution. The oil [illegible] passes through the overflow pipe, together with some of the solution, into the tank *B*. In the tank *B* the oil naturally rises to the top and is removed in buckets. The waste solution, which remains at the bottom of the tank, siphons through the outlet pipe into the sewer. Except for removing the reclaimed oil the process is automatic, and the quantity of oil reclaimed has made the installation well worth while.

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*Hartford, Conn.

†Greenfield, Mass.

*[illegible]

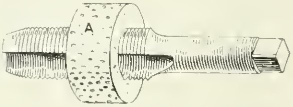
The illustration shows the arrangement at this plant, but of course many modifications can be made to suit existing conditions. Mineral cutting oil does not combine with the soda and saponify, as would animal or vegetable oil, which would negative the results.

⁂

Simple Depth Gage for Tapping

By William Roberts*

A blind hole is very hard to tap unless the machine has an attachment that will reverse automatically. If a few holes have to be tapped to various depths, the attachment is useless. If one tries to machine tap the hole by guesswork, the tap is apt to be broken. The cork *A* is adjusted to approximately the right depth; and when it touches the surface of the work, the machine is reversed. The cork being flexible, if the tap goes in a thread more than intended no harm is done, as there is nothing to break.



THE TAPPING GAGE

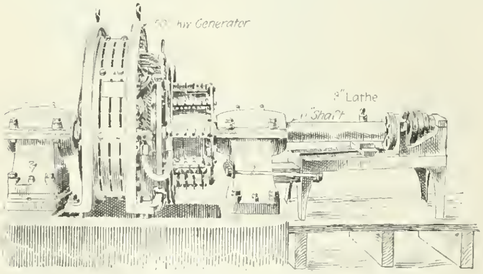
⁂

Taking the Small Lathe to the Big Job

By J. K. Arrowsmith†

The illustration shows what happened when I was called upon to turn up the end of a generator shaft. The machine was out in the country and weighed many tons, and there was no lathe in town big enough to take in the job; so instead of putting the job in the lathe I put the lathe in the job.

The lathe I used was a small one and was clamped to the generator. The center in the shaft was put on the lathe center, and the lathe was then lined up with the job. I drilled the end of the shaft and put in a capscrew through the face plate to hold the center in the center of the shaft.



HOW THE SHAFT WAS TURNED

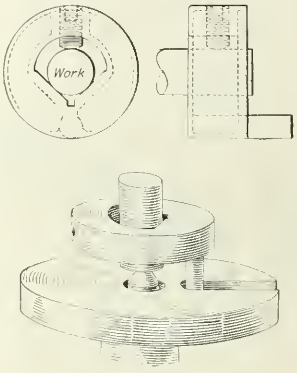
The generator had to be turned by hand as power would have been too fast, but six hours did the job and two laborers took turns rotating the generator shaft. Instead of the work costing about $100, it cost only about $10.

⁂

Simple and Easily Made Safety Lathe Dog

By Joseph V. Dolan*

The accompanying illustration shows a safety lathe dog which consists of a cast drum and socket screw for clamping the work. I think this could be made lighter and cheaper than most safety dogs now on the market.



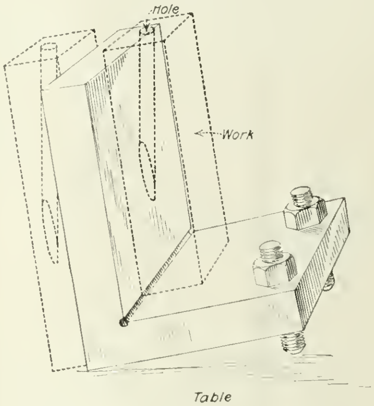
SAFETY LATHE DOG

⁂

Simple Adjustable Angle Plate

By William Roberts†

The accompanying illustration shows a tool that we find quite handy on the drilling machine for drilling holes at various angles. It will be noticed that the adjustment is secured very simply by means of the two studs and clamping nuts.



SIMPLE ADJUSTABLE ANGLE PLATE

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*Springfield, Mass.

†North Yakima, Wash.

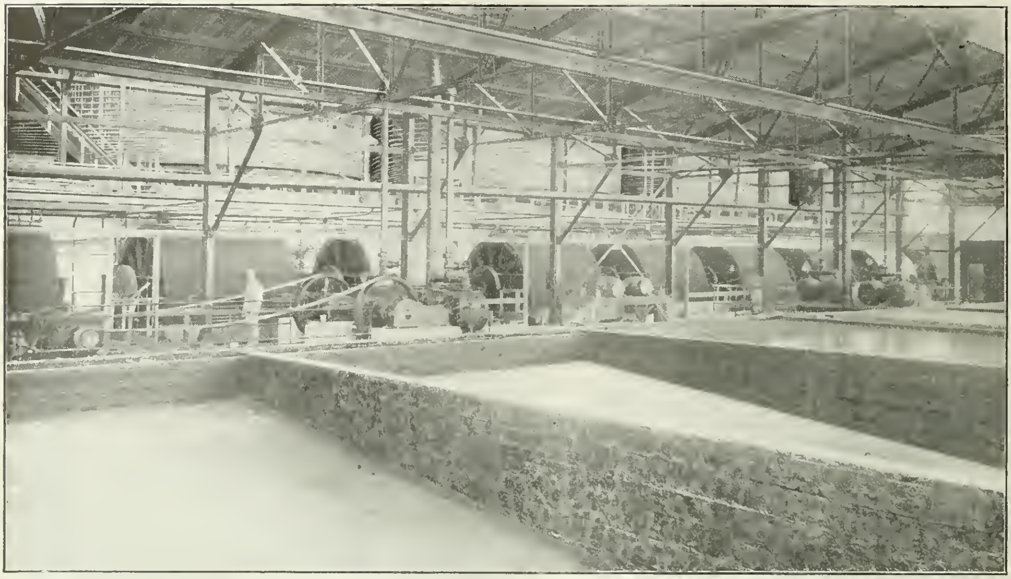
*Ardmore, Penn

†Springfield, Mass.

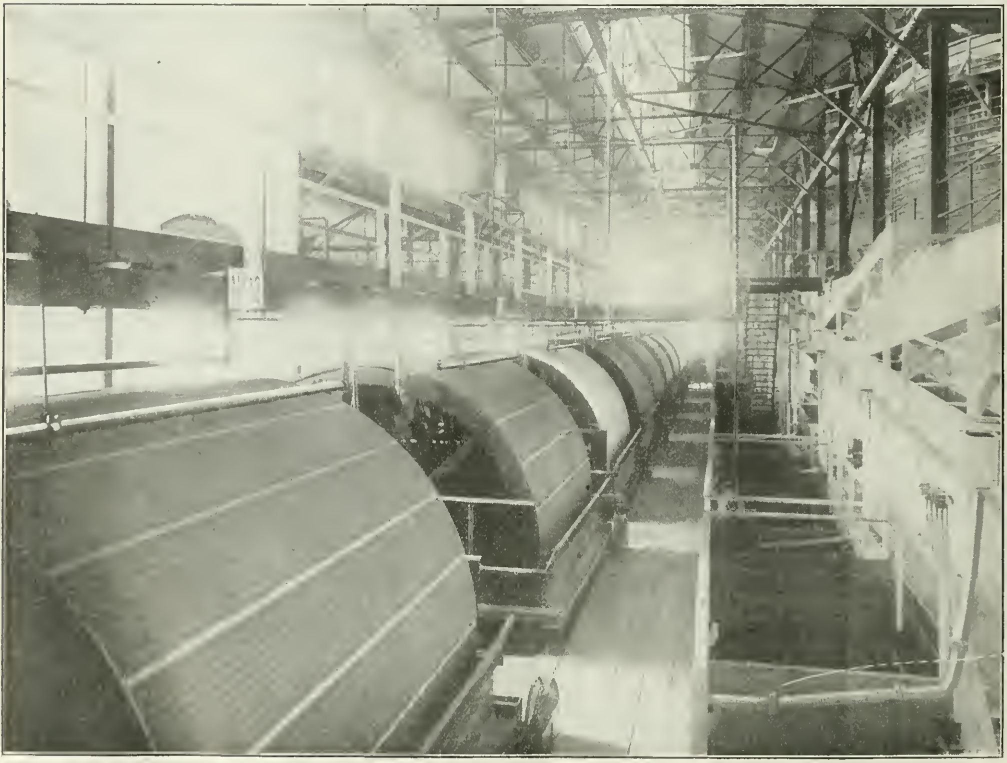
Anaconda's Electrolytic Zinc Plant

VIEW OF ELECTROLYTIC ZINC PLANT FROM THE WEST

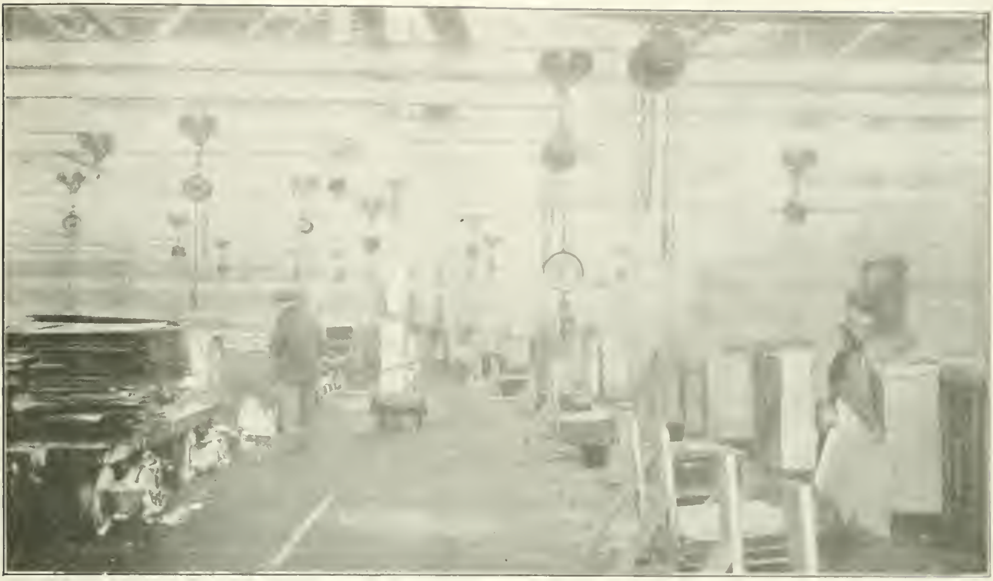
ANACONDA'S NEW ELECTROLYTIC ZINC PLANT AT GREAT FALLS, MONT.—NORTHWEST SIDE



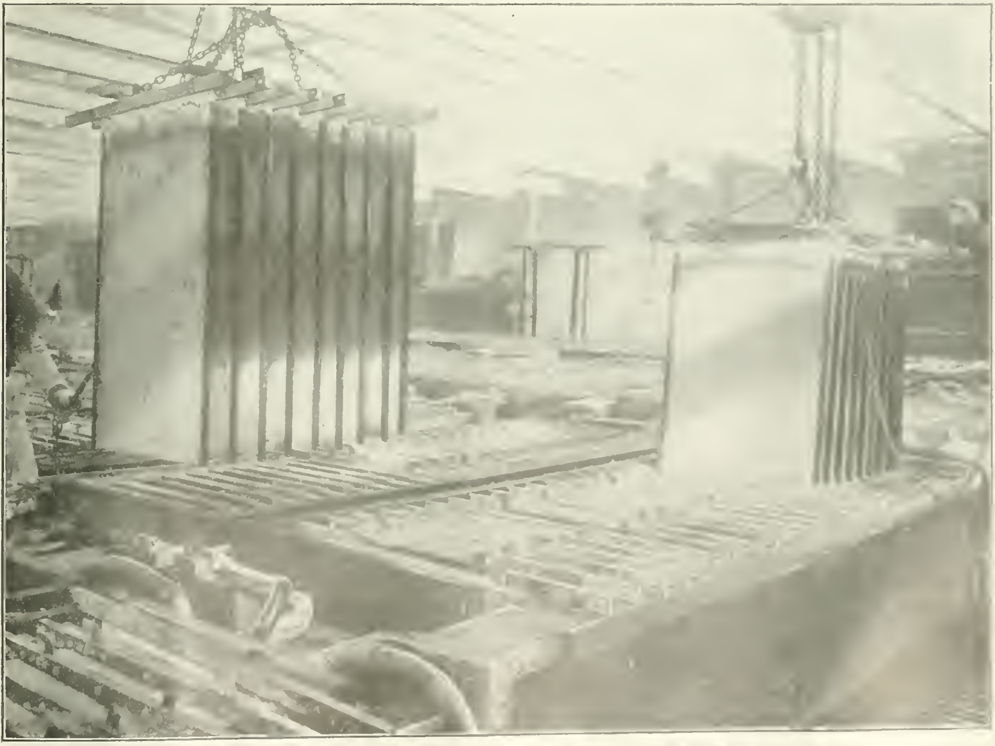
ANOTHER VIEW IN THE SETTLING AND FILTERING DEPARTMENT



A ROW OF FILTERS AT THE ELECTROLYTIC ZINC PLANT AT GREAT FALLS



STRIPPING ZINC SHEETS AT ANACONDA'S NEW PLANT AT GREAT FALLS, MONT.



DRAWING ZINC CATHODES FROM THE ELECTROLYTIC CELLS

Correspondence and Discussion

Early Flotation Practice by the Jemez Indians

In view of the numerous chronologies of flotation which are being published, the following item is of interest.

While making an examination recently of property on the Jemez River, New Mexico, I observed at the pueblo of the Jemez Indians that the ceremonial boards worn by squaws in various dances were painted with a remarkably beautiful shade of green. Inquiry among the Indians disclosed the fact that this green paint is obtained by crushing sandstone containing malachite and subsequent boiling of the sandstone in pine pitch. The pine pitch is gathered in considerable quantity for this purpose. The froth resulting from the boiling is skimmed off and carries all the particles of copper carbonate originally contained in the sandstone. The froth, while still warm, is used as paint.

I was informed that green paint had always been obtained in this manner. The word "always" is somewhat indefinite, but the process has been used for generations among the Indians of this pueblo.

Albuquerque, N. M., Dec. 13, 1916. S. O. Andros.

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Valuation of Mine Plant and Depreciation Assessment

In determining the actual value of a going mine or of a defunct mining property, a mining engineer should possess the instinct of a dealer in "used" motor cars, the insistence of a Shylock, the skepticism of a Missourian, the probity of a judge and the retainer of his client. In short, he should be a mining engineer and not a mere *mining expert*. An item that may involve some careful study and that is quite certain to promote considerable discussion is that of mine plant.

In the case of defunct properties, often classified as moribund if any pretense of exploitation persists, the problem may be easy. Properties long idle should be regarded as *de facto* defunct. The equation for the valuation of mine plant may be expressed, in such cases,

$$x - y - z = V$$

in which x = scrap value at market, y = cost of dismantling, z = freight and V = value. When the sum of y and z exceeds x, the value is negative, but may be assumed as 0 unless the stuff is in the way.

In giving advice regarding the actual scrapping of the junk, due attention should be paid to the value of individual items of the plant when $z = 0$ and y approaches 0; that is to say, whether the individual item can be used in rehabilitating the mine.

In the case of going mines the actual present value of a mine plant, in its entirety, bears no direct relation to first cost less depreciation already assessed. Its true value depends upon the ore reserves of the mine plus the scrap value at the time when the reserves, capable of economic treatment by the plant, are exhausted. If the mine has no ore reserves, it has ceased to be a mine and the plant is junk until more ore has been found, capable of being treated at a profit. If the market price of the potential product falls to the point of rendering exploitation unprofitable, the mine plant automatically enters the junk class until its former status is restored, or irreclaimably lost, by subsequent fluctuations.

T. Montmorency Dillon.

New York, Dec. 14, 1916.

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Not Always a Wildcat

The letter appearing under the caption, "Not Always a Wildcat," in the *Journal* of Dec. 2 contains something, as stated in the editor's note. Too often is the prospect "turned down" because it has no ore blocked out. But there is another side to the question, and Mr. Lord, should he make inquiry, would find that if all those properties which had been turned down and had subsequently made good were placed on the black side of the ledger, and those that had been opened and then failed were placed on the red side, his ledger would be mainly in the red.

When ore has been developed in commercial quantities, it is comparatively easy to secure money for its extraction, but there is far less available for the risks involved in prospecting. There are relatively few mines with substantial ore reserves that are in need of funds for extraction, while there are countless thousands of prospects asking for funds for their development.

The individual or organization that has funds for the latter purpose would soon be bankrupt if it undertook to open the tenth part of the projects offered for consideration. In order to live and to continue in this field of mining activity, the financial manager must be extremely careful, and he will invest the funds of his principals only where he believes the chances for making a mine are excellent—a fair run for his money is scarcely enough. He wants something even better than this, for he knows that when using the best of judgment, he will draw many more blanks than prizes. Of course, in following this method of procedure, one may miss something good, but this is the exception and not the rule.

Mr. Lord's experience has been exceptional if all the men whom he has met while examining prospects have called them wildcats. Many a prospect is turned down with no thought except that the examining engineer sees nothing in it that appeals to him. The term wildcat is generally reserved to apply only to those instances that are associated with fraud.

When certain representations have been made which the engineer finds totally erroneous, he is very likely to think wildcat if he does not say it.

Engineers, like other mortals, are not inclined to publish their mistakes or to tell of the prospects recommended that have failed to make good, but I venture to say that among those engineers who have had occasion to do much of this work, there are few who have not a long string of failures to their credit—much longer than their successes.

New York, Dec. 5, 1916. F. F. Sharpless.

Minerals Separation Decision

WASHINGTON CORRESPONDENCE

That there will be less cause for complaint of the business policy of Minerals Separation, Ltd., and its American subsidiary in the future is an opinion held here by metallurgists who travel widely among the country's mining districts. Prior to the litigation, which ended last week when the Supreme Court of the United States handed down a decision favorable to the Minerals Separation companies, there was some discussion of the conduct of the patentees of the most successful process of flotation that has been devised. Not only had the English syndicates placed royalties at a figure considered high, according to a generally held opinion here, but they seemed to impose conditions that tended toward a hostile feeling among American operators. When the validity of their patent came into question, a more generous spirit at once marked the business policy of the English companies. American operators have been treated well, and objectionable features in the original contracts have been eliminated almost entirely. It is believed here that the advantage of this policy, as compared to the one that characterized previous operations of Minerals Separation in this country, have been brought home to the management of the companies and that there will be no cause for complaint in the future.

The Supreme Court, in its decision, upheld claims Nos. 1, 2, 3, 5, 6, 7 and 12.

Claim No. 1 consists in: (a) Mixing the powdered ore with water; (b) adding a small proportion of an oily liquid having a preferential affinity for metalliferous matter (amounting to a fraction of 1% on the ore): and (d) separating the froth from the remainder by flotation.

Claim No. 2 consists in: (a) Mixing the powdered ore with slightly acidified water; (b) adding a small proportion of an oily liquid having a preferential affinity for metalliferous matter (amounting to a fraction of 1% on the ore); (c) agitating the mixture until the oil-coated mineral matter forms into froth; and (d) separating the froth from the remainder by flotation.

Claim No. 3 consists in: (a) Mixing the powdered ore with slightly acidified water; (b) adding a small proportion of an oily liquid having a preferential affinity for metalliferous matter (amounting to a fraction of 1% on the ore); (c) warming the mixture; (d) agitating the mixture until the oil-coated mineral matter forms into a froth; and (e) separating the froth from the remainder by flotation.

Claim No. 5 consists in: (a) Mixing the powdered ore with water; (b) adding a small proportion of oleic acid amounting to 0.02-0.5% on the ore; (c) agitating the mixture until the oleic acid has been brought into efficient contact with the mineral and has formed a froth therewith; and (d) separating the froth from the remainder by flotation.

Claim 6 consists in: (a) Mixing the powdered ore with water containing a fraction of 1% of sulphuric acid; (b) adding a small proportion of oleic acid amounting to 0.02-0.5% on the ore; (c) agitating the mixture until the oleic acid has been brought into efficient contact with the mineral and has formed a froth therewith; and (d) separating the froth from the remainder of the mixture by flotation.

Claim No. 7 consists in: (a) Mixing the powdered ore with water containing a fraction of 1% of sulphuric acid; (b) adding a small proportion of oleic acid amounting to 0.02-0.5% on the ore; (c) warming the mixture to 30 to 40 deg. C.; (d) agitating the mixture until the oleic acid has been brought into efficient contact with the mineral and has formed a froth therewith; and (e) separating the froth from the remainder of the mixture by flotation.

Claim 12 consists in: (a) Coating the mineral with oil in water containing a fraction of 1% of oil on the ore; (b) agitating the mixture to cause the oil-coated mineral to form a froth; and (c) separating the froth from the remainder of the mixture.

In claims Nos. 2, 3 and 12 it will be noticed that the amount of oily liquid is specified as a fraction of 1%. In claims Nos. 5, 6 and 7 the amount of oleic acid is specified as being 0.02-0.5%.

Claims Nos. 9, 10 and 11 were found invalid by the Supreme Court.

Claim No. 9 provides for the separation of the mineral from the gangue by: (a) Coating the mineral with water containing a small quantity of oil; (b) agitating the mixture to form a froth; and (c) separating the froth.

In No. 10 the separation is provided for by: (a) Coating the mineral with oil in water containing a small quantity of oil; (b) warming the mixture; (c) agitating the mixture to form a froth; and (d) separating the froth.

In claim No. 11 separation is provided for by: (a) Coating the mineral with oil in water containing a small quantity of oil and a quantity of acid sufficient to cause chemical action on the metalliferous minerals present; (b) agitating the mixture to form a froth, and (c) separating the froth.

One of the features of the opinion which has called forth considerable comment in Washington is the skillful manner in which the court reached its conclusion without delving into the intricacies of the process. Transcript of the records presents so many technical metallurgical questions involved that the attorneys were appalled at the complicated nature of the case which they were called upon to discuss intelligently. The briefs are so technical as to call forth comment from counsel and jurists alike.

This interesting deduction from the record in the case is made by the Supreme Court in its opinion:

> The record shows not only that the process in suit was promptly considered by the patentees as an original and important discovery, but that it was immediately generally accepted as so great an advance over any process known before that without putting on other business expedients, it promptly came into extensive use for the concentration of ores in most, if not all, of the principal mining countries of the world, notably in the United States, Australia, Spain, Chile and Cuba, and that because of its economy and simplicity it has largely replaced all earlier processes. This itself is persuasive evidence of that inventive [illegible] purpose of the patent laws to reward and protect.

One of the arguments of the defendant [illegible] by the court as follows:

> The claim that the inventors of the patent in suit [illegible] the essential discoveries of the process [illegible] [illegible] results [illegible] The record [illegible] [illegible] experiments [illegible] [illegible] the results.

Much stress was laid by the defense on the question discussed by the Court in the excerpt about to follow. This expression of the Court is also expected to have an important bearing on the Rittman and other patents where efforts are being made to interpret the patent laws so as to eliminate variation of treatment. With regard to this phase of the case the Court says:

> Equally untenable is the claim that the patent is invalid for the reason that the evidence shows that when different ores are treated preliminary tests must be made to determine the amount of oil and the extent of agitation necessary in order to obtain the best results. Such variation of treatment must be within the scope of the claims, and the certainty which the law requires in patents is not greater than is reasonable, having regard to their subject matter. The composition of ores varies infinitely, each one presenting its special problem, and it is obviously impossible to specify in a patent the precise treatment which would be most successful and economical in each case The process is one for dealing with a large class of substances, and the range of treatment within the terms of the claims, while leaving something to the skill of persons applying the invention, is clearly sufficiently definite to guide those skilled in the art to its successful application, as the evidence abundantly shows. This satisfies the law.

Copper Replaces Aluminum for Electric Transmission Line

One of the aluminum transmission lines from the Madison River power plant of the Montana Power Co. to Butte, a distance of about 60 mi., is now being scrapped, and the electric current formerly carried by the aluminum will be transmitted through a copper line. The aluminum line had been in operation for 15 years, and the line as a whole had reached a condition where maintenance charges were high, owing to the aluminum wire becoming worn in the ties and giving considerable trouble from breakage.

General Manager F. M. Kerr, of the Montana Power Co., states that the following reasons caused his company to adopt copper instead of aluminum for long-distance transmission lines: (1) Aluminum is softer and weaker and particularly susceptible to abrasions at points of support. (2) Aluminum has a low melting point and is easily burned in two and destroyed by arcs. (3) Where the wires are supported on suspension insulators, side swinging to the wind must be considered. Aluminum is at a great disadvantage in this respect, and on account of its light weight and large area, will swing up into close proximity to the crossarms, cutting down the necessary clearance to a dangerous extent. (4) Fire hazard and danger to human life are greater with aluminum on account of its liability to burn in two, drop to the ground and set fire to whatever it touches. The ends of the wire will burn free from the ground and hang down as a menace to human life.

Previous to the summer of 1915 there were in operation three 50,000-volt transmission lines from the Madison plant to Butte, consisting of two 77,000-circ. mil aluminum lines on wooden poles and one No. 0 copper line on steel towers. During the last summer a portion of the tower line was reinsulated for 100,000-volt service in order to serve power to the St. Paul Railway.

In view of the fact that it was apparent that the aluminum lines would have to be abandoned within the next few years, it was decided to complete the reinsulation of the tower line to the Madison River plant for 100,000 volts and dispense with the other lines for the present.

The statements made in the daily press that the aluminum line had been adjudged a failure is not entirely correct, according to Manager Kerr, who writes: "We realize and admit that a successful line can be constructed of aluminum, but as before stated, our experience and observations have placed us on record as favoring copper. While the scrap value of aluminum at this time is high, this fact had little to do with our decision. We were well satisfied that the aluminum lines would have to be abandoned within a year or two in any event, and the only effect the high price had was to hasten this work a little."

Enforcement of Mining Contracts

By A. L. H. Street*

In the law there is a doctrine known as "Specific Performance," under which the courts frequently compel one to carry out a contract under which he has agreed to convey real estate or transfer corporate shares. Some of the limitations on this legal remedy are indicated in a recently handed down and interesting decision of the United States Circuit Court of Appeals, Ninth Circuit, in the case of Ellis vs. Treat, 236 Federal Reporter, 120.

In dismissing this suit, which was brought to compel performance of a contract to convey mining claims to a corporation to be performed and to deliver to plaintiff a percentage of the stock, the court holds that the contract was too indefinite to be enforced, since it did not fix the amount of the capital stock of the proposed corporation, the number or value of the shares, the number of directors, the place of its business or its powers or duration Relief was denied on the further grounds that plaintiff did not show his ability to resell part of the shares, for use of the proceeds in development work, as contemplated by the agreement; and that plaintiff had failed to show that he did not have an adequate remedy against defendant by suit for damages for breach of the contract; it being a fixed rule of law that specific performance in such cases does not lie when there is an adequate remedy by an action for damages.

Mexican Mining Taxes

Important progress has been made recently with regard to the proposed mining taxation in Mexico, and a new schedule of taxes has been agreed upon by Luis Cabrera, Secretary of the Treasury for Mexico, and the committee representing 45 principal American and foreign mining companies. This new schedule is the result of the protest of the mining companies against the taxes announced in the decree of May 1, 1916. These taxes many foreign operators refused to pay on the ground that they were illegal and confiscatory; they provided a 10% ad valorem tax on gold and silver and a 5% ad valorem tax on the metal content of copper, lead and zinc. ores.

The mining companies first took up the tax problem with the American Conference Commission but Mr. Cabrera, declining to discuss the matter in the conference, took the question up directly and eventually agreed to forward and recommend a new schedule to the *de facto* government. It was expected that the new schedule would go into effect on Jan. 1, 1917, but a dispatch from Queretaro to Washington announces that a decree of Dec. 10 suspended the old metal export taxes until Dec. 31, 1917, during which period taxes will be assessed under a new schedule. The principal features of the new tax schedule, as proposed, were as follows:

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*Attorney at law, 829 Security Building, Minneapolis, Minn.

Gold and Silver—If in the form of ore, 7% ad valorem, and 5% ad valorem if in the form of bullion or if contained in bullion.

Copper in Matte or Bullion—When the New York price is 20c. per lb. or lower, the tax will be 1% ad valorem on the full content. When the price is 20.01c. or higher, the tax will be 5% ad valorem.

Copper in Ore—The tax on copper in ore will be 20% greater than the tax on copper in matte or bullion; in other words, 6% ad valorem when the price of copper is over 20c. and 4.8% when copper is 20c. or less at New York.

Lead—On the full metal content a tax of 3% ad valorem is to be levied, the value to be determined by taking full metal content at New York price, minus 25% United States import tax, treatment charges and freight to New York.

Zinc—The tax will be 3% ad valorem, the value to be determined by taking 75% of the metal content at the St. Louis quotation for Prime Western spelter minus 10% United States import tax, and freight and treatment charges in the United States.

Some changes are noted in the telegraphic report of the new schedule which does not mention the exemption of the U. S. import duties in the valuation of lead and zinc ores, and with respect to zinc ores states that the value will be calculated on 75% of the assay result based on the New York price, deducting freight and treatment costs, taking as the average freight charge the rate between Saltillo, Mexico, and Tulsa, Okla.; value of other metals may be calculated on price at port of export.

Exemptions from taxes, it is further stated in the dispatch, will apply in the following cases: Copper ore containing less than 5%; lead ore with less than 15%; zinc ore with less than 20%.

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Do Not Scrap the Printing Press*

When the people of the country, who are served by an intelligent and enterprising press, understand the full significance and effect of the Randall amendment to the post office appropriation bill, which provides that "all newspapers, magazines and other publications regularly admitted to the mails as matter of the second class" shall in future be classified very much like hardware, drygoods and general produce—that is to say, shall pay zone rates for transportation—the amendment, or rider, should have short shrift on the floor of Congress.

It is proposed that such publications pay 1c. per lb. for distances up to 300 mi., 2c. up to 600 mi., 3c. up to 1,000 mi., 4c. up to 1,400 mi., 5c. up to 1,800 mi., and 6c. per lb. for more than 1,800 mi. This indefensible and heavy tax would be a check upon the dissemination of news, useful information, literature and the discussion of public affairs in print; in effect an embargo upon enterprise, for there is many a newspaper and magazine, already crippled by the high cost of paper and of other materials, that could not stand the additional burden and would have to curtail the service it now renders to readers distributed from the Atlantic to the Pacific. Some minor but valuable publications would no doubt have to stop their presses altogether.

It is a prospect not to be endured by the American people, who have always prided themselves upon their excellent newspapers and magazines and the facilities provided by the Government for the circulation of them in the mails. The present flat rate is based upon a principle that the diffusion of printed intelligence is a duty of the Government, performed for the general welfare. Possibly the post office may not always or everywhere make money out of the transportation of newspapers and periodicals, but that is really of minor importance; for the product of the printing press in indispensable to good government. Better that the books shall show no profit than that the printing press shall be scrapped.

(Associated Press Dispatch)

Washington, Dec. 15—The $327,000,000 postal appropriation bill, as agreed on today by the House Committee, retains Postmaster-General Burleson's recommendations for curtailing pneumatic tube service and also retains a provision establishing zones for second-class mail matter, designed to raise the postage rates on periodicals. The bill will be reported immediately.

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American Cyanamid Co.

Negotiations have been concluded whereby the American Cyanamid Co. secures the extensive phosphate-rock mines of the Amalgamated Phosphate Co., in Florida, in exchange for its stock, says the *Boston News Bureau*, Dec. 14, 1916. One of the principal owners of the Amalgamated Phosphate Co. was the Virginia-Carolina Chemical Co., and it is understood the transaction has made the latter one of the largest holders of American Cyanamid stock. James B. Duke has recently acquired a considerable amount of the stock of the American Cyanamid Co. and with the Virginia-Carolina Chemical Co. and Sperlung & Co. of London represents a controlling interest. The balance is closely held.

The company's principal business is in supplying fertilizer companies, although an extensive trade is done with powder manufacturers, mining companies and other industries using nitrates, nitric acid, ammonia, etc. Along with other processes, the United States Government is considering the cyanamide process in connection with the establishment of its $20,000,000 nitrate plant. The process is in general use in European countries, but the American Cyanamid Co. controls American patents.

The Niagara Falls plant of the American Cyanamid Co. in 1910 had an annual capacity of 11,000 tons. In the last six years its capacity has been increased to [illegible] tons per annum. A factory is now being completed at Warners, N. J., for the manufacture of a new fertilizer material consisting of ammonia and phosphoric acid. The acid will be secured from the company's phosphate mine in Florida and ammonia from cyanamide produced at the plant at Niagara Falls.

The outstanding capital is $7,8[illegible]5,200 of 6% cumulative preferred and $6,511,000 common. Dividends at the rate of 6% annually are being paid on the preferred. All back dividends were paid off in December of this year. Earnings for the year ended June 30, 1916, were equivalent to $[illegible] a share on the then outstanding common after charges paid, including preferred dividends.

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*From the New York "Sun" of Dec. 14, 1916

Editorials

Protest Against the Postal Bill

The Randall rider in the postal appropriation bill proposes to charge second-class mail matter according to the distance it is carried. This would be a fair and reasonable proposition if the post-office department were a commercial enterprise, like an express company; and if second-class mail matter were merely a commodity. But neither are such. The post-office department is supposed to be run for the benefit of the people. Magazines are not like goods that are eaten or worn out. They are for the dissemination of knowledge, i.e., most of them are, and they create business for many enterprises and for the post-office department. Anything that tends to curtail the circulation of a good magazine, or increase the cost of it to the public, is contrary to the interest of the people. The Randall rider is contrary to the interest of the people.

Consider what it will do, if enacted. Take the case of the *Engineering and Mining Journal*. A subscriber gets 52 issues in the year, the aggregate weight of which is about 40 lb. The bulk of our circulation goes long distances. A very large part of it—40% of the domestic circulation—goes 1,800 miles or more. On this the postage by the Randall schedule would be upward of $2.40 per subscriber per annum against $0.40 at present. The total increase in our postage bill would be more than the publication could stand, even disregarding the enormous increase in the cost of paper that we, like all publishers, have experienced. There could be but one way out of the predicament, and that would be to raise the subscription price. This is therefore a matter that concerns every one of our subscribers. What Mr. Randall proposes is far beyond what any publication with anything more than a local circulation can absorb. The increased expense would necessarily have to be passed on.

What we have said of the *Journal* applies in more or less degree to every other magazine. Most persons who take a paper like the *Journal* take others. The increased cost of subscriptions would in the aggregate amount to a sum worth thinking about seriously. Therefore the fight against this proposed legislation is your fight, Subscriber, as much as it is ours. Write at once to your representatives in Congress urging excision of the Randall rider from the postal appropriation bill. If they reply that the post-office department needs more money, tell them that it would not need it if it would run its affairs on real business principles. But, anyway, spare no effort to help kill the Randall rider.

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The Flotation-Process Decision

Although we printed the full text of the decision of the Supreme court—unofficial version—in our issue of last week, it reached us too late for comment upon it from the technical standpoint. As we read it at leisure, it impresses us as a perfect confirmation of Judge Bradford's opinion in the Miami case and an absolute upholding of the Sulman, Picard & Ballot basic patent, covering what we know as the froth-flotation process. The United States Supreme Court is emphatic in the opinion that the use of a certain very small quantity of oil produced an entirely different result from any other process, a result that was distinctly an invention, and an invention that had not been anticipated by anybody. The rapid and extensive adoption of this process, without advertising or promotion, impressed the court as a persuasive argument in support of that view.

The Sulman, Picard & Ballot patent comprises specific claims for the use of less than 1% of oil. These claims are sustained, and anybody who uses less than 1% of oil under the conditions set forth in the patent is an infringer. If anybody wants to use more than 1% of oil—even 1.01%—he is free to do so. We have heard the suggestion that some people will prefer to increase the percentage of oil used to the payment of royalty. But will they get the same metallurgical result? Not so, according to the evidence submitted to the courts. The drawing of the line at 1% seems arbitrary. It is arbitrary, for the patent claims had to be specific. The courts refused support of the claims that spoke only of a small quantity of oil and therefore were not specific.

Inasmuch as the United States Supreme Court and the British House of Lords have agreed in upholding the basic patent, the English-speaking world must bow to their judgment. The situation has not been cleared entirely, for there are matters in the Miami case that involve other patents that do not fall within the scope of the decision of the Supreme Court. But that the basic patent owned by Minerals Separation, Ltd., upon which the froth-flotation process rests, is valid there is no longer any doubt.

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"Wildcats"

At such times as the present and under the conditions that have prevailed during a few months past, when earnings are causing standard shares, shares of intrinsic value, to appreciate rapidly on the exchange, when the public awakens to what is going on and, coming into the market with a liberal amount of money, assists the professional operator—when these conditions prevail the "wildcat" finds its opportunity.

There are "wildcats" and "wildcats," but the "wildcat" to which we refer is the illegitimate offspring of a dishonest or ignorant promoter. Many of our readers will not be interested in our words of caution in respect to this breed of pest, and we deeply regret that we are unable to reach those poor fools who, yielding to the dulcet strains of the siren promoter, fall as his victims and then eternally damn the mining game. Nevertheless, we venture to inflict upon our readers some of our thoughts and observations, with the hope that they, in turn, may take up the work for honest mining and warn some of those who are less able to select the chaff from the wheat.

As one glances over the advertisements in the daily press of today, he will notice numerous announcements of new or recent issues of mining stock. The experienced mining investor may not even see these, but they are read by hundreds of persons of small means who want to know a little more and who write to the broker or vender of the stock for the further information that he is glad to send "gratuitously." We have read with some interest and much disgust many sheets of this "gratuitous" literature during the last month, and we confess our inability to tag properly *all* the fakes and *all* the legitimate undertakings.

To one accustomed to reading mining literature, straight-forward statements of facts, as to conditions, yield or prospects, make a favorable impression, but a decidedly unfavorable impression is produced when one observes the extravagant use of adjectives, "beliefs," "expectations," "predictions," and "possibilities," with liberal reference to "the fortunes obtained from adjoining properties." While we say we cannot pick all the fakes, we believe that the literature purporting to describe them will, on its face, nine times out of ten stamp the wildcat with its proper brand, as it will also mark the legitimate type of mining venture.

There are innumerable prospects—thousands of them—well worth spending small sums upon to learn if they contain orebodies of importance. The seasoned operator rather fights shy of these prospects, the percentage of winnings is so small. Yet we want new mines, and mines are only made from prospects; we need the money of the public for this development work, and therefore far be it from our thoughts to discourage the small investor from taking any chances in the mining game. As it should be conducted, there is no more legitimate speculative business than that of mining, so rather than discourage, our aim is to stimulate and encourage the opening of good prospects; but we want the small investor, as well as the larger, to be fully informed of the risks that he takes, to to go in with his eyes open, and to get an honest return, if not a profitable one, for the risk he has taken.

What we object to is that type of literature which induces the uninitiated to come in with the understanding that he is practically sure of a rise in the market value of his stocks, and it is the half-truths that are worse than lies. Lies can be dealt with, deceptions cannot always be. We read such paragraphs as: "There is every reason to believe that these shares will double in value within the next few weeks;" "There are indications of probable ore to the extent of 50,000,000 tons;" "This adjoins the A—— property, is a continuation of the same deposit. A—— shares sold at $1 when they were brought out, now they are above $40.00." These and hundreds of other catchy phrases are not lies, but they are issued for the purpose of securing, and do secure, money under misunderstanding if not misrepresentations.

While we are suffering from lack of money to open numerous prospects, we are not suffering to the extent that makes misrepresentation necessary. An accurate statement of fact should be sufficient, and we venture to advise those who go to the public for their subscriptions that if they would stick to facts, their clients would be apt to stick to them. This is not a theoretical suggestion. Many responsible houses are following it, with the result that they hold their clientele regardless of occasional losses; it is satisfied with what it gets and it grows continuously without a campaign of flamboyant advertising. A prospect that is worthy of expenditures needs no adjectives to warrant it. Conditions clearly set forth in plain English by an engineer who understands the territory should bring the desired funds. Of course, the public has been fed with claptrap so long that it might rather miss it for a while, and a certain type of broker would find little business if his circulars dealt only with facts.

To those who may be interested in following the market or investing in mining shares in a small way, we can only say, "Be careful." You can get reliable information respecting almost any mine promotion or the condition of operating properties from reliable engineers or reliable brokerage houses, and it will cost you little or nothing in comparison with the amount you stake when you take a "flier" without informing yourself of its merits.

Before us lie two circulars. One paragraph of the first reads: "The company's engineer states that in six months the actual and probable ore has grown from $280,000 to $3,112,000, and there is no reason why the next six months should not *do as well*." The engineer's report also lies before us, and in it we read in reference to the work of the future: "There is reason to anticipate that the next six months will also *do well* in this respect, but new ground will be entered more slowly and no such rapid increase is likely. The chief changes will be from probable ore to proved ore." This is a fair sample of the poetic license that has been used to put a stock-market value of over $8,000,000 upon a property which, among its chief assets, has less than $700,000 gross of proved ore.

So far as we know, this particular property was started as a perfectly legitimate enterprise; it has added to its resources, it has employed responsible engineers and conducted considerable development work; but if its officers are cognizant of the methods used in advertising its shares, they are equally culpable with the brokers who are doing that which is not of advantage in the mining business. Is it not a shame to thus convert a legitimate prospecting enterprise into something almost approaching the illegitimate?

Another sheet lies before us wherein the reader is told of fortunes now being made out of copper mines—such fortunes as were never dreamed of—and that these fortunes came through investments in undeveloped properties such as it now advertises. The investor is told that he should select for speculation properties that adjoin big producers, especially those that are advertised, as they not only have all the same surface indications, but there are reasons to believe that the ore will be of higher grade than that produced by their operating neighbors. These shares, we are informed, that are now quoted at $1, have "possibilities of $20." We make note of this advertisement because the properties are in a well-known district where the geology has been carefully studied and regarding which the brokers have the best means in the world of securing information. Copper, like other metals, is where you find it, and there is no proof that it will ever be found in commercial quantities here, though substantial operators have examined it and declined to undertake its development; time and again well-informed geologists have pointed out the discouraging features and the slim chance the owners have of making other discoveries in this particular area.

We do not mean to knock the district—we hope something will be found in addition to the scattered deposits already developed—but we do wish to point out to the broker and to his client that the former is not giving all the obtainable data to the latter and is not giving him a fair run for his money. He is bidding for his patronage by leading him to play the mining game on the curb, when he should be taught to play it only in the field, where nature, not man, will make or break him.

The Metric System Again

Mr. Dillon introduced in the House of Representatives, Dec. 6, a bill (H. R. 151) to make the metric system of weights and measures compulsory in the United States. This bill at least has the merit of explicitness. It does not attempt to sneak in a revolutionary change by language of hidden meaning. It provides:

> Sec. 1. That the weights and measures of the metric system shall be the sole standard of weights and measures in the United States on and after July 1, 1920: Provided, that in the meantime such metric system shall be permissive.
>
> Sec. 4. That any person, corporation, company, society or association who shall use or offer and attempt to use, in any industrial or commercial transaction in the sale or purchase of any commodity, any other weights and measures than those of the metric system on and after July 1, 1924, shall be guilty of a misdemeanor, and upon conviction thereof in any court of competent jurisdiction, shall be punished by a fine of not more than $500 or by imprisonment for not more than three months, or by both such fine and imprisonment.

The most interesting thing about this bill is the recklessness with which it proposes a change that would be nothing less than calamitous to the industries of the United States.

Belgian Kiddies, Ltd.

The subscriptions to this promotion are coming in satisfactorily, so its sponsors inform us, but the sum total is still short of what is needed. This is a flotation that mining engineers have undertaken in the interest of humanity and to support their colleague—Herbert C. Hoover—who has reflected great credit upon their profession.

The par value of the stock is $12 per share, but this does not mean that subscriptions are limited to one share. Let everybody subscribe for as much as he can afford and make out checks to Herbert C. Hoover, and address them to him at room 2124, No. 120 Broadway, New York. If you have not got a subscription blank handy, do not let the lack of it stop you. Just write a letter and inclose your check with it. The subscription books will not close on Christmas, but will remain open as long as the committee finds it necessary in order to make good.

⁂

After four years of "watchful waiting," an important mining-investment company of London has decided to cut in half the capital of the corporation on account of the depreciation of its mining investments in Mexico. At an extraordinary general meeting held in London on Nov. 15, a resolution was adopted by the Exploration Co., Ltd., to the effect "that the capital of the company be reduced from £750,000, divided into 750,000 shares of £1 each, to £375,000 divided into 750,000 shares of 10s. each, and that such reduction be effected by writing off paid-up capital to the extent of 10s. per share." Though the Exploration Co. has other mining investments, its principal interests are in Mexico, where its officials directed the operation of three important properties. Like many British, American, German and other foreign investors in Mexico, they have been compelled to see their properties damaged, idle, deteriorating, plundered first by one side and then by the other. One year passes and then another, and yet today the Mexican situation is as muddled as ever.

⁂

The two admirable pages, "Kinks for the Mine Shop," a novelty in this issue, are made up of sundry handy kinks from the pages of our esteemed contemporary, the *American Machinist*. They are for the benefit of the master mechanic and mine-shop foreman, who are relied on to keep the wheels moving at the mine, no matter what happens, and generally succeed. Too little space is devoted to them in the technical press. We shall continue this department for their benefit.

BY THE WAY

One of our correspondents, who has lately been at Jerome, Ariz., writes us as follows: "There are two mines here, two prospective mines and many wildcats. There will surely be some dumping before long. Excitement is great, but it is all among promoters, stock speculators and locators who are unloading."

⁂

The arguments on the flotation patents before the United States Supreme Court were attended by some unusual and very interesting features. The respective advocates gave demonstrations of the process in the court. This was extraordinary. The Supreme Court does not hear evidence. It considers only the arguments of counsels. In this case, the respective counsels proposed to illustrate their arguments by some experiments. At first the court refused to entertain this novel idea, saying that there would be noise, which would be contrary to all precedents in the annals of the Supreme Court. Upon receiving assurances that there would be no noise, the court consented to witness the experiments in an informal session. Three hours were allowed for this, each side having half the time. The session being informal, the justices attended without wearing their gowns. They were just like "human beings," as one observer remarked. Of course, the experiments had been well planned in advance. Mr. Williams, counsel for Minerals Separation, started three experiments going. The interest of the justices had already become intense. One of them said: "You do not expect us to watch a three-ring circus, do you, Mr. Williams." "Oh, no," said Mr. Williams. "I am simply getting things ready so that results will develop in successive order, and you will have to look at only one at a time." He then exhibited the working of the Everson, Froment, Kirby and other processes. After he had concluded, Mr. Scott, for the defendant, made experimental demonstrations to illustrate his own argument. Altogether the Supreme Court gave about seven hours to the hearing of this case, the time devoted to an ordinary case being about three hours. The fact that the flotation case reached the Supreme Court on a writ of certiorari was in itself extraordinary, for patent cases are not ordinarily heard. The reason that an exception was made of the flotation case was its international character and the fact that the decision of the San Francisco court was in absolute conflict with that the British House of Lords.

New York Section Meeting of the A. I. M. E.

The regular monthly meeting and dinner of the New York Section of the American Institute of Mining Engineers was held at the Machinery Club, Dec. 11. Following the policy of the section in breaking away from strictly technical subjects and dealing with big broad problems of everyday vital interest, the subject for the evening was "Policing a Big City," and the speaker was Raymond B. Fosdick, who spent two years abroad for the Rockefeller Foundation, studying the police system of all the large foreign cities.

The subject did not draw a large attendance; this was unfortunate, because it proved to be an intensely interesting talk. The details of actual policing were not gone into, but in a broad, general way the policing of New York was compared with that of London, Berlin and Paris. Mr. Fosdick said that the policing systems of foreign cities are so far ahead of any of our own in efficiency that it is a waste of time to make comparisons. On the other hand, those same efficient systems, if transplanted to New York, would absolutely fall down on account of the difference in the problem here, largely because of the difference in the size of the foreign-born population. The foreign-born population of New York City is 41%, and adding to this the first generation makes about 66⅔% foreigners in New York City, whereas in the big cities of Europe only 1½ to 4% are foreign-born. This makes the foreign problem of policing much easier than our own. What makes for further greater efficiency abroad is the fact that a man is trained for the duty over there, and like the present head of Scotland Yard, who has been in office for 17 years, serves for uniformly long terms. In New York there have been 11 police commissioners in nine years, no one of them being in office long enough to find out what his job was all about. A policeman in Berlin before he receives his appointment has to have served nine years in the German army and reached at least the grade of *unterofficier*, which is equivalent to the grade of sergeant in our army. When he goes on duty, he is equipped with a very serviceable sword, an automatic pistol, a pair of handcuffs, a blackjack and a set of brass knuckles. His equipment and his previous training make him very brusque and his actions are quite intolerable to Americans who happen to cross his path. This was contrasted with the London Bobby, who is invariably chosen from outside of London so that he will have no acquaintances or connections in the big city. He is equipped solely with a small stick, which would break if he struck anyone with it. The speaker described the method of their handling the suffragettes in one of their attacks on a cordon of policemen, behind which Mr. Fosdick watched the following episode:

One of the belligerent women, armed with a beer bottle, struck one of the policemen a vicious blow on the head. The bobby picked up his helmet, brushed the dirt off, straightened out the dent and said very courteously, "Madam, if you do that again, I shall be obliged to place you in custody."

Thanks to the lower percentage of foreign population in the foreign countries, and much more efficient officers and the much more sensible system, crimes of violence of all classes, including murder, burglary, assault, etc., amount in foreign countries to only a [illegible] number which we have in this country [illegible].

Mr. Fosdick's talk was enthusiastically received by the members present, and many questions were asked after the speaker had closed.

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Direct Brass-Making

According to Mr. Perron in French patent 476,[illegible] Aug. 26, 1915, finely powdered [illegible] oxide, ore, etc., is heated, preferably in crucibles, with an excess of carbon and copper strips or turnings to 800-950° C. for 6 to 10 hr., whereby the zinc vapor is absorbed by the copper, without fusion of the product. The copper may thus be converted into brass containing 10 to 20% Zn in one operation. By repeating the operation three or four times, the zinc content may be raised to 40-45%, but to obtain any given exact composition, it is necessary to melt the brass so formed, and make suitable additions of copper or zinc.

This seems to be simply the ancient process of making brass by cementation. Query: Might the electric furnace be used successfully in a revival of this process?

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Platinum in Russia

The British consul at Ekaterinburg, Russia, reports that during the current year the production of platinum in the Urals has been seriously affected by the scarcity of labor in the case of hand washings by tributers, and in the case of mechanical dredging plants by the difficulty of obtaining spare parts for dredges. The production of platinum in 1916 is estimated at 100 to 120 poods (3,600 to 4,300 lb.), or one-third of the normal. To this decrease in output, as well as to speculation by local buyers, may be attributed the rise in the price of platinum.

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Union Sulphur to Refine Oil

Vice-Pres. Henning, of the Union Sulphur Co., at Sulphur, La., and associates have purchased, according to *Boston News Bureau*, Dec. 11, 1916, 2,000 acres along the ship channel, three miles south of Port Neches, for a large oil refinery. Extensive railroad and deep-water shipping terminals will be built, and the refinery will be one of the largest in the United States. It will be connected with the oil fields of Louisiana and the Gulf Coast territory of Texas by a system of pipe lines.

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Mechanical Analyzer for Carbon Dioxide

In the description of the carbon-dioxide analyzer made by the Bacharach Industrial Instrument Co., in the *Journal* of Dec. 9, p. 1022, the statement of the limit of its error is in error. Instead of being accurate within 2%, the instrument is accurate within 0.2%.

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Imports of Metals Into Russia [illegible]

	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
Z[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]

[illegible]

Personals

Dr. James Douglas, of New York, has made a gift of $15,000 to McGill University, Montreal.

James M. Hyde has removed from Silverton, Colo., to 260 Churchill Ave., Palo Alto, Calif.

W. D. Anderson has been elected president of the Buckeye Iron and Brass Works Co., Dayton, Ohio.

Robert E. Cranston left San Francisco on Dec. 10 for Colorado and New York, on professional business.

Louis D. Huntoon left New York on Dec. 16 for a professional visit to the Black Range district of New Mexico.

H. A. Keller, who is spending considerable time in Cuba, has opened a branch office at San Ignacio 25, Havana.

W. J. Elmendorf is now associated with the firm of Campbell, Wells & Elmenderf, engineers, metallurgists and chemists, at Seattle, Wash.

Meyer Davis, formerly chief engineer for the Asbestos Protected Metal Co., has been made manager of the company's San Francisco office.

Sir Sam Hughes, formerly Canadian minister of militia, visited Bourkes in Northern Ontario, where he has considerable mining interests, on the 13th inst.

Prof. Stephen Leacock, of McGill University, has proposed to the Canadian government the calling in of all silver currency and the substitution of a nickel coinage.

W. C. Stevens has been appointed mill manager of the Cutler-Hammer Manufacturing Co., of Milwaukee. He has been connected with the Cutler-Hammer Co. about ten years.

Edward P. Scallon has been promoted from the position of mining captain of the Lincoln mine, of the Inter-state Iron Co., Virginia, Minn., to the superintendency of this property.

William Sloan, member for Nanaimo, has been chosen as minister of mines for British Columbia, in the Brewster government, which came into power as a result of the provincial election held in September last.

John M. Turnbull, professor of mining in the British Columbia university has returned to Vancouver from Alice Arm of Portland Canal, which he visited to make examinations for the provincial department of mines.

Albert E. Wells, professor of machine construction, Sibley College, Cornell University, will delivered the last lecture in the courses recently inaugurated for the employees of the Shepard Electric Crane and Hoist Co., Montour Falls, N. Y. The lecture was given on Dec. 21 and was on "Measuring Instruments and Systems."

A. L. Tuttle has been appointed acting manager of the Tennessee Copper Co. at Copperhill, Tenn., and A. M. Fairlie has been made superintendent of the acid plant. Milton A. Caine has resumed the position of superintendent of mines, and Thomas W. Cavers remains as smelter superintendent, and William F. Nolan as chief engineer.

Edwin Walter Mills and **John Francis Manning**, recently superintendent and mining engineer respectively, of the Seoul Mining Co., Chosen, who have been in this country visiting for six months, have left for the Pacific Coast and will sail for the Orient Jan. 27. After visiting Chosen, they will go to Peking, where they will open offices as consulting engineers. Their address for the present is care of American Legation, Peking, China.

H. M. Wolflin has been designated by the U. S. Bureau of Mines to succeed Edwin Higgins, in charge of the California coöperative work of the bureau and the Industrial Accident Commission. Mr. Wolflin had charge of this work from January, 1914, to January, 1916, during which time he made a preliminary survey of mine safety conditions in the state and assisted in drafting the mine safety rules. The Industrial Accident Commission has appointed Mr. Wolflin chief mine inspector.

W. W. Johnson, president of the Union Construction Co., of San Francisco, who recently returned from Alaska dredging fields, besides looking after the operation of company dredges, also visited districts in which the company is constructing dredges for other operators, including Dawson, Yukon River, Tananna, Fairbanks, Iditarod, Black Creek, Otter Creek, Flat Creek, Kuskokwin River, Rock Creek and Buck Creek. Placer mining in these districts is not all done by bucket-elevator dredges; steam shovels and draglines are also employed.

A. H. Collbran, general manager of the Seoul Mining Co., has resigned the active management of its Korean properties, and will devote his time to personal and growing mining interests in the Orient and the United States. The company, however, is fortunate in retaining Mr. Collbran's services as a director, in which position the company will benefit by his extensive knowledge of the mines which were developed during the past eight years under his organization and management from mere prospects into one of the best paying properties in the Far East. The profits previous to 1916 were derived almost entirely from the company's principal mine, the Suan, which was developed and equipped under the management of Mr. Collbran. During the current year another mine, the Tul Mi Chung, has come into production, and the profits from the properties for 1916 will exceed $1,200,000. The principal product is gold with copper, bismuth and tungstic acid as byproducts.

Obituary

Rembler Paul, of Kelowna, died at Edmonton Nov. 18, at the age of 85. He was for many years interested in Bankhead coal mines and at the time of his death was the principal owner of the St. Paul gold mine near Vernon.

Frederick Holly Reed, vice-president of J. G. White Co., incorporated, contracting engineers, 43 Exchange Place, New York, died suddenly Dec. 9 from heart disease in his home in New York City, aged 51 years. He was a civil engineer and had been active in railroad development in the Philippines. He was vice-president of the Manila Electric Railroad and Light Co.

Societies

Engineers Society of Western Pennsylvania held a meeting on Dec. 19, at the society's rooms at Pittsburgh. A paper on "Engineering Coöperation and Fellowship" was read by D. Robert Yarnall, of the Nelson Valve Co.

American Institute of Mining Engineers, Utah Section, held its postponed annual meeting at the Hotel Utah, Salt Lake City, on Saturday, Dec. 16. The members assembled at dinner after which officers were elected, and papers on "Notes on Flotation in 1916," by J. M. Callow, and "Manufacture and Use of Sulphuric Acid," by Erwin Wilke, were read. The meeting was well attended and proved interesting to all the members.

Trade Catalogs

Wico Safety Electric Mine Lamp. Witherbee Igniter Co., Springfield, Mass. Catalog. Pp. 12; 5½x9 in.; illustrated.

The Lindsay Oil Furnaces and Burners. The Mine and Smelter Supply Co., Denver, Colo. Bulletin No. 34. Pp. 24; 7x10 in.; illustrated.

Dry-Air Ore Concentrator. National Engineering and Manufacturing Co., Massillon, Ohio. Bulletin No. 100. Pp. 6; 66x9 in.; illustrated.

Imperial Oxy-Acetylene Welding and Cutting Apparatus. The Imperial Brass Mfg. Co., 1200 W. Harrison St., Chicago, Ill. Catalog No. 135. Pp. 28; 7x10 in.; illustrated.

Pine Flotation Oils. Pensacola Tar and Turpentine Co., Gull Point, Fla. Pamphlet. Pp. 8; 8x10½ in. This describes how these oils are produced and contains line drawings of distillation plant.

Industrial News

Terry Steam Turbine Co. has located an agency at San Francisco, Stephenson & Nichols, Monadnock Building, taking the representation.

New Patents

United States patent specifications listed below may be obtained from "The Engineering and Mining Journal" at 25c. each. British patents are supplied at 40c. each.

Amalgamation—Amalgam Mixer. Horace E. Basehore and Edward L. Kraft, York, Penn. (U. S. No. 1,207,703; Dec. 12, 1916.)

Belting—Method of Splicing Belting Material. Ernest L. Burrell, Chicago, Ill. (U. S. No. 1,207,853; Dec. 12, 1916.)

Coke Ovens—Method of Heating Coke Ovens and the Like. Rudolf Geipert, Berlin, Germany, assignor to Dessauer Vertikal Ofen Gesellschaft, Berlin, Germany. (U. S. No. 1,208,134; Dec. 12, 1916.)

Concentrator—Ore Concentrator. Hannibal Scovell, Galena, and Leslie E. Scovell, Columbus, Kan. (U. S. No. 1,207,803; Dec. 12, 1916.)

Crucibles—Composition of Matter to Be Used for Preserving Graphite Crucibles. James B. Carmichael, Seattle, Wash., assignor of one-half to Hine J. Harper, Seattle, Wash. (U. S. No. 1,207,858; Dec. 12, 1916.)

Dipper Bucket. Ellison Edward Vanderhoef, Ruth, Nev., assignor to American Manganese Steel Co., Augusta, Me. (U. S. No. 1,208,055; Dec. 12, 1916.)

Fuel—Method of Carbonizing Fuel. Henry L. Doherty, New York, N. Y. (U. S. No. 1,207,723; Dec 12, 1916.)

Furnace—Furnace and Allied Structures, Utley Wedge, Ardmore, Penn. (U. S. Nos. 1,208,246; 1,208,247; 1,208,248; 1,208,249; 1,208,250; Dec. 12 1916.)

Furnace Equipment—Rabble-Arm Mounting for Metallurgical Furnaces. Utley Wedge, Ardmore, Penn. (U. S. No. 1,206,961; Dec. 5, 1916.)

Furnace for Galvanizing Wire. Guy L. Meaker, Joliet, Ill. (U. S. No. 1,208,185; Dec. 12, 1916.)

Gold—Process of Recovering Gold. James H Alling, Columbia, Calif., assignor of one-half to Francis M. Wright, San Francisco, Calif. (U. S. No. 1,207,261; Dec. 5, 1916.)

Ingot Mold. Edwin E. Slick, Westmont Borough, Penn. (U. S. No. 1,207,645; Dec. 5, 1916.)

Ingot Mold. George A. Dornin, Baltimore, Md. (U. S. No. 1,208,519; Dec. 12, 1916.)

Ingot Mold—Feeder for Standard Ingot Molds Ernest J. Turner, Pittsburgh, and Bloomfield H Howard, Aspinwall, Penn. (U. S. No. 1,208,703; Dec. 12, 1916.)

Ingot-Mold Top. Edward F. Kenney, Westmont Borough, Penn. (U. S. No. 1,207,054; Dec. 5, 1916.)

Metals—Process of Carbonizing and Hardening Metal. Nelson H. Bray, San Francisco, Calif. (U. S. No. 1,207,848; Dec. 12, 1916.)

Metallic Deposition—Process of Producing Metallic Deposits. François Auguste Roux, Paris, France, assignor to Société l'Aluminium Français, Paris, France. (U. S. No. 1,207,218; Dec. 5, 1916.)

Mill Liner. Frank E. Johnson, Salt Lake City, Utah, assignor to American Manganese Steel Co., Augusta, Me. (U. S. Nos. 1,207,173, 1,207,174; Dec. 5, 1916.)

Mine-Car Coupling. David J. Williams, Herrin, Ill., assignor of one-third to George H. Williams, Herrin, Ill. (U. S. No. 1,207,114; Dec. 5, 1916.)

Mining and Surface Support. Arthur Langerfeld, Scranton, Penn. (U. S. No. 1,207,569; Dec. 5, 1916.)

Nitrogen—Manufacture of Oxides of Nitrogen. Carl Bosch, Alwin Mittasch and Christoph Beck, Ludwigshafen-on-the-Rhine, Germany, assignors to Badische Anilin and Soda Fabrik, Ludwigshafen-on-the-Rhine, Germany. (U. S. Nos. 1,207,206; 1,207,207; 1,207,208; Dec. 12, 1916.)

Smelting—Process of Smelting Metallic Ores. Henry L. Dogherty, New York, N. Y. (U. S. No. 1,207,881; Dec. 12, 1916.)

Titanic Oxide—Method of obtaining Titanic Oxide. Louis E. Barton, Niagara Falls, N. Y., assignor to the Titanium Alloy Manufacturing Co., New York, N. Y. (U. S. Nos. 1,206,796; 1,206,797; 1,206,798; Dec. 5, 1916.)

Tungsten—Process of Treating Ferro-Tungsten. Philip M. McKenna, Washington, D. C. (U. S. No. 1,208,596; Dec. 12, 1916.)

Tunneling—Method of Tunneling. Edward E. McCabe, Benton, Wis. (U. S. No. 1,208,178; Dec. 12, 1916.)

Zinc—Process of Extracting Metals from Their Ores. Sidney E. Bretherton and Frank L. Wilson, Berkeley, Calif. (U. S. No. 1,204,843; Nov. 14, 1916.)

Assessments

Company	Delinq.	Sale	Amt.
Atlantic, Ida	Dec. 9	Jan. 9	$0.001
Beaver Copper, Utah	Dec. 11	Dec. 30	0 005
Bullion, Nev	Jan. 8	Jan. 30	0.02
Caledonia, Nev	Jan. 9	Feb. 3	0.05
Carbonate Keystone, Utah	Dec. 14	Jan. 2	0 01
Century Gold, Utah	Dec. 10	Jan. 10	0 01
Challenge, Nev	Nov. 29	Dec. 20	0 05
Christmas, Utah	Nov. 20	Dec. 16	0 005
Con. Virginia, Nev	Dec. 8	Dec 29	0 05
Eagle Mtn., Ida	Dec. 22	....	0 001
East Hercules Ext., Ida	Jan. 2	Feb. 2	0 0005
Ely-Gibraltar, Nev.	Dec. 15	Jan. 10	0 0025
Emerald, Utah	Dec. 15	Jan. 13	0 00½
Eureka, Ida	Dec. 9	Jan. 9	0 001
Exchequer, Nev	Dec. 5	Dec. 27	0 03
Federal Ely, Nev	Dec. 2	Dec. 20	0.005
Four Timbers, Ida	Dec. 2	Jan. 2	0 002
Hector, Ida	Dec. 22	Jan. 16	0 005
Idaho-Nevada, Idaho	Nov. 15	Dec. 16	0.002
Idora, Ida	Nov. 24	Dec. 23	0 005
Imlay, Nev	Dec. 19	Jan. 9	0 01
Iron King, Ida	Dec. 9	Jan. 9	0 001
Mayflower, Ida	Dec. 23	Jan. 25	0 005
Mexican G. & S., Nev	Nov. 25	Dec. 18	0 10
National Lead, Ida.	Nov. 25	Dec. 26	0.001
Nevada Zinc, Nev	Nov. 26	Dec. 16	0 01
New Hope, Ida	Dec. 11	Jan. 11	0 002
North Franklin, Ida	Dec. 30	Jan. 22	0 005
O.K Extension, Utah	Dec. 21	Jan. 10	0 0025
Old Veteran, Ida.	Jan. 6	Jan. 27	0 002
Ophir, Nev	Jan. 9	Jan. 30	0 05
Paloma, Utah	Dec. 12	Dec. 28	0 015
Potosi, Nev	Jan. 8	Jan. 31	0.02
Rarus M. & S., Utah	Dec. 16	Jan. 4	0 00075
Reindeer Queen, Ida	Dec. 16	Jan. 22	0 005
Savage, Nev	Jan. 5	Jan. 29	0.02
Sierra Nevada, Nev	Jan. 4	Jan. 25	0.10
Silver Moon, Ida	Nov. 25	Dec. 23	0.005
Silver Pick, Nev	Dec. 2	Jan. 8	0.02
Slavonian, Ida	Dec. 30	Jan. 20	0.001
Tarbox, Mont	Dec. 22	Jan. 13	0 005
Tiberius, Ida	Dec. 21	Jan. 12	0 00075
Wallace M., M. & R., Ida.	Dec. 8	Jan. 8	0 0025

The publication of this table will be discontinued after Dec. 30, 1916.

Editorial Correspondence

SAN FRANCISCO—Dec. 13

New Oil Wells starting to drill in the 11 months of 1916 have reached a total of 677. For the week ended Dec. 2, 14 new wells started drilling and in the preceding week 13 new wells were ready to In each of these weeks, six wells were ready to be deepened or redrilled and in the two weeks, 22 wells reported ready for test of water shutoff. Since the first of the year, there have been about 825 inspections of wells for infiltration of water. The shutting off and plugging of these wells will occupy a great deal of the time of the oil and gas department of the State Mining Bureau in the coming year.

The Advance in Dredge Construction and operation in California in 1915 and 1916 invites attention to the possibility, if not probability, of a revival of legislation antagonistic to the dredging industry. The danger is by no means an imaginary one. The "friends of the farmers" are as alive if not as active today as they were 33 years ago when they put hydraulic mining in the discard, reducing the industry to an insignificant position. Gold dredging, in spite of various and sundry predictions of prospective rapid decline, produced in 1915 a total of $7,796,465 with 58 dredges. In 1916 three large all-steel dredges have been put in commission and another is in construction. Others will follow in 1917 and in the same year the legislature will again be in session. And the same element in the political fabric of the state that put the ban on the hydraulic mines in 1883 waked up again in 1913 with the purpose of depriving dredge miners of the right of recovery of gold by dredging. Not because the method interfered with farming, but to conserve lands chiefly nonarable for the future. The meddlesome spirit of 1883 and 1913 which sought the protection of the farmer at the expense of the miner without compensation is not dead nor even sleeping. The head of it bobbed up in the legislature of 1915, but the administration had too many other irons in the fire to permit a revival then of the attack upon the dredging interests. The legislature of 1917 may not be so easily controlled as was the case during the administration of Governor Johnson, the only man in the history of the state who successfully occupied the dual position of governor and boss of the administration. Had Governor Johnson permitted the renewal of the attack upon dredge miners in 1915 there would have been a different story to tell at the end of 1916 from that which may be told of the increased acreage prospected for dredging and the advancement in dredge construction. Possibly he foresaw the folly, from a political point of view, of flying in the face of a great industry, or realized the immense damage to the state that must inevitably follow the prohibition of gold dredging.

Plymouth Consolidated on the Mother Lode, in Amador County, has produced in 27 months of active mining since reopening, nearly $1,500,000. The total net profit from operation during that period amounted to $460,000. When the mill started operation July 29, 1911, the ore in reserve amounted to 110,000 tons. The total production of ore has amounted to 270,000 tons and in November there were 180,000 tons in reserve. The mine was recently equipped with an electric hoist capable of lifting from a depth of 5,000 ft. Shaft is now 2,450 ft deep and preparations are being made to sink 300 ft. deeper. The mine is controlled by Bewick; Moreing & Co., of London. The property was developed and put upon a paying basis by William J. Loring and Albert Burch, of San Francisco. William F. Parks is superintendent. Mr. Loring worked at this mine during his boyhood and when he became the active head of Bewick, Moreing & Co.'s American activities, this was one of the first California properties that he undertook to reöpen. Since then he has, without the aid of the English company, taken over other large properties on the Mother Lode, including the Dutch-Sweeney and App in Tuolumne County and a large group near the Melones, in Calaveras County, and has recently begun reopening the Hardenberg mine at Jackson. Prior to the war Bewick, Moreing & Co. had undertaken the reopening and development of the Nashville in Eldorado County. The other properties just mentioned were taken over by Mr. Loring after the war begun and at a time when no investment money could be obtained from England, on account of the war. The money secured for the purpose of development of these properties came from American investors. Mr Loring is one of the increasing number of California mine operators who believe in and follow the policy of letting the public know what is being done at the mines. Plymouth Consolidated conforming to British custom, publishes monthly reports of production, and details of mine operation that can be properly made public about any of these reopened properties are given out without hesitancy. Greater freedom of publicity concerning the activity of the mines in California would assist materially in securing investors for the reopening of a number of properties in this state, which are valuable but which have been long idle for lack of general knowledge concerning their possibilities and the record of the districts in which they are situated

BUTTE—Dec. 14

The Ophir Mill of the Butte-Detroit company will begin operations before the end of December. Zinc ore from the Davis-Daly is being hauled to the Ophir and there will be a good surplus on hand for the mill when it is ready to start. Flotation cells have been installed and the practice will be modern in every particular.

A Miners' Home may be established in Butte. The first bill to be introduced by Representative Ward, of Silver Bow County, in the legislative assembly that meets Jan. 1, will be one to provide for the establishment of a Miners' Home in Butte. While the details of the bill have not yet been perfected, it is understood that the home will be for old Butte miners, too old or incapacitated to continue in the industry of mining but still capable of making themselves useful in less arduous occupations. Mr. Ward is confident that a bill to that effect will be passed

DENVER—Dec. 16

Important Legislation Questions will come before the Colorado Metal Mining Association at its fourth annual meeting in Denver, Jan. 3, 4 and 5, 1917. Among the questions to be considered are the following: Proposed repeal of the present law for the taxation of producing mines; proposed change in laws regarding the Industrial Board and Compensation Insurance; action of the association regarding the regulation of smelters by the Public Utilities Commission; proposed tariff laws affecting tungsten and other metals mined in this state; coöperation of the association with similar organizations in other states for mutual benefit; proposed changes in the Federal mining laws; Government conservation policies and continued withdrawal of public lands from development. Each metalliferous mining county of the state will send delegates to the meeting. County conventions are now being held for the purpose of electing these delegates.

The Prospectors Course at the Colorado School of Mines will be condensed from five into four weeks, this winter. The "Short Course for Prospectors," inaugurated in January, 1915, proved so profitable and popular that in 1916 the course was extended. As a result of the success that attended this innovation, it has become an established part of the work of the School of Mines and will be offered annually as long as there is any apparent need or demand. The third annual short course for prospectors will be given at Golden during the four weeks beginning Feb 5 and ending Mar. 3, 1917. It is planned to condense the work and keep the prospectors occupied throughout the day instead of in the morning only. This will be an advantage from the point of view of instruction and will make the course less expensive to those who attend. All of the courses will be of the most practical nature and will comprise instruction in mineralogy; common minerals and rocks; elementary chemistry; principles of ore dressing; assaying; the more common metallurgical processes; methods of valuing, buying and selling ore; placer and lode mining; location of mining claims; and first aid to the injured. The courses will be given by regular members of the faculty and will consist of lectures and laboratory demonstrations

SALT LAKE CITY—Dec. 15

Resource Maps of Four Counties of the state are being prepared by the Utah Conservation Commission, and will be included in a report to be issued the first of the year The commission has received numerous inquiries in regard to deposits of clays suitable for paint manufacture, iron deposits and mineral resources generally

New Mining Town in Tooele County, is rapidly growing up in the Clifton district in the Deep Creek section to meet the completion of the railroad which will open up this part of the state. Gold Hill, the terminus of the road, is to be called Goodwin in honor of Judge Goodwin, of Salt Lake, who long advocated the construction of such a road. A townsite company has been formed, and houses and store buildings are being built. There is a congestion of freight at Wendover, and freight rates between here and Goodwin have been raised. A good many mining claims in the district have changed hands. One group near Gold Hill said to have been taken over by Eastern men. Two shipments of high-grade tungsten ore were made recently by parcels post from Seminole Copper, owned by the Wilson brothers

WALLACE, IDAHO—Dec. 15

The Evolution Mine, near Osburn, the first location made in the Coeur d'Alene district, is experiencing what [illegible]. After a [illegible] of almost [illegible] years during which time efforts to place it on a productive and profit-earning basis proved unsuccessful, it is now [illegible] to serve a useful purpose and return some revenue to its owners by furnishing [illegible] for the new Bunker Hill & Sullivan smelting operations. The Evolution vein is a large one and has been exposed by a crosscut and drift. It carries about [illegible] besides more or less lead, zinc, gold, silver and copper. The Bunker Hill & Sullivan company has taken a lease on a block of ground 800 ft. [illegible] the vein, extending 800 ft. to the surface and will mine it for the [illegible], paying the Evolution owners 2[illegible] of all valuable metals recovered. The Evolution was located in 18[illegible] by Andrew J. Prichard, who believed that he had discovered a gold mine. It was from his camp at Evolution that Prichard wandered north about 20 miles and in 1883 discovered placer gold on the creek that bears his name, an event that caused a stampede the winter of that year and marked the beginning of mining in the Coeur d'Alene district

Renewal of Gold-Mining Activity is in sight for next year in that section of the Coeur d'Alene district, commonly referred to as the North Side and including the drainage of Prichard and Trail Creeks, the scene of the early-day gold mining which preceded the development of the great lead deposits on the South Side. These prospective operations include both placer and quartz gold, with tungsten as an important side issue. For many years the Golden Chest, near Murray, has been worked intermittently and with indifferent success, liberal amounts of scheelite either being left in the mine or allowed to escape as waste in the tailings. During the last year, however, much attention has been given, through changes in the stamp mill, to the recovery of tungsten in the form of concentrates. These efforts have been partly successful, but recently the price of tungsten dropped from its high estate to about $16 per unit, which has rendered necessary more perfect methods of separation and concentration than the plans contemplated. This situation, together with the approach of winter and the shortage of water for power, have combined to close the property until spring, when it is announced the owner of the Golden Chest, Vivian Green, a wealthy New Yorker, will build a new and modern mill, designed for the economical recovery of both the gold and tungsten. After many years of inactivity, the large tract of placer ground owned by the Coeur d'Alene Mining Co. was the scene of extensive prospecting during the summer. The holdings of this company include practically all the ground adjacent to Prichard Creek throughout its length, a distance of 1[illegible] miles. The company is composed of a group of Boston capitalists, but the report is current that the ground is now under option to the Guggenheims. The property was acquired by the Boston people many years ago and nothing whatever was done toward its development until last spring, when J. S. Wyatt, of California, appeared on the ground and proceeded to prospect it thoroughly. Two Keystone drills were used and for a period of four months about [illegible] men were employed night and day systematically sinking prospect holes to bedrock, covering a large section of the ground above and below Murray. While no authentic information can be obtained on the subject, the impression prevails that this prospecting work was done for the Guggenheim interests, that it proved in every respect satisfactory and that dredging operations on Prichard Creek will be inaugurated during the coming year

JOPLIN—Dec. 18

Increase of 15c. per Ft. for Drilling is threatened by drill contractors of the district. Two years ago 90c. per ft. was [illegible]. Now it is $1.1[illegible], and drillers say they [illegible] per ft. to make as much as they were making [illegible] year ago. They declare the price of [illegible] and coal has gone up about [illegible] and teams are also paid for at [illegible]. The increase, if it goes into effect, [illegible] to slow down prospecting more [illegible] present it is impossible to get drill rigs [illegible]

The Strongest Operators Association the Joplin district ever had, the [illegible] Missouri Mine Safety and Sanitation Association, held its annual meeting last week and [illegible] B. Shackleford, of Webb City, president [illegible] Charles T. Orr, who was made [illegible] W[illegible] Rhea, of Carthage, was reelected [illegible] and A. F. Carmean treasurer. Richard Jenkins, of Webb City, is the assistant secretary of the organiza tion. Mr. Orr doubtless would have been reëlected to head the organization but insisted his name be not considered, as his interests in the Athletic Smelting Co., which is erecting a plant at Fort Smith, Ark., would prevent his giving the association the necessary time. Mr. Shackleford is one of the veteran operators of the district. For a time he was at the head of the Jasper County Anti-Tuberculosis Society.

HOUGHTON, MICH.—Dec. 16

Labor Supply Easier now in the Lake copper country. During the earlier part of the year it was found necessary, by the mining companies, to import men into the district, but conditions at present are such that the companies near the larger towns have been obliged to turn away men, thus enabling the smaller and more remote mines to increase their forces. Some of the smaller mines in the outlying districts that were operating as best they could with short crews, will now be able to make a showing. With the bonuses lately announced, the mining companies in the copper country are now paying the highest wages ever offered in this district.

Shortage of Coal among the Lake copper mines for the present winter is now generally acknowledged. One fuel company, which has been accumulating screenings for nine years, hoping some day to be able to sell them for $2 a ton, recently disposed of the lot for $5 a ton to a large producer. The only large fuel-using interests in the Lake Superior country who have coal enough on hand to tide them over until midsummer of 1917 are the Stone & Webster people, who operate the electric-light plants and the street-railway system. Their fuel supply, sufficient to last until September of next year, was brought in early last summer. Mining companies bought their usual requirements, but they are using at least 20% more than ordinarily.

Quincy's Record Tonnage of 4,600 tons of copper rock was sent to the mill one day last week. The average now maintained is above 4,300 daily. This is a great tribute to the efficiency of the Quincy, from manager down to trammer, for the whole tonnage comes out of three shafts, all of them deep and one requiring a shaft haulage alone of 1½ mi., to say nothing of the tram haul. Further increase in tonnage may be anticipated from No. 2 shaft where a new hoisting engine, with a rope length of about 2 mi. will be installed within the next six months. The present hoist is being worked to its limitations. The working force at the Quincy has been increased recently and will be further added to in Januray.

Mass Consolidated has just finished unwatering the old Evergreen workings, the work having been done at small expense by an air lift and a drill hole. Miners will be put to work there this week and it will be opened wherever favorable showings are found. This may result in substantial additions to the company's production as the Evergreen was in good rock when last abandoned. Mass is today securing most of its copper rock from the Butler lode, but about half of its actual production comes from the newer Evergreen workings. The anomoly is explained by reason of the fact that of the total Mass production fully one-quarter is barrel and mass stuff that goes directly to the smeltery on flat cars; practically all of this comes from the newer Evergreen workings and in addition the lode furnishes a proportion of the stamp mill rock.

WASHINGTON, D. C.—Dec. 16

Glossary of Mining Terms is being compiled by the U. S. Bureau of Mines. In order to have the new glossary complete, 60 different glossaries have been studied and are being embodied in the new compilation. In addition, other sources of mining terms are being drawn upon. Expressions peculiar to mining in South Africa, in Wales, in New Zealand and in other parts of the United Kingdom will be embodied as well as those in use in the different mining regions in this hemisphere. The glossary, which will be published ultimately as a bulletin by the Bureau of Mines, will also include a lengthy list of Spanish mining terms.

Mining Experiment Station Plans are being formulated, with the return to Washington of Dr. F. G. Cottrell, chief metallurgist of the Bureau of Mines. At Seattle it is the intention to pay important attention to electro-chemical problems. Possibilities of the utilization of electric power in mining is also to be given a prominent place in the work of this station. It is expected that the Seattle station will be a sort of clearing house for Alaskan mining matters in addition to the work on the general problems of the Northwest. At Tucson the problems of handling low-grade ores profitably will be given first place. This will include studies of the flotation and leaching processes. A special effort is to be made at Tucson to aid the small operators. Another matter which is to be given careful attention is the study of methods of ore treatment which require a small amount of water. Dry concentration, electrical concentration and hydro-metallurgy, in general, will be made the subject of constant research. In the opinion of J. A. Davis, who is to have charge of the Alaskan station, the fuel problem has such an important bearing on mining in eastern Alaska, that this matter is to be given immediate attention. With wood at $16 a cord, which is equivalent to paying $30 a ton for coal, placer mining is greatly handicapped in a region where frozen ground must be handled. Since cheaper fuel is a necessity through the continuance of extensive mining operations in the Fairbanks district, a study will be begun at once of the lignite in the Nanana field. A year hence this field will be connected with Fairbanks by rail. The Nanana lignite, however, is of too low grade for use in a raw state. Some method of treating this lignite must be devised. It is believed that this can be done so as to make available a reliable source of fuel supply at a cost materially less than wood. The hope is expressed that a lignite product which will make an excellent fuel can be laid down at Fairbanks for less than one-third of the present price of wood. Another activity of the Fairbanks station will be the encouragement of prospecting for other metals than gold. Tin and platinum are among the metals offering promising development. Since most of the bonanzas are believed to have been discovered, the question confronting placer mining in eastern Alaska is the development of means which will make possible the working of the lower grade of gravels. While placer mining is to be given special prominence in the work of the Fairbanks station lode mining is not to be disregarded. By pointing out certain economies and bringing to general attention some of the mistakes of the past it is believed that lode mining in the Fairbanks district can be stimulated.

TORONTO—Dec. 14

Development of Canada's Iron and steel industry on the Pacific Coast and keeping it out of alien hands have been under consideration lately in British Columbia and in Ottawa. Premier Brewster, of British Columbia, announces that steps will be taken by the provincial government to coöperate with the Dominion government in a plan by which British Columbia ores required for the manufacture of war munitions may be placed under reserve for the use of the Empire and removed from possible control by enemy interests. This statement was made to a deputation of business men of Victoria, who asked for assistance in the development of the iron and steel industries. Premier Brewster will discuss the matter with Sir Robert Borden, Premier of Canada, who will be in British Columbia this week with the view of effecting some arrangement to safeguard imperial interests.

The Mining News

ARIZONA

Cochise County

SHATTUCK-ARIZONA (Bisbee)—Mine operatios in November, reported by Superintendent Houle include 1,883 ft. of development work; continued opening promising oxidized area on 200-ft. level of Southwest claim; most important development was on 100-ft. level, where disclosures to date indicate an ore zone about 40 ft. wide carrying 5% copper ore. Mine shipments in November averaged 600 tons daily of copper ore and 50 tons of lead ore; shipments of latter may be doubled in December.

Gila County

GREATER MIAMI (Miami)—To be developed by three adits; some ore being encountered. No. 1 adit is in about 142 ft.; No. 2 is in 84 ft. and No. 3 is to be started in December to cut the same vein being developed by No. 2 but 300 ft. farther south. H. C. Malloy, manager.

Pima County

NEW CORNELIA COPPER (Ajo)—On Dec. 1, the new 5,000-ton leaching plant was about 90% complete. Coarse-crushing department under cover and only a little concrete work remained to be done; No. 24 gyratory crusher, taking steam-shovel size direct, is practically complete as also the four No. 8 gyratories. The 10,000-ton storage bins were being lined. Fine-crushing plant under roof and five of the eight crushers are in place. All concrete work on leaching tanks finished, and lead lining and wood protection being added; central structure for solution pumps, etc., and asphalt flooring in solution tanks are well along. Reduction of ferric iron is to be accomplished with sulphur dioxide, for producing which will be employed pyrites and four Wedge roasters, Cottrell precipitation for purifying the gas and absorption towers; foundations complete and some steel being erected. One of the two 7,500-kw. turbines about 80% installed. Excavation made for 150x400-ft. cooling pond. First steam shovel, Osgood type, with 4-cu.yd. dipper, now on ground.

Yavapai County

CALUMET & JEROME (Jerome)—McIntosh-Seymour oil engine and Crocker-Wheeler generator now in place. Sinking three-compartment shaft under direction of John Rauber.

GREAT WESTERN SMELTERS CORPORATION (Mayer)—Remodeled smelting plant to start with capacity of 400 tons of Big Ledge and custom ore. Considerable equipment obtained from old United Verde smeltery at Jerome. A. C. Cole, superintendent.

CALIFORNIA

Amador County

SOUTH KEYSTONE (Amador City)—Grading for buildings and machinery; construction under way.

CONSOLIDATED AMADOR (Sutter Creek)—Expected that deepening of Old Eureka shaft for a working shaft will begin early in 1917. New hoist will then be in operation.

SOUTH EUREKA (Sutter Creek)—Forty of the 60 stamps are dropping and it is expected to put the remaining 20 in commission soon. Underground force being rapidly increased. New strike of ore in the Oneida is reported to be improving.

KEYSTONE (Sutter Creek)—Shaft retimbered to 400 ft. below surface; timbers 18x18 in., 18 ft. long, are being used. Large stations with concrete floors and modern appliances for handling ore being constructed at important levels. Company expects to resume regular mining before end of year. C. R. Downs, manager.

CENTRAL EUREKA (Sutter Creek)—Good quartz disclosed by crosscut on 1,800 level, about 650 ft. from station. It is of low grade at point of discovery, but improving as crosscutting progresses. Drifts will be run north and south. Discovery is west of main workings in section where rich rock has heretofore been mined. Fred Jost, superintendent.

Butte County

HEDGE (Oroville)—W. T. Baldwin installed 5-stamp mill; 10 men at work. Will install 1-stamp developing mill on adjoining property in Morris Ravine.

MASCOT (Oroville)—Ore reported to average $15 a ton disclosed and three heavy stamps will be installed for crushing. Mine is near the Banner. W. T. Baldwin, lessee.

BANNER (Oroville)—Strike of rich ore reported on the 400 level in the south drift of the South Banner; 25 men employed. Richard Phillips, manager and principal owner.

MORRIS RAVINE LEASING CO. (Oroville)—Underground station started at old Butterfly mine. Hoist will be installed and gravel mining resumed. Tests in the 1,200 ft. of tunnels, driven this year, indicate pay gravel.

Calaveras County

SOUTH CAROLINA (Angels Camp)—Reported that new operator contemplates exploration of gloryhole to greater depth.

ETNA KING (Angels Camp)—May be reopened; situated between Gold Cliff and Utica. Equipped with hoist, stamp mill and other machinery.

Eldorado County

TUNGSTEN DEPOSITS reported in the Lotus district by the U. S. Geological Survey.

LEMON (Placerville)—Mine to be reopened immediately by Holly Quartz Mining Co., recently incorporated at Fresno. C. E. Stovall is manager.

WOODSIDE (Georgetown)—Reopening of this mine within the town limits depends upon securing easement, 3 ft. wide, across properties in which the town sanitary ditch passes; the easement to provide for carrying off waste water from the mine. Mine owned by Woodside-Eureka Mining Co. A. E. Westover, of Shasta County, will have charge.

Nevada County

SULTANA (Grass Valley)—Rich ore reported at 1,100 ft. from surface. Some time ago company decided to sink vertical shaft 1,700 ft. before drifting or developing. Some prospecting was done, however, when shaft reached 1,100 ft. Albert Crase, superintendent.

EMPIRE-PENNSYLVANIA (Grass Valley)—Reported that these two mines are producing at the rate of $1,250,000 a year and that ore reserves are sufficient for 10 years without further development; 80 stamps are dropping continuously, most of the ore coming from the Empire shaft, which has an incline depth of about 4,600 ft.

Owned by three stockholders and policy of owners is to give out no information, hence these statements cannot be verified.

Plumas County

BONITA COPPER (Portola)—Walker Bros. Consolidated Co., of Salt Lake, has started work. Compressor and drills installed and 20 men will be employed during winter.

Sacramento County

NATOMAS CO. (Natoma)—Two prospecting drills in operation on the William Comstock ranch near Folsom. No. 10 dredge is working on adjoining ground and if Comstock ground proves satisfactory by prospecting, No. 10 will probably continue into the new ground.

San Bernardino County

CALZONA MINES CO. (Vidal)—This copper property, comprising 12 mining claims 8 mi. south of Calzona Junction, has ordered a small mill, and the Calzona Smelting and Refining Co. is to erect a furnace to treat this and custom ores. New compressor and hoist en route. James W. Neill, Pasadena, Calif., consulting engineer; Henning E. Olund, resident engineer.

Shasta County

BALAKLALA CONSOLIDATED (Coram)—Shipping about 300 tons daily to Mammoth smeltery, netting $30,000 to $35,000 per month.

MAMMOTH (Kennett)—Construction of electrolytic zinc plant is progressing rapidly; expect to have building ready for machinery during winter and plant ready to operate in early spring. Friday-Lowden tunnel nearing completion, and laterals will immediately follow.

Sierra County

ROMAN (Sierra City)—Bonded by Richard Phelan, owner, to San Francisco operators. New mill on ground, and active development to begin in spring.

WISCONSIN (Forest City)—Incline shaft, sunk in this gravel mine in 1855, unwatered and sinking continued. Supplies laid in for winter work. D. E. Hayden, manager.

GRAY EAGLE (Downieville)—Drifting under way in two crosscuts at bottom of shaft. Stamp mill, moved to mouth of main tunnel, again in operation; will work all winter with full crew. Sydney C. Love in charge.

Trinity County

TRINITY STAR GOLD DREDGING CO. (Lewiston)—Reported that company will move the old Consolidated dredge from Butte Creek near Chico and install it on Paulsen ranch, near Lewiston.

Tuolumne County

BLACK OAK (Soulsbyville)—A fair-size vein of good ore disclosed by diamond drilling at the 700 level. Crosscut is being driven to vein. At 1,300 level, south drift has reached a point about 1,400 ft. from shaft. At the 1,800 level, high-grade ore about 1 ft. wide is said to have been opened.

COLORADO

Clear Creek County

TORPEDO (Idaho Springs)—Drifting is in progress on Black Eagle vein. John Hull, superintendent.

FRENCH FLAG (Idaho Springs)—A 2½-ft. vein of $50 gold-copper ore opened in 315-ft. level, 160 ft. west of shaft.

JEAN (Empire)—Being developed by Hager & Co., who have opened payable ore and are shipping from development.

GRAND CLEAR CREEK (Empire)—Development resumed under management of E. R. Willey. Main adit advanced 600 ft.

ARGO MILL (Idaho Springs)—Flotation equipment and additional concentrating tables being installed to increase capacity to 150 tons a day.

HOMESTAKE (Ward)—Rich strike made by John McDonough and associates, of Denver. Vein 2 ft. wide and assays $45 a ton in gold, silver and copper.

NEWTON MILL (Idaho Springs)—Early in January this plant will be remodeled and flotation equipment will be installed. Treats ore from the Gem mine and custom ore.

BRODERICK MINING AND MILLING CO. (Georgetown)—New incorporation of William S. Broderick and associates to develop mining property in Clear Creek County.

MAMMOTH-VIRGIN MINING CO. (Georgetown)—New incorporation of C. D. Smith, R. M. Sanford, and R. W. Street, to develop mines in Clear Creek County. Principal office will be in Denver.

BIG FIVE (Idaho Springs)—Walde & Co. have lease on Edgar No. 2 vein; payable ore opened in breast of drift; raise will be started soon. Roy & Co., leasing on Edgar vein, have advanced drift to total length of 1,100 ft. from tunnel and have raised 180 ft. above tunnel level.

Gilpin County

COLORADO-CARR (Central City)—Oreshoot opened on 800-ft. level; drifting and raising now in progress. Shipping ore averages 20 in. wide.

BECKY SHARP (Russell Gulch)—Lessees have started 360-ft. diamond-drill hole from drift in Old Town mine to tap lowest workings and drain mine through Old Town workings and Newhouse tunnel.

Denver County

SMELTING RATES were discussed at [illegible] in Denver by members of a subcommittee of the Colorado Metal Mines Association and the [illegible]. Chief districts dissatisfied with present rates, which are culmination of increasing rates for Clear Creek and Gilpin counties and the San Juan district. Claim are made that smelting rates are much lower in Montana and Utah than in Colorado.

COLORADO FUEL AND IRON CO. has given notice of 5% bonus on wages, the same to be paid during December, January and February to all employees who do not lose more than one day per month. This is done to keep mines working full capacity during months when fuel is in greatest demand.

Fremont County

UNITED OIL CO. (Florence)—Improvement to refining works totaling $125,000 contracted.

Mineral County

COMMODORE (Creede)—Reported company will build power plant.

San Juan County

ELK (Silverton)—Being developed by J. [illegible] Cusick and associates.

BLACK PRINCE (Animas Forks)—This property, together with Esmeralda mine, leased to Peter Orella and associates.

SLIDE (Silverton)—This group being developed by John Yager and associates, a 3½-ft. vein recently exposed in drift.

BARSTOW (Ironton)—Leased by C. E. Wilfley and associates. Mine will be developed under superintendence of W. A. Sheldon.

PRECIOUS METALS (Ironton)—E. H. Brown and associates have bonded this Mill Gulch property and have started underground development.

NORTH STAR (Silverton)—Development under way in this property on Sultan Mountain under direction of Matt Delsant. Mill recently overhauled and will be operated under superintendence of L. O. Bastion.

HIGHLAND MARY (Silverton)—Considerable work being done in this property at head of Cunningham Gulch by J. H. Slattery and associates. Mill being remodeled and new equipment installed.

COLUMBUS (Animas Forks)—Development of lower working tunnel being driven by contract under supervision of A. Sturgeon, tunnel will be advanced to intersect the Columbus vein. Arthur Johnson, of Chicago, is manager.

EUREKA MINING AND MILLING CO. (Silverton)—New incorporation, capital $10,000, to develop mining properties in San Juan County. Directors are F. G. Moffatt, Tyson Dines, Jr., and L. E. Rowland, of Denver, where principal office will be situated.

BELLE BUTTON MINING CO. (Silverton)—Is developing group of claims in Stony Pass. Operations are financed by E. J. H. Amy, of 11 Wall St., New York, and associates. A 20-ft. vein opened by crosscut tunnel contains 12 ft. of quartz carrying gold and silver.

San Miguel County

OPHIR GOLD MINES AND REDUCTION CO. (Ophir)—Small force engaged in development under direction of James Belisle.

MORNING STAR (Telluride)—Property on Mt. Wilson being developed by W. R. Vanderveer.

CARRUTHERS (Telluride)—This lease on part of Smuggler-Union ground has completed repairs to Carruthers mill and tramway from mouth of Sheridan crosscut to mill; milling will begin at once.

SILVER BELL (Ophir Loop)—Main tunnel, now in 1,800 ft., will be advanced to prospect veins on the Priest properties. Compressor plant placed in operation and machine drills installed. Frank Trumble, manager.

GERTRUDE (Telluride)—Three claims at head of Bear Creek being developed by King & Ferrell Leasing Co. Equipped with modern drills and a carload of crude ore produced from development has been shipped to smeltery [illegible].

Summit County

FOUR DREDGES [illegible] in Breckenridge district despite continued intense [illegible]. Three Tonopah dredges somewhat [illegible]; French Gulch dredge [illegible] in running water.

IRON MASK (Kokomo)—[illegible] shoot lead ore.

JESSIE (Breckenridge)—[illegible] development. Expects to [illegible].

JO DANDY (Breckenridge)—[illegible] grade zinc ore. Property [illegible].

HAMILTON (Breckenridge)—[illegible] and repairing buildings [illegible] extensive operation.

ORO EXTENSION (Breckenridge)—[illegible] sharpener installed and better [illegible] made in crosscut to vein.

MICHIGAN (Kokomo)—Two [illegible] shipped daily to Denver [illegible] of lead ore to Leadville.

PIONEER CONSOLIDATED (Breckenridge)—Remodeled milling [illegible] from Deadwood [illegible].

PUZZLE (Breckenridge)—[illegible] 900 ft. [illegible] ment done. [illegible] filling.

IDA BELLE (Montezuma)—[illegible] property; [illegible]. Development work [illegible] be resumed after next [illegible].

BUFFALO LEASING CO. (Breckenridge)—[illegible] difficulties in connection with operation of Buffalo placer removed. Preparations being made for hydraulicking next spring.

LEE MINING CO. (Breckenridge)—[illegible] work on Lee placer. Boiler, [illegible] and pump to be installed [illegible] dredge [illegible].

IDAHO

Shoshone County

KELLOGG UNITED MINES CO. (Kellogg)—New company to operate the [illegible] Great Western and Atlas groups in Pine Creek district. Theodore Brown of Kellogg interested.

CARBONATE HILL (Mullan)—Survey completed for 1,900-ft. crosscut that will give depth of 900 ft. from surface and 240 ft. below present workings. Considerable stoping ore on dump.

JACK WAITE ([illegible])—Hauling ore to [illegible] road, 10 mi., and expects to ship 100 to 200 tons per month during winter. Shipments average [illegible] lead with a little silver. May build small mill in spring.

REINDEER QUEEN MINING (Mullan)—Pres. E. R. Crawford at annual meeting announced erection of a mill likely in the spring. In the property on Willow Creek about 1,200 ft. of drifts and crosscuts have been driven; 700 ft. yet to go to reach Copper Queen orebody.

DOUGLAS (Beeler)—The Anaconda company of Butte, which has a lease and bond on this property, is now making regular shipments, four 4-horse teams being engaged hauling ore to the railroad, 10 mi. Compressor, hoist, pump and other equipment now being installed.

POLARIS (Osburn)—Returns from smelter on first car of ore shipped $[illegible]. Most of the ore averaged 140 oz. silver and slightly over [illegible] copper. Company expects to ship three or four cars of such ore a month. [illegible] parallel vein, known as Southern Cross, contemplate crosscut during coming year that will give 800 ft. additional depth.

AMBERGRIS MINES CO. (Burke)—New company organized, reducing capital from [illegible] to 1,000,000 shares; control [illegible] by Hercules company in settlement of litigation [illegible]. Shaft 200 ft. on Ambergris shows 2 [illegible] ft. clean galena with exceptionally [illegible]. Shaft sunk near north line of Hercules, which led to the litigation. Crosscut now being run from No. 4 tunnel of Hercules will cut Ambergris orebody at depth of 1,000 ft. or more. Announced that property will be made productive as quickly as possible. Company has right to use Hercules tunnels [illegible].

MICHIGAN

Copper

DIAMOND-DRILL EXPLORATION [illegible] started near the town of Salem [illegible] NW [illegible], on the Hancock side of the road to the Portage Canal. The work will be done by the E. J. L[illegible] company, presumably for George [illegible] [illegible] year.

OSCEOLA [illegible]

COPPER RANGE (Painesdale)—[illegible] addition to the [illegible] completed.

NEW BALTIC (Houghton)—At depth of [illegible] ft. [illegible] New [illegible].

HANCOCK (Hancock)—[illegible]

ADVENTURE (Greenland)—First [illegible] Winona mill [illegible] from the [illegible].

WINONA (Winona)—[illegible] Winona work.

FRANKLIN (Demmon)—[illegible] 29th level [illegible].

ISLE ROYALE (Houghton)—[illegible] The new [illegible].

NEW ARCADIAN (Houghton)—[illegible] and new rockhouse [illegible]. New rockhouse will [illegible].

CALUMET & HECLA (Calumet)—[illegible] November for Calumet & [illegible]: Ahmeek, 2,157 [illegible].

Calumet & Hecla, 6,513,333; Centennial, 155,505; Isle Royale, 1,036,492; La Salle, 135,220; Osceola, 1,533,944; Superior, 204,487; Tamarack, 501,831; White Pine, 314,534 lb.

MISSOURI

Joplin District

FLANNERY ZINC (Sarcoxie)—Contract let for rebuilding mill burned Dec. 2; cost about $40,000; capacity 250 tons per 10-hr. shift; to be completed in 45 days.

LONDON LIFE (Joplin)—With only two men underground, made carload of calamine and lead concentrate during recent week. Operating at 60 ft. on Roaring Springs land.

GEORGE MOORE and associates, of Webb City, have taken 13-acre lease just south of St. Regis mill at Chitwood and now doing check drilling. Will probably erect 250-ton mill

POOR BOY'S (Joplin)—John Davis has bought out Jesse Ader and associates of Webb City and will increase development operations at mine, 9 mi. north of Joplin, in new territory.

CONCORD (Webb City)—Building 250-ton mill on Zinc Corporation land south of Carterville To be steam plant. Crane, Wenk and Philip Gray, of Webb City, who recently built 500-ton Unity mill, principal owners.

OSCEOLA (Webb City)—No. 1 mill, under lease to Cisco company, destroyed by fire Dec. 16; insured for $5,000; was 300-ton mill, but old To be rebuilt immediately at cost of $10,000. T. F Coyne and A. D. Hatton principal owners.

MISSOURI MINING CO. (Joplin)—Has about completed new 150-ton mill on old Frisco tract at Thoms Station. Mine developed as hand-jig operation, and at first was principally lead producer. Arthur Raymond, president of Oronogo Circle Co., interested.

REBECCA (Joplin) Will resume charge of La Nora B mine at Chitwood, Jan. 1. For several months property has been operated by George Bayless, to prove contention of landowners that it is paying mine. Bayless employed by Rebecca company to continue as manager.

UNDERWRITERS (Joplin) Have moved Geronimo and Purciller mills from West Joplin camp to Oklahoma field. One has been completed in Century camp and the other now being erected 1 mi. east of Picher, Okla. No. 1 mine at Century is producing 150 tons of concentrates weekly from 1,500 tons of ore.

MONTANA

Beaverhead County

BANNACK GOLD MINING (Bannack)—Great activity reported at company's Original Bannack mine, 11 mi. from Grant, Mont., to which ore is to be hauled by motor trucks recently purchased. Sixty men engaged on development, and bins and chutes filled with gold ore. The 200-ton mill completed but will not be put into operation until March, due to lack of waterpower during winter months, the newly ordered oil engine not having yet arrived.

Fergus County

BARNES-KING DEVELOPMENT (Kendall)—November was banner month in company's history Output $80,024 in gold; $12,524 came from North Mocassin mine at Kendall, being the yield from 2,242 tons of ore; balance came from Piegan-Gloster and Shannon in Lewis and Clark County, 3,093 tons of Shannon ore averaging $15.80 per ton and 2,196 tons of Piegan-Gloster ore averaging $8 per ton.

Granite County

MONTANA MANGANESE CO. (Philipsburg)—Manganese ore mined from limestone beds about 1 mi. from town, being shipped to Eastern market. Production about 40 tons daily by hand mining; will be increased to 100 tons with four new machine drills and 10x12-in. compressor driven by 50-hp. motor. Ore hauled to railroad by auto trucks.

Jefferson County

BOSTIN & CORBIN (Corbin)—November production was 831 tons of concentrates.

Silver Bow County

TUOLUMNE (Butte)—First shipment from strike at Main Range property made Nov. 9. Will erect 1,000-ton storage bins and ship to Washoe smeltery steadily.

BUTTE & LONDON (Butte)—Crosscutting on 1,600 level is nearing completion by Rainbow Development Co. which is to receive 51% of the Butte & London stock for this work.

BULLWHACKER (Butte)—Syndicate, operating the Bullwhacker mine under lease and bond, reports daily shipments of 125 tons of 3½% ore, partly to Granby smeltery and partly to the East Butte's plant. November profits greater than for entire preceding nine months. The Wall syndicate has paid so far a total of $115,000 for 230,000 shares of Bullwhacker stock. Car shortage restricts output.

ANACONDA (Butte)—Sunday, Dec. 10, company's Butte mines were closed for two shifts because of inability to move ore as fast as taken out. Plenty of ore at company's Washoe and Great Falls works and employees at these plants were not affected by the shutdown. Break-out of casting furnace at Washoe works Dec. 11 caused injury of four men who were removed to hospital, though burns are not considered serious.

NEVADA

Esmeralda County

SPEARHEAD (Goldfield)—Shaft recently encountered shale, and station being cut at 910-ft. point, from where lateral development of the contact will be undertaken.

REORGANIZED KEWANAS (Goldfield)—At a point about 800 ft. northerly from main working winze, 3 ft. of ore has been encountered a short distance above shale contact. Raise being driven on the showing.

Nye County

TONOPAH ORE PRODUCTION for week ended Dec. 9 was 9,952 tons, valued at $195,076, compared with 9,747 tons for week previous. Producers were: Tonopah Belmont, 2,992 tons; Tonopah Extension, 2,380; Tonopah Mining, 2,300; Jim Butler, 950; West End, 814; Halifax, 210; Rescue-Eula, 194; McNamara, 52; miscellaneous, 60 tons.

WEST END (Tonopah)—Sinking Ohio shaft. Now down about 900 ft.

MONARCH PITTSBURGH (Tonopah)—Crosscutting on 850-ft. level to connect with raise from 1,000-ft. level that recently encountered ore. About 400 ft. to go.

GREAT WESTERN (Tonopah)—Unwatering of lower levels completed; additional pump placed, giving total pumping capacity of 500 gal. per min. Lateral development to be resumed.

MONTANA TONOPAH (Tonopah)—Has bonded property of Lost Burros Gold Mining Co. in Inyo County, Calif. Consideration $40,000. About 10,000 tons of mill ore "blocked"; development faces being extended. Expect to have 50-ton mill in operation by March.

White Pine County

CONSOLIDATED COPPERMINES CO. (Kimberly)—Financing of company assured by Albert E. Humphreys and associates, of Charleston, W. Va., and Denver, Colo., and property will be put on substantial operating basis; funds provided to meet the Giroux bonds when they fall due and the floating indebtedness is expected to be cleared up by middle of January. Mr. Humphreys will become the financial advisor and take active part in the management. The remodeling of the Giroux concentrator into 500-ton flotation mill will be completed early in January and another 500-ton unit will be constructed. Output will be brought up to 1,000 tons daily as soon as possible. Development of low-grade disseminated ores will also be resumed as soon as weather permits, with 10 churn drills. Charles H. Boynton, president, 60 Broadway, New York; Elmer F. Gray, manager.

NEW MEXICO

Grant County

CHINO DEL NORTE COPPER CO (Hanover)—New incorporation to develop 30 claims on Hanover Mountain, north of the Chino. George E. Coxe, I. J. Ketman, of Winterset, Iowa, and W. A. Ulman, of 233 Broadway, New York, interested.

OREGON

ELDORADO COPPER MINING CO. (Riddle)—New incorporation to operate the old Banfield mine, 32 mi. east of Riddle. Workings include six adits Andrew Laidlaw, of Spokane, Wash., interested.

PENNSYLVANIA

CHARLES M. SCHWAB reported to have acquired from Lackawanna Steel Co. control of the Cornwall iron-ore mines and furnaces; also outright purchase of American Steel and Iron plants including steel mill; Lebanon furnaces and concentrator; and the Polebrook furnaces.

CAMBRIA STEEL CO. (Johnstown)—At recent directors meeting of Midvale Steel and Ordnance Co. in Philadelphia, immediate erection of two more blast furnaces was ordered. It is understood that one will be used for production of ferromanganese and the other for special irons.

WASHINGTON

LEAD-ZINC MINING CO. (Metaline)—New York men reported interested and $50,000 provided for increasing output, raising mill from 125 to 250 tons capacity. New electric hoist and compressor being installed. Wide sulphide orebody, free from pyrite, opened for 600 ft.; diamond drilling to be done from 550-ft. level. Lewis P. Larsen, president and manager.

WISCONSIN

Zinc-Lead District

EWING (Benton)—Company reports rich drillings on land adjoining old Etna mine.

VANDERVENDER (Benton)—Rich lead ore found below the old mine workings at Benton.

BUCHAN (Benton)—New shaft penetrated good vein of zinc ore on Buchan land at Benton.

G. O. P. (Platteville)—Good strike of ore at old Gritty Six mine on the Raisbeck range, near Cuba City

FRONTIER (Benton)—Another .25-ton mill completed on the Grotkin land, ¼ mi. south of Bull Moose No. 1.

MINERAL POINT ZINC (Galena, Ill.)—A new shaft will be sunk and complete surface equipment erected on Meloy land in Benton-New Diggings camp; to be known as the Hoskins mine.

CANADA

British Columbia

BELL (Beaverdell)—This Westkettle River property has commenced shipments of gold-silver ore to Trail.

ST. EUGENE (Moyie)—Concentrator being remodeled to treat lead-zinc ore from Sullivan mine at Kimberly.

LANARK MINING (Illicillewaet)—Erecting 150-ton mill; to be ready in February; William B. Dornberg, manager. Tousley-Ely Co., of Spokane, Wash., interested.

CONSOLIDATED MINING AND SMELTING (Trail)—Has decided to enlarge its electrolytic copper refinery, increasing its present output 50% or to about 15 tons daily.

GRANBY CONSOLIDATED (Vancouver)—Production for November 4,151,000 lb. copper, of which 3,017,260 lb. was produced at Anyox and 1,133,740 lb. at Grand Forks plant.

Manitoba

TONOPAH MINING (Schist Lake, via The Pas)—At the copper deposit being developed by this Philadelphia company arrangements are being made to take out 5,000 tons during the winter. The ore will be hauled to Sturgeon Portage, 38 mi. distant, whence it will be transported by water to The Pas from which it will be shipped to the smeltery at Trail, B. C. Company has placed large orders for machinery and is considering building of an 18-mi. railway between the end of navigation on Schist Lake and Sturgeon Portage.

Ontario

McKINLEY-DARRAGH (Cobalt)—Order given for new ball mill to take the place of gravity stamps.

INSPIRATION (Porcupine)—Diamond drill cores from depth of 285 ft. showing good mineralization.

THOMPSON-KRIST (Porcupine)—Contract let for diamond drilling to begin first week in January.

MATTHEWS (Mine Centre)—In this claim, development is being undertaken on a copper vein believed to be a continuation of the Mine Centre vein.

KERR LAKE (Cobalt)—Production for November was 215,840 oz. of silver, compared with 210,073 oz. in October. Production for eleven months of 1916 was 2,343,645 oz.

APEX (Porcupine)—Diamond drilling started. Shaft will be put down from 125 ft. to 300 ft. and crosscuts run to cut veins coming in from West Dome and Dome Lake.

NIPISSING (Cobalt) In November, ore was mined of an estimated value of $246,629 and shipments made of bullion from Nipissing and customs ore of estimated net value of $372,636.

DAVIDSON—(Porcupine)—New vein, found at depth of 50 ft. in south shaft, is showing well. Bottom of shaft is in solid mineralized quartz with plentiful showings of free gold.

MINERAL PRODUCTS CO. (Madoc)—This company, of which Charles A. Darborn, West Somerville, Mass., is president and Charles R. Ross, manager, has commenced operations on a fluorspar property.

ALGOMA STEEL CORPORATION (Sault Ste. Marie)—It is understood that this company has let the contract for 4,000 ft. of diamond drilling at the Helen mine to the E. J. Longyear Co. of Minneapolis, Minn.

MINE CENTRE COPPER CO. (Mine Centre)—Company, which owns 8 claims, has shipped six cars of copper ore to the Trail smeltery from a vein 60 ft. wide carrying sulphides of copper and low gold contents. Will build concentrator during winter.

BEAVER (Cobalt)—Report for quarter ended Nov. 30 shows bullion, and ore at smeltery and mine 274,341 oz. and cash on hand $71,452. Vein found on 600-ft. level carrying 1,500-oz. ore; proved for 35 ft. Mill rock and some high-grade ore being recovered on 700-ft. level. Small stringers encountered in 400 ft. of crosscutting on 1,600-ft. level. On McKane claim, Kirkland Lake, shaft sunk from 300- to 400-ft. level; on latter level vein has been crosscut for 11 ft. without reaching south wall.

PERU

CERRO VERDE property of Carlos Lohmann acquired by William Braden, presumably for Anaconda or Andes Exploration Co. account. Property is 12 km. from Tiabaya station on the Ferrocarril del Sur and 161 km. from port of Mollendo.

SPITZENBERGEN

NORWEGIAN SYNDICATE, capitalized at about $2,680,000 and headed by the Central Bank of Norway, has purchased control of the Arctic Coal Co. from John M. Longyear and Frederick Ayer. of Boston, Mass. At different times, these coal mines have been sought by Russian and German interests.

The Market Report

Metal Markets

NEW YORK—Dec. 20, 1916

During the last week all of the markets were unsettled and lower, as was the case with most commodities and with the stock market.

Copper, Tin, Lead and Zinc

Copper—Following the peace proposal of Dec. 12, the market wavered. By Dec. 14 it was certain that copper was going to be offered for resale by consumers, and, indeed, such offerings developed in many quarters and for fairly liberal quantities. It was surprising how much copper turned up for sale, both for prompt and first-quarter delivery, in this market which had been so tight only a few days previous. Some first hands also found that they had some early copper to offer. As previously expressed, suspicion that some consumers had overbought proved to be correct. Observing the turn of the tide, those who purchased copper lower down and had a surplus of it were glad to take a profit. On the other hand, the opinion that some consumers had not covered their first-quarter requirements proved also to be correct, and some of these were buyers on the decline, while others expressed their intention of holding aloof until they could buy more cheaply. The transactions of the week naturally were small, but such as there were, together with offers and bids, gave a fair reflection of the market. Some first hands offered copper for delivery far ahead at relatively low prices, but we heard of no such transactions and such offers were, of course, purely speculative. The major market, which a fortnight ago was for second-quarter delivery, became this week for near-by and first-quarter. The premium on prompt copper has practically vanished.

Copper Sheets—The base price for copper sheets is at 42c. for hot rolled and 43c. for cold rolled. Wire is based on 37c., f.o.b. mill.

Tin—This market declined on small business. At the opening of the week spot was 42⅞c., and futures, 41⅞c. At the close, spot was 41⅞c. and futures, 41c.

Lead—This market declined further on the liquidation of speculative holdings and probably also on some bear selling. Some producers reported no sales, being entirely sold out up to February, and other producers found that they had lead available both for prompt and January delivery, and some round lots were sold at 7½c., New York, but later second hands were sellers at 7¼c. Some sellers made no distinction between St. Louis basis and New York basis, and the St. Louis market did not decline quite so much as New York. There were inquiries in the market from abroad, including some from Denmark, South America and Japan.

In the Dec. 16 issue of the "Journal" the price of lead at New York on Dec. 8 was given as 7⅝@7¾. By a typographical error the latter figure was wrongly printed—the correct price range was 7⅝@7⅞.

Spelter—At the beginning of the week, this market went off sharply. On Dec. 16 buyers became interested, especially galvanizers. The market meeting with some resistance, the decline was not only stayed, but there was a trifling advance. However, the buying demand petered out on Dec. 18 and the market again sold off, closing weak. Throughout the week, however the largest producers held aloof, most of them asking 11c.

In the "Journal" of last week some of the copies were blurred in printing so that the quotation of Dec. 13 on St. Louis spelter was not altogether clear. The correct quotation was 10⅞@11.

Imports at Baltimore during the week included 5,545 tons of zinc ore from Cartagena, Spain.

Zinc Sheets—The price of zinc sheets remains based on $21 per 100 lb., f.o.b. Peru, Ill., less 8% discount.

Other Metals

Antimony—Market quiet but firmer at 11½@15c. January-February shipment from China quoted at 13@13½c., c.i.f., New York, duty unpaid.

Quicksilver—Market quiet, but steady at $80. San Francisco reports by telegraph $78, firm.

Aluminum—Quotations remain nominally unchanged at 63@65c. per lb. for No. 1 ingots, New York. The market is very quiet, practically no transactions taking place.

Nickel—There is no change in the market quotation, prices remaining at 45@50c. per lb.; electrolytic commanding an extra 5c. per lb.

Gold, Silver and Platinum

NEW YORK—Dec. 20

Gold—J. P. Morgan & Co. deposited about $10,000,000 more gold at the Assay Office on Dec. 12, a shipment from Ottawa for account of the British Government. The inflow of gold to New York and Philadelphia during the last week has amounted to $27,000,000. Since Jan. 1 about $608,500,000 of the metal has come into the country.

The shipments of the 13th and 14th were partly in Russian and French coin, being drawn from the fund accumulated by Great Britain from her Allies' stores in the last two years. The total of $35,000,000 awaiting smelting at the Assay Office last night was enough to supply seven days' work for the plant, and because of this congestion it is expected in banking quarters that continued shipments will be made to Philadelphia and San Francisco if the gold movement continues on a broad scale.

Silver—Market continues steady with good undertone, but no new features present themselves. Latest letters from London indicate the demand on the Indian Treasury for rupees has been very great. This necessitates further silver coinage as from date of Dec. 1.

Under date of Nov. 30, Samuel Montagu & Co., London, report that although purchases have not been made upon any substantial scale on account of China, the firmness of exchanges from that quarter has not been without effect upon prices, for it has acted as a deterrent to sellers. Prices have advanced without a check, though with pauses, from 34[illegible] to 35[illegible]d., but no sensational rises have taken place as was the case in May last. Selling has been fitful in amount and on the whole, sluggish. Buying has been varied in character and comprised some orders from the Indian Bazaars. The stock in London was reported on the 24th inst. as 8,360,000 standard ounces, an increase of about 600,000 since the 27th of last month. A considerable portion of the stock, however, was earmarked and not available for resale.

It will be observed from the figures given below that during one week the net shrinkage of the silver holding in the Indian treasuries, inclusive of fresh coinage, amounted to about 11,000,000 rupees. To replace this amount the quantity of silver required would be almost equal to the present stock in Bombay. The decline has not been spasmodic, but almost without a break from July 31 last, when the total holding was over 28,000,000 rupees. During this time very large additions of fresh minted coin have been made.

Mexican dollars for Dec. 18, 19 and 20 are quoted at 59½@62⅛c.

Platinum—Market dull and weaker. We quote $80@82.50.

Palladium—Declined to $60 per oz.

Iridium—Quoted at $150 per oz.

Zinc and Lead Ore Markets

Joplin, Dec. 16—Price quotation per 2,000 lb. Blende, high $96.70, 60% zinc, premium ore $95, medium $90@85, low $80; calamine per ton 40% zinc, $60@50; average selling price, all grades of zinc, $87.72 per ton.

Lead, high price, $99.60; base, $99@96; average selling price, all grades of lead, $91.90 per ton.

Shipments of the week: Blende, 7,642 tons; calamine, 475 tons; lead, 1,176 tons. Value, all ore the week, $820,110; 50 weeks, $36,[illegible]720.

Peace talk seems to have wrecked the metal market and the ore market has suffered to some extent, but the apparent shortage in production prevents lowering ore prices on a parity with the metal.

Sellers of zinc ore take no stock in the peace talk and very little ore was offered for sale this week, the week's shipment being from advance purchases.

Other Ores

Tungsten Ore—Market [illegible] announcement of German peace proposal. At the close we quote $1[illegible]

Charles Hardy reports [illegible] Dec. [illegible] week as follows: "One of the [illegible] in the tungsten market has been experienced [illegible] letter was immediately [illegible] issued, the German [illegible] and the market [illegible] how [illegible] peace would affect the tungsten position. Inquiries as to the market [illegible] reached [illegible] from all quarters and [illegible] being [illegible] with orders, it was easy to [illegible] quantities [illegible] upon the market from [illegible] sellers. As [illegible] the [illegible] peace would not affect the price downward, but rather upward for the first few months, [illegible] a heavy buying movement would start for consumption in Europe. Independent, however, of the prospect of peace, Great Britain and France appeared again on the market as buyers on a large scale during the past fortnight and closed not only prompt deliveries, but also contracted to cover requirements for the next six months. The price paid ranged from $16.50 to $18, the latter price was paid for high grade Argentine ore. At the moment of writing one of our greatest [illegible] has come into the market for large quantities and the market is quite firm from prices at $17.50 to $20, according to grade and position. The tungsten position in Great Britain has been such that though the [illegible] largest users of tungsten [illegible] to build their [illegible]

SILVER AND STERLING EXCHANGE

Dec.	Sterling Exchange	New York, Cents	London, Pence	Dec.	Sterling Exchange	New York, Cents	London, Pence
14	4 7550	75[illegible]	36[illegible]	18	4 7550	76[illegible]	36[illegible]
15	4 7563	76[illegible]	37	19	4 7544	76[illegible]	36[illegible]
16	4 7563	76[illegible]	36[illegible]	20	4 7544	76[illegible]	36[illegible]

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine.

DAILY PRICES OF METALS IN NEW YORK

	Copper	Tin	Lead		Zinc
Dec.	Electrolytic	Spot	N. Y.	St. L.	St. L.
	33				10[illegible]
14	@33[illegible]	42[illegible]	7[illegible]	7[illegible]	@10[illegible]
	32[illegible]		7[illegible]	7[illegible]	9[illegible]
15	@33	42[illegible]	@7[illegible]	@7[illegible]	@10
	32[illegible]		7[illegible]	7[illegible]	[illegible]
16	@32[illegible]	42[illegible]	@7[illegible]	@7[illegible]	@10[illegible]
	32[illegible]		7[illegible]	7[illegible]	10
18	@32[illegible]	42	@7[illegible]	@7[illegible]	@10[illegible]
	32		7[illegible]	7[illegible]	9[illegible]
19	@32[illegible]	42[illegible]	@7[illegible]	@7[illegible]	@10
	31		7[illegible]	7[illegible]	9
20	@32	41[illegible]	@7[illegible]	@7[illegible]	@9[illegible]

The above quotations are our appraisal of the average of the major markets based on [illegible] and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for the deliveries constituting the major markets, reduced to basis of New York, [illegible] except where St. Louis is the normal basing point.

The quotations for electrolytic copper are for [illegible] ingots and wirebars. Electrolytic copper is [illegible] sold on "regular terms" (r.t.), including freight to the buyer's works and is subject to a discount for cash. The difference between the price delivered and the New York cash equivalent is at present about 0.25[illegible] [illegible] domestic business. The price of [illegible] is 0.05 to 0.10c. below that of electrolytic. Quotations for spelter are for ordinary Prime Western brands. We quote New York price at 17[illegible] 0[illegible] above St. Louis.

Some current freight rates on metals per 100 lb.: St. Louis-New York, 17[illegible]; St. Louis-Chicago, [illegible] 6.3[illegible]; St. Louis-Pittsburgh, 13.1[illegible].

LONDON

	Copper			Tin	Lead	Zinc	
	Standard		Electrolytic				
Dec.	Spot	3 Mos.		Spot	[illegible]	[illegible]	[illegible]
14	142[illegible]	136	164	184[illegible]	[illegible]	[illegible]	[illegible]
15	142	136	164	184[illegible]	[illegible]	[illegible]	[illegible]
16							
18	142	136	162	[illegible]	[illegible]	[illegible]	[illegible]
19	142	136	16[illegible]	[illegible]	[illegible]	[illegible]	4[illegible]
20	142	136	161	[illegible]	[illegible]	[illegible]	4[illegible]

[illegible] Metal Exchange [illegible] per ton of 2,24[illegible] [illegible] of 1[illegible] [illegible] 2,240 lb. [illegible] the following [illegible] 4[illegible] [illegible] 20 [illegible] 6.4[illegible] [illegible] own works for the reduction of tungsten, these works have not been able to work continuously, being hampered by a shortage of ore supplies. The prospects of the tungsten market are that prices will not only be manitained, but will have a tendency to harden."

Antimony Ore is difficult to obtain and buyers are reported offering as high as $1.70 per unit c.i.f., New York.

Manganese Ore—Higher prices are being named on Indian manganese ore at tidewater principally as a result of freight rate increases, although the offering supply of ore also is limited. A quotation was made yesterday at a shade under 78c. a unit, at tidewater. A large eastern Pennsylvania consumer reports Brazilian ore may be had at around 60c. a unit, delivered at Eastern seaboard. This figure is out of line with that commonly heard in the market and some sellers will not entertain less than 70c.

Imports at Baltimore during the week included 7,000 tons of manganese ore from Brazil.

Iron Trade Review

NEW YORK—Dec. 20

The outstanding feature of the week's market has been the German peace suggestion and the consequent panic-like decline in stocks. In the actual market for the metal itself there has been no great change and no perceptible effect of the peace proposition. The trade is dominated, undoubtedly, by the belief that at this date no basis of agreement can be found upon which the war can be ended soon. The consensus of opinion seems to be that, while there may be some talk about peace, and it may go so far as to result in a congress of representatives of different governments, yet reaching of peace terms is unlikely.

PITTSBURGH—Dec. 19

The entire iron and steel market has suddenly slowed down in the past week and is now distinctly quiet. There is scarcely any inquiry for deliveries after the middle of next year, and not a great deal for the earlier deliveries. Such inquiry could not result in much business in any event because the mills are already so well sold up. There is no weakness whatever in prices, which are as firmly maintained as ever, but the sharply advancing tendency of the market, which was exemplified by continued advances in one product or another until a week or two ago, has evidently been arrested.

The German peace proposal, news of which reached large buyers and sellers a few hours after last week's report was written, resulted in some diminution in buyers' enthusiasm, for the next morning's mail, brought less than the usual amount of inquiry. The possibilities of the overture really leading to peace are appraised higher in the trade than a week ago. All of the slowing down that has occurred is not to be attributed to the peace proposal, however, for trade was marked to slow down within a short time, the pace of November, when the Steel Corporation booked nearly twice as much tonnage as it shipped, could not be maintained when the mills were already so well filled, while a slowing down in the market always occurs a few days before Christmas.

The transportation situation has grown worse. Car shortages are still more pronounced, while a great many embargoes have been placed. The New York Central has an embargo against the Pittsburgh & Lake Erie as to shipments east, except export material with a special permit, and there are various other embargoes. Steel continues to accumulate at some mills and while the tonnage is not large in proportion to production it is large compared with storage facilities, and if improvement in transportation does not come within a week or two a curtailment in production at some points will be forced.

Pig Iron—Demand for pig iron has become very light for the late deliveries but there is occasional urgent inquiry for prompt and first quarter iron. The slowing down in demand only makes the showing clearer that early delivery iron is very scarce, for offerings have not increased. Malleable is very difficult to find at any price. Production at the merchant furnaces has probably been curtalied somewhat by the coke scarcity, but as yet not seriously. One Shenango valley furnace is banked. We quote: Bessemer, $35@37; basic, $30; foundry, second half, $30; prompt, $31@32; malleable, prompt, $32@33; forge, $29@30, f.o.b. valley furnaces, 95c. higher delivered Pittsburgh.

Steel—Bids for billets for export have advanced, and in some cases it is possible $60 could be obtained. There is practically nothing being done in the domestic market. We quote: Billets, $55@60; sheet bars, $57@62; rods, $70@75; forging billets, $80.

FERROALLOYS

Ferromanganese—Domestic producers of ferromanganese recently began advancing prices, and all are now up to $175 for spot or contract, an advance of $10. Imported on contract remains at $164, and there is no prompt imported as deliveries are behind on contracts.

Spiegeleisen—Spot and contract is quoted $50@55 per ton.

Ferrosilicon—Quotations on 50% material are at $100 per ton. For 10% bessemer ferrosilicon the figure of $42 is asked.

STOCK QUOTATIONS

N. Y. EXCH †	Dec. 19
Alaska Gold M.	12¼
Alaska Juneau	7¼
Am. Sm. & Ref., com.	106¾
Am. Sm. & Ref., pf.	114½
Am. Sm. Sec., pf. A	98
Am. Sm. Sec., pf. B.	94½
Am. Zinc	44½
Am. Zinc, pf	75
Anaconda	86¼
Batopilas Min	1¼
Bethlehem Steel	540
Bethlehem Steel, pf.	145
Butte & Superior	51
Chile Cop.	26¼
Chino	55½
Colo. Fuel & Iron	47¼
Crucible Steel	66¼
Dome Mines	20½
Federal M. & S.	13
Federal M. & S., pf.	42
Great Nor., ore ctf.	39
Greene Cananea	46
Homestake	132
Inspiration Con	58½
International Nickel	43
Kennecott	47
Lackawanna Steel	88
Miami Copper	39¾
Nat'l Lead, com.	61¼
National Lead, pf.	110
Nev. Consol.	25¼
Ontario Min.	6⅝
Quicksilver	2
Quicksilver, pf.	2½
Ray Con	27¾
Republic I.&S., com.	79¾
Republic I. & S. pf.	107
Sloss-Sheffield	64½
Tennessee C. & M.	19
U. S. Steel, com	112
U. S. Steel, pf	119
Utah Copper	103½
Va. Iron C. & C.	52

N. Y. CURB †	Dec. 19
Buffalo Mines	1.10
Butte & N. Y.	1½
Butte C. & Z.	11⅝
Caledonia	.50
Can. Cop. Corpn.	1¼
Cashboy	.07
Cerro de Pasco	39¼
Con. Ariz. Sm	2 1/16
Con. Coppermines	4 1/16
Con. Nev.-Utah	.18¼
Crystal Cop.	1
First Nat. Cop	3⅞
Florence	80
Goldfield Con	.55
Goldfield Merger	.06½
Granite	.50
Hecla Min.	7⅝
Howe Sound	7
Jerome Verde	1½
Joplin Ore & Spel	35
Kerr Lake	4⅞
Magma	40
Majestic	81¼
McKinley-Dar-Sa	50
Mother Lode	44
Nevada Hills	.21
N. Y. & Hond	16¾
Nipissing Mines	9
Oro	‡ 03½
Ray Hercules	4¾
Rochester Mines	70
St. Joseph Lead	17
Standard S. L	1 1/16
Stewart	.25
Success	.46
Tonopah	4¼
Tonopah Ex.	4¼
Tribullion	.37½
Troy Arizona	.55
United Zinc	4½
White Knob, pf.	2¼
White Oaks	3¼
Yukon Gold	2⅝

SAN FRAN.*	Dec. 19
Alta	.04
Andes	18
Best & Belcher	06
Bullion	01
Caledonia	.25
Challenge Con	06
Confidence	.10
Cons. Imperial	‡ 01
Con. Virginia	.10
Gould & Curry	03
Hale & Norcross	09
Jacket-Cr. Pt.	.03
Mexican	19
Occidental	65
Ophir	.17
Overman	06
Savage	05
Seg Belcher	02
Sierra Nevada	19
Union Con.	.54
Utah Con.	02
Belmont	4 65
Jim Butler	84
MacNamara	06
Midway	.21
Mont.-Tonopah	.18
North Star	.13
Rescue Eula	.25
West End Con.	.70
Atlanta	.09
Booth	.09
C.O.D. Con	‡ .02
Comb. Frac.	05
D'field B.B	04
D'field Daisy	.04
Jumbo Extension	.27
Round Mountain	.38
Sandstorm Kendall	‡ .04
Silver Pick	.27
Argo	06
Ariz. Central	.10
Big Jim	1.25
Lazy Boy	.05
Nellie	.29
Tom Reed	1 90
United Eastern	5 10
United Western	04

BOSTON EXCH.*	Dec. 19
Adventure	4
Ahmeek	110
Algomah	1½
Allouez	66¼
Ariz. Com., ctfs	14¼
Bonanza	‡ 40
Butte-Ballaklava	2
Calumet & Ariz	80
Calumet & Hecla	545
Centennial	19½
Copper Range	68
Daly West	3
East Butte	16½
Franklin	9¼
Granby	93½
Hancock	16½
Hedley	24
Helvetia	90
Indiana	4
Island Cr'k, com.	65½
Isle Royale	36½
Keweenaw	4½
Lake	14¼
La Salle	4¼
Mason Valley	6¼
Mass	15¼
Mayflower	40
Michigan	3¾
Mohawk	96¼
New Arcadian	5⅝
New Idria	16
North Butte	24½
North Lake	2
Ojibway	2½
Old Colony	2½
Old Dominion	66
Osceola	94
Quincy	90
St. Mary's M. L.	93
Santa Fe	2
Shannon	9¼
Shattuck-Ariz.	28
So. Lake	5
So. Utah	.36
Superior	16
Superior & Bost.	5½
Tamarack	43½
Trinity	6¾
Tuolumne	2⅛
U. S. Smelting	66½
U. S. Smelt'g, pf.	52
Utah Apex	3¾
Utah Con	18⅛
Utah Metal	6¼
Victoria	6¼
Winona	5
Wolverine	48
Wyandot	1¼

BOSTON CURB*	Dec. 19
Alaska Mines Corp.	.92
Bingham Mines	9⅜
Boston Ely	55
Boston & Mont.	61
Butte & Lon'n Dev	.50
Calaveras	5
Calumet-Corbin	01¼
Chief Con	2 1/16
Cortez	25
Crown Reserve	40
Davis-Daly	‡6 11/16
Eagle & Blue Bell	1⅞
Houghton Copper	1⅜
Iron Cap Cop., pf	17
Mexican Metals	.40
Mines of America	2
Mojave Tungsten	1½
Nat. Zinc & Lead	.60
Nevada-Douglas	1⅞
New Baltic	2¾
New Cornelia	16½
Ohio Copper	1½
Oneco	.75
Rex Cons	45
Rilla	06
United Verde Ext.	38¼

SALT LAKE*	Dec. 19
Big Four	1 10
Black Jack	05
Cardiff	7 25
Colorado Mining	16½
Crown Point	04¼
Daly-Judge	8 50
Emma Cop.	1 50
Empire Copper	1 50
Gold Chain	15
Grand Central	52
Iron Blossom	1 17
Lower Mammoth	06¾
May Day	.10½
Opohongo	‡ 01¾
Prince Con.	1.20
Seven Troughs	‡ 03
Silver-King Coal'n	3.30
Silver King Con.	4.55
Sioux Con.	.12½
So. Hecla	1.30
Uncle Sam	.06
Wilbert	.09
Yankee	.20

TORONTO*	Dec. 19
Bailey	06½
Beaver Con.	.43
Chambers Ferland	16
Coniagas	4 75
La Rose	.56
Peterson Lake	17
Right of Way	05
Seneca Superior	‡ 09
T. & Hudson Bay	72.00
Temiskaming	61½
Wettlaufer-Lor	.09
Dome Exten	24
Dome Lake	62
Foley O'Brien	70
Hollinger	6 80
Jupiter	27
McIntyre	1 80
Newray	54
Porcu. Crown	67
Vipond	.46
West Dome	33

STOCK QUOTATIONS—Continued

COLO. SPRINGS	Dec. ..
Cresson Con	7.70
Doctor Jack Pot.	.10½
Elkton Con.	.12
El Paso	.41
Findlay	.06¾
Gold Sovereign	.06¾
Golden Cycle	2.58½
Granite	.62
Isabella	.22¼
Mary McKinney	.27
Portland	2 00
Vindicator	1.25

LONDON			
Alaska Mexican	£0	12s	6d
Alaska Tre'dwell	2	15	0
Burma Corp.	3	10	6
Cam & Motor	0	10	6
Camp Bird	0	6	6
El Oro	0	7	6
Esperanza	0	10	0
Mexico Mines	3	12	6
Nechi, pfd	0	12	0
Oroville	0	16	0
Santa Gert'dis	0	9	6
Tomboy	1	1	3

* Bid prices. † Closing prices. ‡ Last Quotations

MONTHLY AVERAGE PRICES OF METALS

Silver	New York			London		
	1914	1915	1916	1914	1915	1916
January	56 572	48 855	56.775	26.553	22.731	26.960
February	57 506	48 477	56.755	26 573	22.753	26 975
March	58 067	50 241	57.935	26 788	23.708	27 597
April	58 519	50 250	64.415	26 958	23.709	30 662
May	58 175	49 915	74 269	26 704	23 570	35 477
June	56 471	49.034	65 024	25 948	23.267	31 060
July	54 678	47.519	62 .940	25.219	22.597	30 000
August	54.344	47 163	66 083	25.979	22 780	31 498
September	53 290	48 680	68.515	24.260	23 591	32 584
October	50 654	49.385	67.855	23.199	23 925	32 361
November	49 082	51.714	71.604	22 703	25 094	34 192
Dec.	49 375	54.971	......	22 900	26 373	
Year	54.811	49.684	......	25.314	23 675	..

New York quotations cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

Copper	New York		London			
	Electrolytic		Standard		Electrolytic	
	1915	1916	1915	1916	1915	1916
Jan	13.641	24.008	60 756	88 083	65.719	116.167
Feb	14.394	26 440	63 494	102.667	*	133 167
Mar.	14.787	26.310	66.152	107.714	*	136 000
April	16.811	27.895	75.096	124.319	*	137.389
May	18.506	28.625	77.600	135.457	*	152.522
June	19.477	26.601	82.574	112.432	95.333	137 455
July	18.796	23.865	76.011	95.119	91 409	125 500
Aug.	16 941	26.120	68.673	110.283	82.333	126 304
Sept.	17 502	26 855	68 915	113.905	85.250	134 071
Oct.	17 686	27 193	72.601	122.750	88 000	142 523
Nov.	18 627	30.625	77.744	134 659	93.273	155 432
Dec.	20.133	.....	80.773	.....	100 430	
Year	17 275	.....	72.532	.....	.....	.....

Tin	New York		London	
	1915	1916	1915	1916
January	34 260	41 825	156 550	175 548
February	37 415	42.717	176 925	181 107
March	48 426	50.741	180.141	193 609
April	47 884	51.230	166 225	199 736
May	38 790	49.125	162 675	196 511
June	40 288	42.231	167.636	179 466
July	37 423	38.510	167.080	168 357
August	34 389	38.565	151.440	169 870
September	33 125	38 830	152.625	171 345
October	33.080	41 241	151.554	179 307
November	39.224	44 109	167.670	186 932
December	38 779		167 000	....
Av. year	38 590	.....	163 960	....

Lead	New York		St Louis		London	
	1915	1916	1915	1916	1915	1916
January	3 729	5 921	3 548	5 826	18 606	31 167
February	3 827	6.246	3.718	6.164	19.122	31 988
March	4 053	7.136	3.997	7 375	21 883	34 440
April	4.221	7 639	4 142	7 655	21.094	34.368
May	4.274	7 463	4 182	7.332	20 347	32.967
June	5.932	6 936	5 836	6 749	25 170	31 011
July	5.659	6 352	5 531	6 185	24 611	28.137
August	4 656	6 244	4 520	6 088	21 946	29.734
September	4.610	6.810	4 490	6 699	23.151	30 786
October	4 600	7.000	4 499	6 898	23.994	30.716
November	5.155	7 042	5 078	6 945	26 278	30 500
December	5.355	.....	5 266		28 807	.
Year	4 673	.....	4.567	...	22 917	.

Spelter	New York		St. Louis		London	
	1915	1916	1915	1916	1915	1916
Jan.	6 386	16.915	6 211	16 745	30 844	89 810
Feb	8 436	18.420	8 255	18 260	39 819	97 762
Mar	8.541	16.846	8.360	16 676	44 141	95 048
April	10.012	16.695	9 837	16 525	49 888	99 056
May	14.781	14.276	14.610	14 106	68 100	94 217
June	21.208	11 752	21.038	11.582	100 614	68 591
July	19.026	8.925	18.856	8 755	97.250	50 750
Aug	12.781	8.730	12.611	8 560	67.786	51.587
Sept	13.440	8.990	13.270	8.820	67.841	52 095
Oct.	12.800	9 829	12.596	9.659	66.536	54 159
Nov.	15.962	11.592	15.792	11 422	88 409	56 023
Dec.	15.391	.	15.221	.....	89 400	
Year	13.230	.....	13.054	.....	67.553	

New York and St. Louis quotations, cents per pound, London, pounds sterling per long ton. * Not reported.

Pig Iron, Pitts.	Bessemer‡		Basic‡		No. 2 Foundry	
	1915	1916	1915	1916	1915	1916
January	$14 59	$21 60	$13.45	$18 78	$13.90	$19 70
February	14 55	21 16	13.45	18.93	13.90	19 51
March	14 55	21 81	13.45	19.20	13.95	19 45
April	14 55	21 65	13.45	18.95	13.95	19 45
May	14 61	21 78	13.60	19 11	13.83	19 58
June	14 70	21.95	13 67	18 95	13 77	19.34
July	14 94	21 95	13 91	18 95	13 68	19 20
August	16 01	21 95	15 31	18 95	14 75	19 25
September	16 86	22 88	15 95	19.58	15 70	19 53
October	16 95	24 61	15 96	21.26	15.80	21 51
Novemoer	17.57	29 12	16 47	27.23	17.20	25 60
December	19 97	.....	18.44	..	18.95	...
Year	$15 82	...	$14 76		$14 95	.

‡ As reported by W. P. Snyder & Co.

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Sulphuric Acid from Copper Smelting Gases

By E. L. Larison*

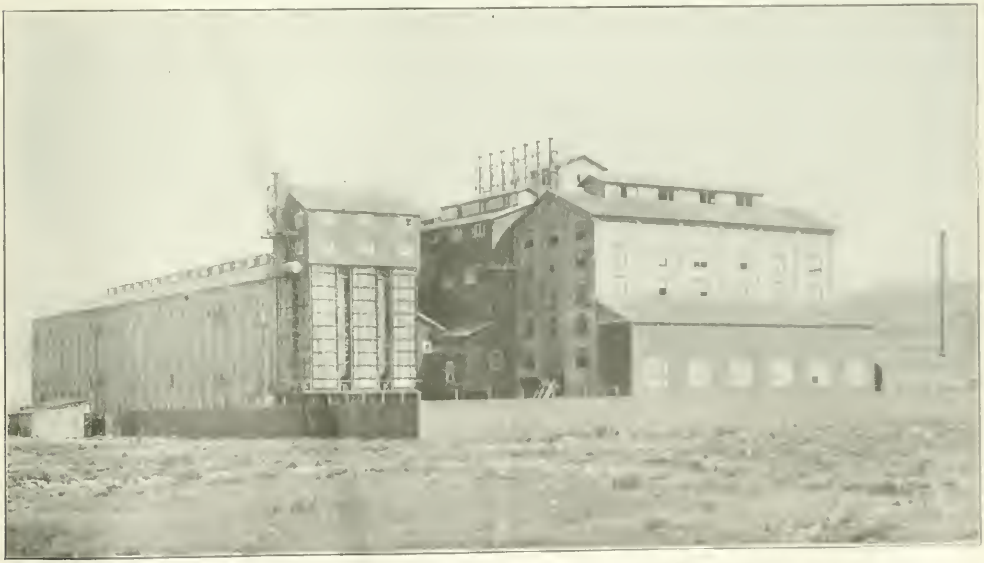
SYNOPSIS—The four largest acid plants in the United States operating on gases from copper smelteries are those of the Mountain Copper Co., Mococo, Calif.; Tennessee Copper Co., Copperhill, Tenn.; Ducktown Sulphur, Copper and Iron Co., Isabella, Tenn.; and Anaconda Copper Co., Anaconda, Mont. Details of acid manufacture at each of the plants are given. They all employ the old chamber method rather than the newer contact process, for which reasons are given.

The last 10 years, and particularly the last three years, have witnessed developments in the metallurgy of copper and zinc which involves the use of large quantities of sulphuric acid. These are, of course, leaching and flotation. It is almost always desirable to make the acid at the works using it, because transportation is expensive, and if smeltery gases are available, acid can be made for much less than it can be bought.

There are at least four copper-reduction works in the country that have sulphuric-acid plants of consequence operating on gases made in the regular course of the reduction of the ores. These are the Mountain Copper Co., whose acid plant at Mococo, Calif., was erected about 12 years ago; the Tennessee Copper Co., whose first unit was built nine years ago; the Ducktown Sulphur, Copper and Iron Co., whose plant at Isabella, Tenn., was put into operation about eight years ago; and the plant at the Washoe Reduction Works at Anaconda, which began operating about 18 months ago.

The Mountain Copper Co. plant uses gas from McDougall type roasters, the sulphur-bearing material being fines from the company's heavy sulphide ores. This ore carries 18 to 50% sulphur. The calcine is treated along with other materials, in reverberatories. The acid plant consists of six Meyer tangential chambers and suitable Glover and Gay-Lussac towers. The output is about 35 tons of 100% acid or 45 tons of 60° B. acid daily.

While this happens to be an example of a company with copper production as the chief end, this ore was also well suited for acid making. In fact, [illegible]



ACID PLANT OF WASHOE REDUCTION WORKS, ANACONDA, MONT same ore to other firms particularly for acid making. There are no particular novelties or differences in the process from the conventional chamber-plant burning such as that, for example, employed at Rio Tinto.

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*Metallurgical engineer, superintendent acid department, Anaconda Copper Co., Anaconda, Mont

ACID FROM PYRITIC SMELTING IN TENNESSEE

The Tennessee Copper Co. and the Ducktown Sulphur, Copper, and Iron Co. both use gases from blast furnaces. The Ducktown ores are unusual. They are heavy sulphide ores, the iron mineral being largely pyrrhotite with only a small proportion of pyrite, and the copper mineral being chalcopyrite. The following is an analysis of a typical sample: Pyrrhotite, 29.50%; pyrite, 5.82; chalcopyrite, 7.89; blende, 4.23; magnetite, 7.73; quartz, 15.59; silicates, 22.74; calcite, 2.16; and dolomite, 3.56%. The quantitative analysis of this ore is: Cu, 2.74%; Fe, 30.37; S, 18.87; SiO, 26.96; CaO, 66.70; MgO, 2.97; Mn, 0.34; Zn, 2.80; AlO, 2.91.

The reduction practice of both companies is the same. The ore is taken directly from the mines to the furnace bins with no preliminary dressing whatever. It is smelted in water-jacketed blast furnaces with from 4 to 6% coke and a small amount of quartz. A matte is made carrying 12 to 15% copper. This is run into beds, broken up, and resmelted with a sufficient amount of quartz on the charge to produce a 40 to 50% Cu matte. The process is about as near to true pyritic smelting as is attained anywhere.

When these two companies first attempted the manufacture of acid from blast-furnace gases, it was not known just how seriously detrimental to the process the high CO_2 content and the irregular SO_2 was going to be. There were no precedents. It was supposed that the CO_2 would tend to segregate, producing dead corners and perhaps blanketing the bottom acid. It was not a very attractive undertaking, technically. There were two conditions that made it necessary and possible to make acid. The Supreme Court decision in the Georgia case made it imperative to do away with most of the smoke. The fortunate and redeeming feature of the situation was that the plants are situated in the center of the greatest fertilizer-consuming district in this country. A market for the acid was assured.

Tests on the gas delivered by the blast furnaces showed that when they were in good condition, there was an almost complete consumption of the oxygen blown in. By this is meant when no bad crusts or blowholes existed in the charge. This phenomenon was first noted by Robert Sticht in his pyritic work in Tasmania. It was many times confirmed at the Ducktown plant. Some doubt has been expressed at times as to the reliability of these results on account of using metal pipes for drawing the samples in some cases. Numbers of these tests were later made with silica tubes in the gas stream, so that no consumption of the oxygen by the hot metal of a pipe was possible.

AIR ADMISSION COMPLICATES PROCESS

The other constituents of the gas were normally about as follows: SO_2, 8 to 9%; CO_2, 6 to 7%; CO, 0.8 to 1.0%; N, about 84%. It was necessary to admit air to this gas in sufficient amount to allow the acid-making reactions to take place and to give some excess-oxygen in the exit gas. Several different methods and proportions were tried. It was a case of being between the devil and the deep sea. If normal oxygen were maintained—that is, 4 to 6%—in the exit gas, so much air would have to be admitted that the SO_2 tenor of the gas entering would be very low. After trying many different ideas, the Ducktown company decided that the best results were attained by blowing in air at several points in the system. This was done with low-pressure blowers, and the control of the air volume was positive and close. This method is much better than simply allowing flues under suction to draw in air, for drafts always vary from time to time and good control is not certain. The first air was blown in at the flue between the furnace and the Glover tower, and an oxygen content of 3% was aimed at. Each chamber was fitted with air pipes and valves, and the valves were so manipulated as to maintain from 3 to 4% oxygen throughout the system at any given point. Below 3% oxygen, the vigor of the reactions fell off, and the niter recovery in the Gay-Lussacs decreased. This scheme of introducing air at various points as the oxygen is consumed was devised by N. L. Heinz, the company's consulting engineer. While this arrangement was the best one discovered, there was never the same vigorous reaction in the front of the system as that which took place with gas having the usual SO_2 and oxygen percentages.

CO_2 GAS MAKES PROCESS SLUGGISH

The effect of the CO_2 was certainly bad, but not in the exact way that had been looked for. Many times for days together the CO_2 percentage equaled or even exceeded that of the SO_2. This occurred when the furnace condition demanded more coke than usual or when the grade of matte became too low; that is, when the sulphur elimination fell off. As to segregation of the CO_2, we were never able to establish any such thing in the chambers. Many tests at different levels and in corners, etc., failed to show CO_2 consistently higher in any parts of the same chamber. The general effect of CO_2 is simply to slow down the reactions and make the process sluggish. It is difficult with high CO_2 to oxidize the last one or two tenths of a per cent of SO_2, and in order to get a reasonable production, a little SO_2 must be allowed to go to the Gay-Lussacs. This of course makes niter loss abnormal. To compensate to some extent for the deadening effect of the CO_2, a very large niter circulation was maintained, and this also tended to make the Gay-Lussac loss more than normal.

The irregularities of the gas quality and quantity were found to be quite as serious as the CO_2 feature. It is to be expected that blast-furnace gas would be irregular, because of the necessity of frequent opening to charge, to bar down crusts, and to perform many other necessary operations. Changes in the composition of the ore, or irregularities in weighing influence the gas immediately. We were able, by means of the air-blower system previously mentioned, to take care of some of the variations. When, however, the relation of the CO_2 to SO_2 changed considerably, very little could be done except at the furnace. Operating the furnace for gas as well as matte becomes a matter requiring much more skill and attention than when matte alone is the aim.

The problem of exclusion of false air at the furnace top always gave trouble and always will. It is very difficult if not impossible to make tight the top of a copper blast furnace as now constructed. When the acid plants were built, the Tennessee Copper Co. was using the conventional side-charging method employing vertical sliding doors. The Ducktown company had an unusual arrangement. Instead of the ordinary brick and steel superstructure with steel flue downtake, the gas was taken off at one side of the furnace below the charge floor level. The furnace was covered by a flat top made up of water jackets, which was hung from trucks. These ran on a track laid in water beams resting on the tops of the side jackets of the furnace. A charge car electrically driven, ran on the same track, which extended back under the charge bins. The essential feature of this charge car was an endless belt made up of lapping steel plates and driven by a motor. To operate this arrangement, the car ran under the bins and the charge was drawn down onto the belt. The car then advanced over the furnace, pushing ahead of it the furnace top. By moving the belt forward, the charge was dumped and distributed as the operator desired.

It soon developed that the acid plants got better gas and could control the process more closely when the flues were so dampered as to create some slight back pressure at the furnace tops. The ideal condition for operating both furnace and acid plant was to have neither pressure nor suction at that point. This was aimed at, but the way it worked out was that the acid plant maintained some back pressure. This made conditions on the charge floor bad, and the hot gas was very hard on the structure.

N. H. Emmons, in the *Journal*, of Mar. 18, 1911, described the experience of the Tennessee Copper Co. with furnace tops. At that time he considered best a top similar to the usual design, but with cast iron instead of steel for the posts and dividers and with inward-opening doors operated by an ordinary railroad switch stand. This article shows by photograph the destructive effects of the hot gas blowing back upon the structural-steel parts of the original top. If any changes in top design have been made there I do not know.

The Ducktown company found its top and charging arrangement to work successfully. One improvement was made, however. The original top had no means for raising or lowering, but an inch or two of clearance was left between the lower face of the top and the edge of the water beams. Later, the top was altered to raise and lower by the use of four air cylinders. Just before the charge car arrived each time, the top was raised about four inches, and when charging was completed, it was lowered to seat on the edge of the beams. This made a practically tight top so long as it was kept in good adjustment. W. H. Freeland, former manager of the Ducktown company, devised this top and charging arrangement.

HIGH VS. LOW CHAMBER CONSTRUCTION

The acid systems themselves at the two plants differed greatly. The original Tennessee plant consisted of 12 Falding high chambers, 50x50 ft. by 70 ft. high. The idea with this type of chamber was to have each one accomplish the complete process in itself. The gas mixture was admitted at the top, and as the SO_2 was oxidized and the vigor of the reaction became less and generated less heat, the gas cooled and finally was drawn off at a point near the bottom. The gas movement was originally intended to be accomplished by the pull of the 325-ft. smelter stack, and [illegible] in the connecting flues [illegible]. This plant was never very successful while working along these lines, and it was later altered. The chambers were connected in series, fans were added, and the work was much improved.

The results obtained from high chambers were apparently no better [illegible] than those from chambers whose long dimension is horizontal. It is customary where ground space is [illegible] to have chambers 30 ft. wide instead of 40 ft. or less. It also introduces some structural problems.

ACID PLANT OF DUCKTOWN SULPHUR, COPPER AND IRON CO., ISABELLA, TENN.

Unless ground space is limited, it is probably better to build the vertical dimension not over 30 to 40 ft., on account of the difficulties of building maintenance, and of operating high structures.

The Ducktown company's plant was built more along conventional lines; that is, the chambers were about 24x30 ft. by 96 ft. long and were connected eight in a set. Special flue connections between them were designed to thoroughly mix and cool the gases and to prevent segregation of the CO_2. They were quite effective in this, but were rather expensive to build and difficult to repair.

Both plants found it economical to provide unusual Gay-Lussac space on account of the large niter circulation and the sluggish process. Whereas in the usual plant Gay-Lussac volume equal to from 2 to 3% of the chamber space is sufficient to give 85 to 90% niter recovery, the Tennessee and Ducktown plants both had near 6% and had even then, high losses.

No Charge for Sulphur Results in Low Costs

The cost of making acid at these plants was low because there was no charge for sulphur, which ordinarily amounts to about \$3 per ton of 60° acid. Niter cost, as mentioned, was high. Whereas many plants run with from 3 to 4% niter and some under 3%, these plants on blast-furnace gas used from 6 to 8%. This means, with niter at \$50 a ton, that the ordinary cost per ton of acid for niter is 40 to 50c., while the Tennessee plants were doing well under \$1 per ton.

Labor in the South is cheap, so that actual labor cost was low. The number of men required, however, was large owing to the irregularity of the process and to the dirty gas, which made an unusual amount of flue cleaning and tank washing necessary. It should also be said that the irregularities of gas supply, together with frequent complete stops, also the high niter circulation, were very hard on the lead, so that the life of these plants will be shorter than normal, and repair costs high.

The Tennessee Copper Co. operated its acid plant on a mixture of gas from several furnaces. Some doubt was expressed at first as to whether successful operating could be done with only one furnace. The Ducktown company, however, showed that very good work could be done with one furnace alone; in fact, the customary practice there is to run only one.

Anaconda Low Pressure Complications

The acid unit at Anaconda was described by Mr. Mathewson in the *Journal* of Apr. 24, 1915. Its purpose was to supply acid for leaching and flotation. The gas is derived from fine jig concentrates from the mill, which carry 35% S and 7% Cu. This material is roasted to about 7% S, which is the grade of calcine desired by the reverberatories. Except for the fact that the ground for a large acid plant was not available within the smeltery site at Anaconda, the plant would have used gas from the regular roasting plant. Because it was necessary to place the acid plant a mile away, separate roasting furnaces were installed for the particular purpose of making acid. The roasting operation is as truly a part of the copper recovery, however, as if it were done at the regular roasting plant.

There is nothing unusual about the acid system at Anaconda. It is well constructed, all the buildings being of brick, and is of very pleasing appearance. Exceptionally large chambers are used, 40 ft. wide, 36 ft. high and 96 ft. long. There were originally six of these in series, and later two were added. As this 36x40-ft. section gives a low ratio of radiation surface to volume, 29 small circular chambers of 11 ft. diameter by 36 ft. high were introduced among the main chambers to effect cooling and mixing. Two 8-ft. hard-lead fans move the gases.

There is one distinct disadvantage that the Anaconda plant is under. This is the altitude, 5,300 ft. above sea level, with a normal barometer of 622 mm. In the operation of a gas process this matter is of importance. It means in this particular case that 1.25 cu.ft. of SO_2 must be handled to get the same weight of acid that the sea-level plant gets with 1 cu.ft. Also with the reduced pressures all the reactions are lower and the absorption of the N_2O_3 in the Gay-Lussacs is not so active. By allowing chamber space in about the ratio of the barometric pressure to sea-level barometric pressure, something over the rated capacity has been produced, with normal niter consumption; that is, about 3.5% on the sulphur. This has been accomplished without unusual Gay-Lussac space, the ratio being about 3% of the chamber volume.

One feature of the roasting operation which causes it to lack the simplicity of straight pyrites roasting, is the high copper content—about 7%. This lowers the fusing point of the ore, and on the second and third floors tends to matte and stick to brick and rabbles with the trouble always attendant. This is not serious, but accounts for some daily cutting and renewing of rabbles.

At the Garfield plant, near Salt Lake, a chamber-acid unit is nearing completion.[1] This plant will use mainly gases from McDougall-type roasters burning fines. A novel feature of this plant will be the passing of the roaster gas through contact masses of lump ferric oxide obtained by burning lump pyrites in conventional lump burners. A considerable conversion of SO_2 to SO_3 is expected by this arrangement before the gas enters the Glover tower.

Contact and Chamber Processes Contrasted

The plants described, excepting the Garfield unit, are all straight chamber processes. The Garfield is a combination of contact and chamber, but probably does not rely on the contact for more than 25% conversion. The fact that all these are chamber plants does not mean that nobody has considered or tried applying the contact processes to metallurgical gases. The contact processes always appear attractive because the plants look small and cheap to build and no high-priced niter is consumed in their operation. But even the owners of the contact processes concede that for making low-strength acid where purity is not essential, the chamber process is considerably cheaper.

Without going greatly into detail, it will suffice to give two or three general reasons for this. The great essential of successful contact work is absolutely clean gas and dry gas. Dust or even a most minute amount of arsenic is highly injurious to a platinum-contact mass. Moisture is as bad on a ferric-oxide mass. Metallurgical gases are always dirty and usually wet. If they be thoroughly cleaned, they must be cooled to a considerable extent. If cooled, they must be reheated to contact temperature, 400 to 650° C., which means the consumption of fuel. Use of the contact processes means payment of royalties. Operating costs are higher than with the chamber process, and this soon wipes out the advantage of lower capital expenditure.

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[1] Since this article was written this plant has begun operations.—Editor.

The chamber process will make 60° acid at a metallurgical plant, nothing being charged for sulphur, for from $2 to $3 per ton, depending on conditions and methods of bookkeeping. A well-constructed chamber plant in normal times costs from $3,000 to $4,000 per ton of daily capacity to build.

The plants described have used roaster or blast-furnace gases. About a copper-reduction works one other possible source of suitable SO_2 exists; namely, the converters. Reverberatories will not do, of course, as the sulphur elimination is slight and the gas low in SO_2. One would expect very high SO_2 gas from converters, and actual tests show percentages approaching 20 at certain stages of the blow. The operation is intermittent, of course, and to run a chamber process on the gas delivered, it would be necessary to have several converter units discharging into a large common flue. Dampers for closing the hoods while skimming and pouring would be required, and in general all possible means for excluding false air. If the Ducktown company has been able to operate successfully on a single blast furnace, producing CO_2 as high as SO_2, operation with a battery of converters delivering 10 to 20% SO_2 should not be impossible.

Minerals Separation Ltd., vs. James M. Hyde

In the report of the decision of the United States Supreme Court in the case of Minerals Separation, Ltd., vs. James M. Hyde, made in the *Journal* of Dec. 16, there were some minor points that need correction. First, the court did not sustain the Minerals Separation patent under consideration as to claim No. 4, but otherwise the claims sustained were as stated.

On page 1069, line 39, the word "impossible" should be replaced by the word "clear." On the same page, line 55, the word "Air" should read, "Ore." The official version of the decision makes no further changes in the text as published.

Alaska License-Tax Law Valid

By A. L. H. Street*

The law enacted by the Alaska legislature in 1913 imposing a license tax on the business of mining of 0.5% on all net incomes above $5,000 per annum, was lately upheld by the United States Circuit Court of Appeals, Ninth Circuit, against an attack upon its validity. (Alaska Mexican Gold Mining Co. vs. Territory of Alaska, 236 Federal Reporter, 64). The court says:

> The tax being one which could be lawfully imposed, we believe it beyond judicial power to declare the law imposing it to be invalid merely because the legislature laid down a procedure which, if literally obeyed in the arrangement of the steps required, necessarily would defeat the plain, expressed object of the legislation. The intention being plain, the inartificiality of the law should not result in its overthrow.

Other points decided in the same opinion are that one who has never applied for a license under the law has no standing in court to attack the validity of the law on the grounds that its provisions render the granting of a license an arbitrary power; and that, since the law is not a pure revenue measure, it is not invalid under the provisions of the Alaska Organic Act, requiring uniformity of taxation.

Co-Operation in Export Trade

Legislation now pending in Congress for the purpose of clarifying the antitrust laws in so far as export trade is concerned is of great importance to the copper-producing industry. Indeed, it is scarcely too much to say that the copper producers, under the leadership of John D. Ryan, whose arguments have been extraordinarily lucid and impressive, have had more to do with getting consideration for this movement than anybody else. It is held by good lawyers that the Sherman law does not, anyway, apply to foreign trade, but it is considered desirable that Congress shall make this quite clear.

The Federal Trade Commission in its last annual report expressed itself on this subject as follows:

> Among the first questions to which the commission directed its attention was one which it was specifically authorized to investigate under its organic act (Sec. 6, Par. h), namely, "trade conditions in and with foreign countries where associations, combinations or practices of manufacturers, merchants or traders, or other conditions, may affect the foreign trade of the United States." The commission was directed, moreover, "to report to Congress thereon with such recommendations as it deems advisable."
>
> The scope and character of this investigation has been described above. The commission, as a result of its investigation, found that, while there were various conditions which affected the successful development of export trade, there was one factor which was peculiarly within its jurisdiction, namely, cooperative organization of American exporters for the purpose of efficiently conducting their trade in foreign markets. The commission found that American exporters were at a disadvantage compared with their rivals in the chief foreign exporting countries, where combinations for the export trade are effectively developed.
>
> Furthermore it was found that doubt and fear as to legal restrictions prevented American exporters from developing equally effective organizations for overseas business and that the foreign trade of our manufacturers and producers, particularly the smaller concerns, suffered in consequence. The commission recommended, therefore, that declaratory and permissive legislation be enacted by Congress to make it clear that such organizations are lawful. The chief conclusions of the commission, as stated in the summary of the report were as follows:
>
> PREVENT DANGER OF MISUSE OF COOPERATIVE EXPORT ORGANIZATIONS
>
> Two chief dangers from cooperative export organizations of American manufacturers and producers are apparent. They may be used to exploit the home market, and they may be used unfairly against individual American exporters in foreign trade. The dangers in cooperative action should be faced frankly and provided against fully.
>
> The commission is confident that this can be done without sacrificing the essential advantages of combination and without altering the policy of the antitrust laws in connection with their enforcement. [illegible] retention in the law prohibiting unfair methods of competition [illegible] and requirement of full reports to the Federal Trade Commission from cooperative export organizations [illegible] the individual exporter, while the enforcement of the antitrust laws will prevent the use of such organizations to effect restraint of trade or monopoly in the domestic market.
>
> The commission does not believe that Congress intended by the antitrust laws to prevent Americans from [illegible] in export trade for the purpose of competing effectively with foreigners where such cooperation does not restrain trade within the United States and where no attempt is made to hinder American competitors from securing their share of the trade. It is not reasonable to suppose that Congress meant to obstruct the development of our foreign commerce by forbidding the use in export trade of forms of organization which [illegible] to the [illegible] of the American public, are lawful in the countries where our trade is to be

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*Attorney at law, 829 Security Building, Minneapolis, Minn.

carried on, and are necessary if Americans are to meet competitors there on equal terms.

DECLARATORY LEGISLATION RECOMMENDED

By this investigation the commission, however, has established the fact that doubt as to the application of the antitrust laws to export trade now prevents concerted action by American business men in export trade, even among producers of noncompeting goods. In view of this fact and of the conviction that coöperation should be encouraged in export trade among competitors as well as noncompetitors, the commission respectfully recommends the enactment of declaratory and permissive legislation to remove this doubt.

The commission feels that it would fail of its duty if it did not urge the pressing need of such action immediately. If American business men are to make the most of the great opportunities now before them, are to build securely in foreign trade and are to avoid disaster in the shock of the stern and determined competition that will doubtless follow the war, they must at once perfect the organization demanded by the conditions of international trade.

This recommendation of the commission was given consideration by the Committee on the Judiciary of the House of Representatives, which reported a bill (H. R. 17,350), commonly known as the Webb bill (see Exhibit 5), embodying the principles recommended by the commission. This bill was passed by the House near the close of the last session, but there was not sufficient time left for its consideration by the Senate.

Particular attention, however, is called to the fact that though the bill as originally reported to the House appears, in the opinion of the commission, to effectively meet the purpose for which it was drafted, yet, on the other hand, two amendments were made to the bill during the debate which seem to give a basis for legal construction that might entirely nullify this purpose.

The first amendment referred to was made in the first section of the bill. In order to permit coöperation only with respect to export trade, the term "export trade" was originally carefully defined to exclude the production or manufacture of goods within the United States, but the amendment made it also exclude "trading in or marketing" such goods within the United States. (See Exhibit 5.) Obviously a successful coöperative export organization would, in most cases, be obliged to purchase goods in the United States and therefore to trade in them.

The second amendment referred to is found in the second section. This originally granted the right of coöperative association for export trade, provided such association did not involve "restraint of trade within the United States." But the amendment added a further proviso; namely, "and does not restrain the export trade of the United States." (See Exhibit 5.) The commission is of the opinion that these provisions of the bill would not change the present law. But the very purpose of the bill was to clarify the law, while this amendment presents the same question of construction as the existing law. The law, therefore, would be neither changed nor clarified if the bill were enacted in the form in which it was passed by the House. Therefore the business man who is deterred from engaging in coöperative action in export trade by fear or doubt concerning antitrust laws would be left in exactly the same position as before.

Exhibit 5—the Webb bill—is as follows:

AN ACT TO PROMOTE EXPORT TRADE, AND FOR OTHER PURPOSES

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the words "export trade" wherever used in this Act mean solely trade or commerce in goods, wares or merchandise exported, or in the course of being exported from the United States or any Territory thereof to any foreign nation; but the words "export trade" shall not be deemed to include the production, manufacture, trading in or marketing within the United States or any Territory thereof of such goods, wares or merchandise, or any act in the course of such production or manufacture.

That the words "trade within the United States" wherever used in this Act mean trade or commerce among the several states or in any territory of the United States, or of the District of Columbia, or between any such Territory and another, or between any such Territory or Territories and any State or States or the District of Columbia, or between the District of Columbia and any State or States.

That the word "association" wherever used in this Act means any corporation or combination, by contract or otherwise, of two or more persons, partnerships, or corporations.

Sec. 2. That nothing contained in the Act entitled "An Act to protect trade and commerce against unlawful restraints and monopolies," approved July second, eighteen hundred and ninety, shall be construed as declaring to be illegal an association entered into for the sole purpose of engaging in export trade and actually engaged solely in such export trade, or an agreement made or act done in the course of export trade by such association, provided such association, agreement, or act is not in restraint of trade within the United States, and does not restrain the export trade of the United States.

Sec. 3. That nothing contained in section seven of the Act entitled "An Act to supplement existing laws against unlawful restraints and monopolies, and for other purposes," approved October fifteenth, nineteen hundred and fourteen, shall be construed to forbid the acquisition or ownership by any corporation of the whole or any part of the stock or other capital of any corporation organized solely for the purpose of engaging in export trade, and actually engaged solely in such export trade, unless the effect of such acquisition or ownership may be to restrain trade or substantially lessen competition within the United States.

Sec. 4. That the prohibition against "unfair methods of competition" and the remedies provided for enforcing said prohibition contained in the Act entitled "An Act to create a Federal Trade Commission, to define its powers and duties, and for other purposes," approved September twenty-sixth, nineteen hundred and fourteen, shall be construed as extending to unfair methods of competition used in export trade against competitors engaged in export trade, even though the acts constituting such unfair methods are done without the territorial jurisdiction of the United States.

Sec. 5. That every association now engaged solely in export trade, within sixty days after the passage of this Act, and every association entered into hereafter which engages solely in export trade, within thirty days after its creation, shall file with the Federal Trade Commission a verified written statement setting forth the location of its offices or places of business and the names and addresses of all its officers and of all its stockholders or members, and if a corporation, a copy of its certificate or articles of incorporation and by-laws, and if unincorporated, a copy of its articles or contract of association, and on the first day of January of each year thereafter it shall make a like statement of the location of its offices or places of business and the names and addresses of all its officers and of all its stockholders or members and of all amendments to and changes in its articles or certificates of incorporation or in its articles or contracts of association and of all contracts, agreements, and understandings had with any foreign or domestic association in regard to the conduct of or practices in foreign trade. Any association which shall fail so to do shall not have the benefit of the provisions of section two and section three of this Act, and it shall also forfeit to the United States the sum of $100 for each and every day of the continuance of such failure, which forfeiture shall be payable into the Treasury of the United States, and shall be recoverable in a civil suit in the name of the United States brought in the district where the association has its principal office, or in any district in which it shall do business. It shall be the duty of the various district attorneys, under the direction of the Attorney General of the United States, to prosecute for the recovery of the forfeiture. The costs and expenses of such prosecution shall be paid out of the appropriation for the expenses of the courts of the United States.

Passed the House of Representatives September 2, 1916.

In his last message to Congress the President of the United States urged the enactment of this legislation.

Liens Against Nevada Mining Property

The Nevada Lien Law provides that an owner of property may avoid attachment of a lien against it on account of an improvement made by a lessee, by posting in some conspicuous place on the property a written notice that he will not be responsible. Under this statue the Nevada Supreme Court holds in the case of Phillips vs. Snowden Placer Co., 160 Pacific Reporter, 786, that an owner of mining property did not avoid liability to a lien by posting a notice at the collar of a mine shaft which he knew would be destroyed before entry upon work by the lien claimants. The notice must be so posted that under ordinary conditions it will remain in place for a reasonable length of time.

The Wave-Transmission System and Its Use in Drilling

By E. M. Weston*

SYNOPSIS—The invention of a sixth method of power transmission is described. This has been recently patented in England and promises to reduce greatly transmission and plant costs. Its application to rock drilling is described. Power is transmitted by means of alternate compressions and expansions in a system of pipes filled with water.

The wave-transmission system is claimed to be a new and revolutionary method of transmitting power in variable amounts over variable distances with efficiencies in small installations greater than that of electricity and in all cases equal efficiency at a smaller cost of installation. These are big claims for a new invention; but I believe that this system has an enormous field of usefulness and that the invention is of importance equal to or greater than those of wireless telegraphy and electrical transmission of power.

What is wave transmission? Wave transmission depends for its possibility on the fact that water is compressible and elastic. It is popularly supposed that water is incompressible, but it is really very many times more compressible than steel. Water is compressed about 0.000046 for every atmosphere. It will easily be shown by a simple calculation that in a pipe only one inch diameter 600 ft. long with a pressure of 1,000 lb., the compression of water amounts to many cubic inches.

Now let us imagine a pipe completely filled with water, having a plunger at one end fitting in it and a similar plunger at the other end. If, by means of any prime mover the plunger is made to reciprocate, alternate waves of compresion and rarefaction are set up, which travel along the pipe. These waves travel at the same rate as sound travels in water, about 4,800 ft. per sec. The length of the wave is this distance divided by the frequency, or the number of pulsations per second. It is obvious that at the other end of the pipe a similar piston will reciprocate in sympathy with the plunger of the prime mover. The prime factor is the mean pressure times the mean flow. Angle of phase and flow and influence when in place produce work, otherwise they are mutually destructive.

The power-transmission pipe is first completely filled with water at a pressure of 100 lb. per sq.in. The plunger has an auxiliary pump attached for making up any loss by leakage. The pressures producing waves may be anything from 500 lb. upward; for rock drills 1,000 lb. will be employed. Now it is obvious that, if in a simple pipe line supplying power to a distant plunger, the plunger is stopped, the waves will rebound and "resonance" will be set up; otherwise the pipe will be subjected to such stresses that it will burst. The inventor discovered, however, that if a vessel of a certain cubic capacity in relation to the displacement of the piston plunger and completely filled also with water were attached to the pipe line, the vibrations would be absorbed and the only result of turning off one or all of the machines worked from the pipe line would be to return some or all of the energy generated in waves to the plunger (or the rebound as it were), so that the work taken from the prime motor is always proportional to the work being delivered. The losses of power in friction of the pipe line are small because this system differs entirely from hydraulic systems, as there is no flow or transference of water along the pipe line. As before stated, these losses compare favorably with those of electrical transmission.

It is necessary to join all branch pipes or small feeds along the main pipe lines, those to drills or some motors, to them only at certain points along the wave lengths, but by inserting a "condenser," which [illegible] plunger of certain weight with a spring [illegible] reciprocating in the pipe, the wave length can be changed and power branch lines can be taken off at any point.

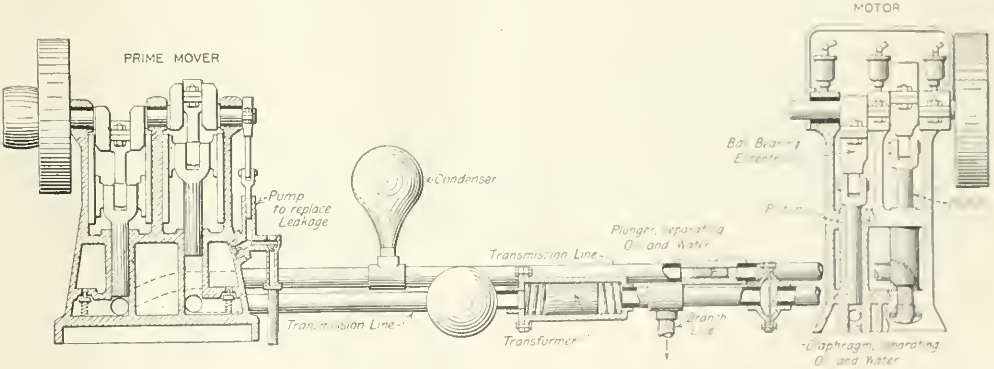

FIG. 1 TWO-PHASE TRANSMISSION LINE FOR ROTARY MOTOR OPERATION

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*The Randfontein Central Gold Mining Co., Millsite, Transvaal, South Africa

Water is the liquid most suitable for general work in pipe lines for wave transmission, but an important advantage is gained by the fact that, by introducing a flexible diaphragm or a plunger, the working portions of tools or motors can be filled with oil, causing perfect lubrication and transmitting the power waves with equal facility. Fig. 1 is an illustration of a two-phase transmission for working a rotary motor and shows the essential parts of the system.

From both the scientific and practical points of view one of the most interesting facts about wave transmission is its similarity in many features to electrical transmission. The points of resemblance are not mere coincidences, but go to prove an important fact; namely, that this purely physical method of transmitting energy is clearly allied and is for all practical purposes a sister method to electricity, more particularly to the alternating-current system. Anyone with a knowledge of electricity will find it easy to understand wave transmission.

Analogy of Wave and Electrical Transmission

The laws and formulas of wave and of electrical transmission coincide to the extent that they are nearly interchangeable. Most of the phenomena of electricity have been parallel to wave transmission. The accompanying table shows this resemblance.

ELECTRICAL EQUIVALENTS TO WAVE TRANSMISSION

Alternating current...	Alternating pressure and flow of liquid caused by plunger of generator
Volts..............	Pressure
Amperes	Flow
Power factor.........	The customary electrical formula and not the hydraulic one Mean pressure × mean flow × cos. of angle of phase Flow and pressure when in phase give work when otherwise are mutually destructive
Inductance..	Weight or inertia (in regard to condensor effect)
Capacity...	Elasticity of fluid medium
Resistance..........	Volume capacity in proportional to press and flow
Condenser.....	Elasticity proportional to inertia
Transformer...	Differential piston
Generator..	Generator
Motor.......... ...	Motor
Wires or line......	Liquid column in pipes
Resonance and surge.....	Exact equivalent, but controlled absolutely by simpler apparatus
Single-phase or polyphase system . .	Each has its exact counterpart in the wave system
Synchronous or asynchronous motors..	
Rotary or reciprocating motors.... ..	
Conversion of energy into heat directly by friction.............	By passing current. That is, liquid of any given flow and pressure through a smaller section of piping the pressure and velocity increase in proportion and both skin friction and molecular friction occur and are dissipated in heat

It will be noted that either reciprocal or rotary motion may be produced at the end of a wave-transmission line. For reciprocal motion either two or three pipe lines are usually employed; but by shortening the wave length and number of plungers, these could be made to work in a way to produce rotary motion. That means that a satisfactory motor (equivalent to driving a motor by single-phase alternating current) can be constructed exempt from many of the drawbacks of such an electric motor.

Theoretically, equally high efficiencies are obtained in electrical and wave systems of transmission. In commercial electrical practice, however, it is well known that considerations of capital cost induce the adoption of efficiencies well below the theoretical. In general industrial practice the lower initial cost of appliances of wave transmission is expected to result in obtaining either the same efficiencies as in electricity at a lower initial cost, or obviously higher efficiencies at the same cost.

The field of application is broad, as there are at present five methods in commercial use for the transmission of power. These are steam, direct mechanical, electric, compressed air, and hydraulic, the last being comparable to direct-current electricity, as wave transmission is to alternating current. Each of these has its field. Some fields are, however, very inefficiently occupied, and the advantages and defects of each system for any particular work are well known and need not be repeated. Wave transmission as a system of power transmission possesses the following advantages: It is simple—any ordinary mechanic can install and keep in order these few moving parts; it is adaptable—it can efficiently perform much that any of the other systems are capable of; it is portable—a 10-hp. generator could be lifted by a man.

Breadth of Application of the System

The initial cost of installation is naturally very low as no expensive copper lines or insulators are necessary. The maintenance charges are low because there are no cranks or couplings in the motors and the chief item would be attention to the packing of the plungers and maintenance of pipe lines.

For mining, its high efficiency and the absence of any danger from fire make it a competitor of electricity—in coal mining for coal cutters, drills, pumps, hoists and conveyors. In metal mines the wave-transmission rock drill promises to compete with the air-driven rock drill to make one source of power apply to all underground mechanical appliances.

In mechanical shops it is already being used for riveters and calkers and has a field in shearing, stamping, hammering and pile driving and for portable stone chippers and metal punchers. In workshops and factories it offers important advantages in running various tools from their own motors, dispensing with overhead shafting and belting.

In pumping, a very simple pump can be designed for all conditions of work—one that will run submerged and be very light. Experiments have also been made showing that it is probable that the ideal method of gear reduction for rail cars, motor cars and, above all, steamships of the largest power has been found. Railway signaling and submarine work also appear promising fields of application. One of the most striking experiments in connection with wave transmission is the production of boiling water by friction in small tubes at the end of a long cold-water column. This can be applied for heating houses and factories most economically. It is being employed for submarine signaling.

Wave transmission was discovered by George Constantinesco, a Roumanian engineer. The system was worked out mathematically, and patents were applied for before a single demonstration had been made, and working models were first made for the patent authorities.

The diameter of the piping in the transmission line is determined by the pressure adopted and the power to be transmitted. The greater the pressure in the liquid column the smaller may be the diameter of piping. In experimenting with a line 50 ft. in length with right-angle bends it was found that 1-in. diameter wrought-iron pipe of ordinary good steam quality would convey 10 hp. with high efficiency. Hydraulic piping and increased pressure will, however, increase this figure 300 or 400%. For many applications steam piping can be used, but hydraulic piping will no doubt be most largely employed. The practical engineer will at once ask what effect the vibration set up will have on the pipe line and whether the power can be transmitted without too great a loss when the pipes are much bent, as they would be when used in mining. It is stated that experiments have shown that only a very ordinary amount of bracing is necessary to steady the pipes, and the vibration does not seem likely to cause trouble with perfectly designed joints. The system has been in use in engineering shops for some months. The effect of the bends does not appear to be serious, and the power is readily transmitted through a flexible hose to a rock drill. The water used in such a system must of course be free from grit and acid.

Its Application to Rock Drilling

The Haddon drill (Fig. 2) is the first attempt to apply wave transmission to drilling. It is evident that a system that produces reciprocal motion directly and in which the frequency of the blows can be increased up to any limit desired has great possibilities in drilling rock used in either a hammer or a piston-drill machine.

The Haddon drill (Fig. 2) is a piston machine and is in outward appearance similar to an air-operated drill except that there is no valve and no valve chamber is apparent. It consists of a piston mounted between a rear and a front bearing and "floating" between a strong spring on the front and a weaker one on the back. The rear of the piston is cut for the ratchet and enters a rear chamber containing pawl and ratchet for giving rotations. This chamber is full of water connected with the power line by a hose. The wave of compression sweeps into this chamber and forces out the piston against the spring, which brings it back on the return stroke, which is governed by the rear spring.

The drill has few moving parts. The introduction of springs has been criticized but it would be easy to arrange the return stroke by wave motion. Tests, however, show that satisfactory springs having a long life can be procured, and they are easily changed if necessary. The length of stroke is controlled by opening or closing the cock, but apart from the momentum of the piston and tool being decreased by the shorter stroke, the strength of the blow remains the same. This allows holes to be rapidly collared on a very short stroke.

A positive mechanical revolution is being introduced into later designs of the drill, brought about by an auxiliary piston panel acting as a floating ratchet disk on the piston. This will be an important point in any hammer-drill model.

The following questions naturally suggest themselves to the practical mining engineer: Will not the return stroke of such a drill be weak, causing constant fitchering? It is reported that trials show that fitchering rarely occurs, owing to the constant hammering action due to the repeated blows of the wave motion going on whether the drill is struck or not, and that this is a most important feature of the drill. With such high pressures will not leakage be excessive? It is said that [illegible] leakage is trapped to supply water for the drill, but owing to the design of the drill the leaking water due to joint leakage can be made very low and can be easily replaced by any special hydraulic design that may be found suitable. Personally, I consider that only long underground experience will prove whether this consideration will be vital. It is easy to calculate that a certain percentage of leakage can be allowed without vitally impairing the efficiency of the system. The drill can be used with either solid or hollow steel, and naturally the system lends itself admirably to the use of hollow steel and water injection. Acid or gritty water must not be employed, or the springs and the interior of the drill must be of some acid-resisting alloy. The latest type of drill is designed to strike 1,000 blows of a force of about 40 to 50 ft.-lb. and weighs only about 180 lb. The original design struck 500 blows a minute and showed itself a rapid driller.

Short-Stroke Piston Drill Preferable to a Hammer Drill

I have long held the opinion and expressed it in my writings that the ideal drill for really hard work is not the hammer drill, but that if a piston drill could be designed to work on a very short stroke and to strike 1,000 blows or more per minute and deliver water under pressure to the drill bit, it would prove the ideal tool. It will be remembered that on certain tests on a 2½-in. torpedo drill in California it was found that the fastest drilling was done with a 2½-in. stroke, running about 930 strokes per minute. It is, however, recognized that hammer drills give more time in changing steel, but with a modern rock-drill chuck this is not vital.

The trials of the first model of the Haddon drill ran for several months near London and were witnessed by numerous engineers. The inventor is convinced that leakage can be easily controlled and claims that while with the compressed-air drill the efficiency is under 10%, the efficiency of a wave-transmission system will be between 60 and 80%; that the cost of installation will be only one-half, the power consumption one-quarter and maintenance charges half, allowing for more expensive hose and supplies; that there are no valves or delicate parts, and that more powerful and frequent blows can be delivered, or a lighter drill with a more flexible stroke. It is estimated that on the Rand, compressed-air [illegible] $8,000,000 per annum and drill maintenance, [illegible], and of this

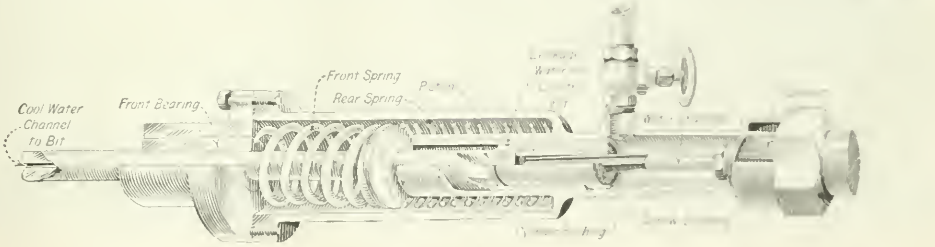

FIG. 2. THE HADDON ROCK DRILL, WHICH IS OPERATED BY WAVE TRANSMISSION

about $500,000 might be saved. In July, 1915, there were 9,831 drills on the Rand, 6,410 being in daily use.

If the Haddon rock drill in its piston- or hammer-drill form proves an economic success over a lengthy underground trial, its introduction into mines throughout the world will no doubt take place. It must, however, be remembered that for certain work and in certain situations the exhaust air from the air drill is of priceless value in ventilation and that the expense of providing an adequate alternate system must be charged against any substitute. This matter will no doubt be adjusted, but the merits of the wave-transmission system as applied to mining would be that in any mine a simple power unit (apart from the generation of some electric light) could transmit all its energy into wave transmission and all the work of the mine in stoping, driving ventilation fans, hoisting, pumping, rock drilling and underground haulage could be arranged in the one system. The possibilities of reduction of costs thus shown are enormous, and the fuller economic development of this system, which is of course much hindered by the war, will be watched by all mining engineers with great interest.

One of the leading houses on the Rand has subscribed for and is giving all facilities for an extensive underground test with several machines of different designs. These tests are expected to take place toward the end of the year in one of the large mines of the Rand, and the results obtained will be looked forward to with interest by all mining engineers.

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Iron Blast-Furnace Slags

Properties of iron blast-furnace slags and methods employed for calculating the charges (M. A. Pawloff, Rev. Soc. Russe Metal., 1914, 1, 652-79; Rev. Met., 1916, 13, Ext., 50-60) are given as follows by *Jour. Soc. Chem. Ind.,* Nov. 15, 1916:

In calculating the charge of a blast furnace, the relation between the ore, the flux and the fuel-ash must be determined, so that the quantity and composition of the slag may correspond to the kind of iron desired. The amount of slag is kept as low as possible for reasons of economy, and the quality, as determined by the physical properties and chemical composition, is chosen to favor the reduction of the elements desired in the metal, while opposing the passage to the metal of objectionable substances. The fluidity of blast-furnace slags is almost entirely dependent on the relative proportions of $(SiO_2 + Al_2O_3)$ and CaO. Normal slags in charcoal furnaces contain 65 to 60% $(SiO_2 + Al_2O_3)$, and the ratio $\frac{SiO_2 + Al_2O_3}{CaO}$ varies only from 2 to 1.5. When coke is used, the proportion of lime must be increased on account of the sulphur. In these slags the ratio $\frac{SiO_2 + Al_2O_3}{CaO}$ approaches unity corresponding to 40 — 50% $(SiO_2 + Al_2O_3)$, the average content of CaS being 5%. The second important physical property of slags is the heat required for melting. In charcoal furnaces the most fusible slags with a heat of fusion between 340 and 400 cal. per kg. are chosen; in coke furnaces the degree of fusibility is generally within the limits 350 and 460 cal. Diagrams showing the degree of fusibility of slags with varying amounts of lime, alumina and silica are given, with additional lines for the ratios $\frac{SiO_2}{Al_2O_3}$ and $\frac{RO}{SiO_2}$. Slags having different chemical compositions may possess the required fluidity and degree of fusibility, and the composition selected will depend on the kind of iron desired. The proportion of sulphur retained by the slag depends on the proportion of lime (or of CaO + MgO + MnO). Silica does not exceed 38% in the slags of modern coke blast furnaces. Charcoal furnace slags are characterized by a smaller lime content, ore for these furnaces being desulphurized when necessary, by preliminary roasting. The reduction of manganese also depends directly on the proportion of lime and magnesia in the slag, and to prevent the formation of infusible masses in the furnace, lime is often replaced by magnesia. In the manufacture of ferromanganese the slag may contain up to 12% MgO, with 38—36% CaO. The reduction of silica is, on the contrary, prevented by the presence of much lime and magnesia in the slag, and other things being equal, the consumption of fuel required to cause the passage of a certain quantity of silicon into the iron is less as the amount of $(SiO_2 + Al_2O_3)$ in the slag is higher. With charcoal the $(SiO_2 + Al_2O_3)$ may attain 70% of the weight of the slag, but with coke, in view of the necessity of eliminating sulphur, the slag should not contain more than 45 to 50% $(SiO_2 + Al_2O_3)$. Where high temperatures are employed, less lime is needed, as the sulphur is partly volatilized. The reduction of phosphorus is complete when the ratio $\frac{CaO}{SiO_2} = 1.65$. The quantity of slag formed depends on local conditions. With charcoal, a minimum of 25% of the weight of the iron may be attained; with coke, the proportion varies from a minimum of 40% to a maximum of 150%, the latter amount being formed in smelting Cleveland ores. The weight of coke required varies from 80 to 120% of the weight of iron produced and rises to 200 to 250% for ferromanganese and ferrosilicon. The determination of the quantity of flux necessary for slagging the ash of the fuel and the gangue of the ore may be based on four different quantities:

1. The ratio of the oxygen of the silica to that of the base of the slag. This method is only suitable for charcoal furnaces, the ash of the fuel taking no part in the action and the ratio $\frac{SiO_2}{Al_2O_3}$ in the slag being given directly by the analysis of the ore. The most fusible and most acid slag being the most advantageous and the ratio $\frac{SiO_2}{Al_2O_3}$ being known, a suitable degree of acidity may be obtained by reference to the diagrams.

2. The ratio (by weight) $\frac{SiO_2 + Al_2O_3}{RO}$. This ratio, proposed by Platz, is a better basis for calculating the charge than the former ratio. In coke furnaces its value is generally made $\frac{48}{52}$ for cast irons and $\frac{52}{48}$ for irons to be refined. An objection, however, to the use of a constant figure for this ratio is that the properties of slags may vary according to the relative proportions of SiO_2 and Al_2O_3. In charcoal furnaces the ratio $\frac{SiO_2 + Al_2O_3}{RO}$ is generally about $\frac{63}{37}$. It is shown by diagram that

slags with 37% CaO may vary largely as regards Al_2O_3 and SiO_2 without raising the heat of fusion above 360 cal., and with the ratio $\frac{63}{37}$ fusible slags are given for all values of $\frac{SiO_2}{Al_2O_3}$ between 1 and 30.

3. The ratio (by weight) $\frac{RO}{SiO_2}$. In this method alumina is considered as neutral. In coke furnaces the ratio varies from 1.65 for the most basic and least fusible slags, to 1.20 for the most fusible slags. The usual value is 1.1 to 1.5. This method is not suitable for calculating the charges of charcoal furnaces.

4. The content in the slag of SiO_2, CaO, (SiO_2 + Al_2O_3), or RO. This method is equally suitable for coke and charcoal furnaces. The most suitable constituent to consider in both cases is (SiO_2 + Al_2O_3).

Oatman Output Will Increase

Oatman Correspondence

The United Eastern's 200-ton cyanide mill* is nearly completed at Oatman, Ariz., and is expected to begin operating during the Christmas holidays. This will be followed next summer by an increase in the Tom Reed's milling facilities, and a steady increase in the gold production of the Oatman district during the next few years is expected. The new mill will use the continuous counter-current system of decantation and agitation. Marcy ball mills are used for crushing, and for fine grinding Allis-Chalmers tube mills with balls, the ore being ground to 200-mesh. The crushing-and-grinding department has a capacity of 400 tons, but the thickeners and agitators are designed to treat only 200 tons per day. In places the vein is 10 to 50 ft. wide. A new three-compartment shaft has been sunk to the 665-ft. level and connected with the vein by crosscuts. The shaft is equipped with electric hoist, and sinking has been resumed; the shaft should cut the vein at 950 ft.

At the beginning of the year, only 10 of the 20 stamps of the Tom Reed mine were dropping and development had been practically confined to the Tom Reed and Ben Harrison claims, comprising but 36 of the 152 acres owned by the company. The interior shaft on the Tom Reed claim has been sunk to a depth of 1,400 ft. A drift to the southeast from the main shaft on the Ben Harrison claim developed a large tonnage of mill ore. At the extreme southeast part of the company's property, east and north of the Big Jim, mill ore has been developed on the Black Eagle, Gray Eagle and Aztec claims. The orebody on the Aztec is of good grade and up to 30 ft. between walls. This development is on the 500-ft. level of the Aztec shaft, where ore bins have been built preparatory to hauling the ore extracted to the mill, a mile

UNITED EASTERN NO. 2 SHAFT AND THE NEW 200-TON MILL NOW READY TO BE PUT IN OPERATION AT OATMAN, ARIZ.

Reduction of Acids of Selenium

The reduction of selenic acid to selenious acid is by no means an easy reaction to accomplish. Some recent data on the problem are given by de Coninck and Chauvenet, *Ann. Chim Appl.*, Vol. 21, p. 111.

When a mixture of formic acid with a slight excess of colorless selenic acid (sp.gr. 1.4) is heated gradually to boiling, carbon dioxide is disengaged and selenium is precipitated. Malonic and pyruvic acids also reduce selenic acid; acetic and succinic acids do not; boiling with oxalic acid causes only partial reduction. The selenium deposited has a dark reddish-brown color, is amorphous, and practically insoluble in carbon bisulphide; it is apparently identical with that obtained by reducing selenic acid with sulphur dioxide.

[The precipitation of selenium from selenic-acid solutions by sulphur dioxide is difficult and uneconomical commercially, although the reduction of selenious compounds by this reagent is easy. Carbon monoxide reduces selenious solutions readily, but the resultant selenium is so finely divided as to be almost unfilterable.—Editor.]

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*"Eng. and Min. Journ.," July 29, 1916.

distant, by auto trucks. With these developments in the easterly end of the property, the company decided to increase the capacity of the mill from 175 tons to 350 tons. Supt. E. W. Rabb is now contracting for the machinery and expects to have the new unit completed by July 1, 1917.

The Big Jim Mining Co. is proceeding with plans for a 400-ton cyanide mill which is to be built along the same general lines as the United Eastern. The orebody in the Big Jim has been developed on three levels—the 300, 400 and 500—for a length of 650 ft. and maintains an average width of 30 ft.

The Johnson District, Arizona

By Harry E. Scott*

One of the most prosperous of the smaller copper camps of Arizona is Johnson, in Cochise County, situated about 10 mi. north of Cochise on the Southern Pacific R.R. and reached from that point by automobile. The boom days of the camp seem to be over, and the place has a permanent appearance.

The Keystone Copper Mining Co., owning 310 acres of ground, is situated about 2 mi. south of the town. This property is equipped with a 30-hp. gasoline hoist and a four-drill Ingersoll-Rand air compressor driven by a 28-hp. crude-oil engine. The two-compartment, perpendicular shaft, which is down 550 ft. at the present time, is being sunk with jackhamers. From the 300- to 500-ft. level the shaft is in a low-grade copper ore, while from the latter point to the bottom the ore averages 4½% copper. W. W. Miller is president and general manager; A. Bannow, vice-president; W. J. Truesdale, treasurer; and T. C. Miller, secretary. The general office of the company is at Newton, Kan.

TWO ACTIVE PROPERTIES IN THE JOHNSON COPPER DISTRICT, ARIZONA
Shaft of the Peabody Copper Co. on the left. Shaft and hoist of the Keystone Copper Co. on the right

The Cobriza Mining Co., owning 35 claims and adjoining the Keystone on the west, has the following equipment on its property: A 200-hp. oil-fired boiler, a 12-drill steam-driven Ingersoll-Rand compressor, an electric-light plant, a number of small fans for mine ventilation and a gasoline hoist. This property is being worked through an 800-ft. inclined shaft, shipping 150 tons of 4% copper ore daily and employing 100 men. The Goodrich-Lockhart Co. is operating this mine, the work being under the direction of Robert Morrison, superintendent.

The Arizona & Michigan Development Co., west of the Cobriza, owns nine claims, is equipped with a 200-hp. oil-fired boiler and a 12-drill steam-driven compound Sullivan compressor. A second-motion steam hoist does the hoisting from the main shaft, which is down 400 ft. This company is shipping daily about 50 tons of copper ore running over 4% and is employing 60 men. S. French Hoge, of Frankfort, Ky., is president, and E. C. McMahon, of Louisville, Ky. secretary and treasurer. N. T. Trigar, superintendent, has charge of all work.

The Peabody Consolidated Copper Co., owning a large number of claims, is the oldest producer of the district, having been worked over 30 yr. ago, and is said to have produced several million dollars' worth of copper ore. At present 400 tons per month is being shipped, averaging 6% copper. This property is being worked through a 300-ft. inclined shaft, the hoisting being done by a gasoline hoist. Forty men are employed. Isidore Niner, of New York, is president of the company. W. G. Eberhardt has direct supervision of all work.

The Black Prince Mining Co. has a group of claims about one-quarter of a mile east of Johnson, adjoining the Peabody. These are equipped with two 100-hp. coal-fired boilers, a Sullivan compressor, a first-motion Danville hoist and Waugh drills and three Cameron pumps. All work is being carried on through a two-compartment perpendicular shaft 965 ft. deep, this being the deepest shaft in the district. At present this company is cross-cutting on the ninth level to strike the vein, working three shifts and employing 25 men. The officers of the company are: Robert N. Bell, president; Dr. John C. Thompson, vice-president; J. B. Wright, secretary-treasurer. The main office is in Denver. W. C. Bartlett is superintendent at the mine.

The Johnson Copper Co. is one of the new companies operating in the district. Its main shaft is within the limits of the town, the equipment consisting of a large gasoline hoist, a five-drill belt-driven compressor and jackhamers. One of the drifts on the 750-ft. level has passed through 14 ft. of ore, J. T. Tong is superintendent.

In nearly all parts of the Johnson district a high-grade copper ore is found near the surface, making it attractive to leasers, of which there are many, all of whom are making much better than wages out of shallow shafts and opencuts, as some of the ore runs as high as 30% copper. The ore is a carbonate near the surface, underlain by the usual sulphides at depth.

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*Johnson, Ariz.

Seventeen-Million Dollar Tax on Intelligence

Our esteemed contemporary, the *American Machinist*, published the following editorial, Dec. 21, which is so illuminating, on the vital subject of one of our own recent editorials, that we are republishing it in full.

Yes, you have read the title correctly—a *tax*, not a premium. Not on our daily physical necessities, nor on our more or less dispensable luxuries, but on information—the one thing that is essential to the development of the mind. And this is proposed in the Congress of the United States of America in the year A. D. 1916.

The greatness of a nation may be measured by the extent to which it fosters the enlightenment of its citizens. No statesman, even of present-day average caliber, would be foolhardy enough to oppose the public-school system. A stand in favor of restricting the teaching of reading, writing and arithmetic would be unthought of by the most unthinking politician. It would have the deserved effect of terminating his public life as abruptly as a well-aimed hand grenade would blot him out physically.

Yet reading, writing and arithmetic are merely the tools one uses to acquire the further information that is to be of use to himself, to the community and to the state. The three R's never built a railroad, or ran one. Beyond the education given in public schools must come acquirement of the knowledge of how to do things—that is the basis of material prosperity; and the knowledge of how to think—which is the basis of culture. A small percentage of our population obtains this additional knowledge in universities; another small percentage absorbs it from personal experience, but the great majority of us must get it by reading educational books and periodicals.

The more one sees of the limited vision of some present-day politicians the more he admires the wise and far-seeing statesmanship of past generations that led to the unification of our country in ideals and ideas. They were men who could look a deficit in the face without becoming hysterical, provided the deficit was of such a nature as to be a tremendous national asset in disguise. They were men who in days of depleted national revenue could formulate the wise policy of exempting schools and colleges from taxation, thereby placing a premium on intelligence. And not stopping with educational institutions, but realizing that knowledge and information are sought as often in the pages of periodicals as in the classroom, they took a step toward encouraging those who were ambitious to read and keep informed, by boldly cutting in half the Governmental postal revenue upon these periodicals.

Bear in mind that this was at a time when the stagecoach and pony express still carried a large portion of the mail to the remote parts of our country. It was at the time when the Post Office Department was confronted with a heavy deficit at the close of each fiscal year—not such a time as the present when it earns a surplus, as reported by Postmaster-General Burleson within the last few days!

And now comes the tax on intelligence that will add a burden of $17,000,000 upon those who are ambitious enough to keep themselves informed on current events or to possess themselves of up-to-the-minute information on developments in the arts, professions or trades.

On Dec. 9 the House Committee on Post Offices voted to include as a legislative rider on the Post Office Bill an amendment fathered by Representative Randall of California, applying the zone system, as applied to parcel post, to all second-class mail matter. Instead of the present flat rate of 1c. per lb., or an increased rate of 1½c. per lb., as advocated by Mr. Burleson, the committee makes the unthinkable proposal to discriminate against those American citizens who live remote from publication centers by taxing them as high as 6c. per lb. postage on all of their magazines, periodicals and newspapers. And this in spite of the fact that the Postmaster-General had recommended that the question be postponed until it could be ascertained what effect the change would have on the spread of educational periodicals.

The *American Machinist* has no quarrel with honest and intelligent postal reform. Nor, we are sure, have our readers any desire to defraud the Government of what justly belongs to it. But neither you nor we should sit idly by and permit a few unthinking representatives who can see no further than next year's budget to upset the broad-minded policies set down by wise and far-seeing statesmen. Just *two days* after the Post Office Bill was reported, this ridiculous rider was jammed through the committee. Two days to reflect upon a measure that will take $17,000,000 out of the pockets of the people who subscribe to periodicals! Hurrah, boys, hurrah; down with the cost of living and up with the cost of learning! Off with the tax on drinkables and on with the tax on thinkables! Let's give Shoats Corners, Wash., $500,000 for a marble post office and soak Tom Jones, who goes there to get his *American Machinist* every week, $5 a year extra for postage on his favorite paper!

We have not exaggerated this case a particle. The zone system as proposed for all periodicals proposes an increasing rate similar to the parcel post, culminating in 6c. per lb. for a distance of 1,800 mi. or over. The present rate is a flat one of 1c. per lb. anywhere in the United States. The weight of the Dec. 7 issue of the *American Machinist* was 33 oz. The average in November was 1.7 lb. Readers who live 1,800 mi. or more distant from New York are to be penalized approximately $5 each per year for being ambitious enough to desire to keep posted on machine-shop practice, because apparently of their bad taste in not picking out a publication center as a place of residence.

The revenue last year on 1c. postage was in round numbers $11,500,000. Mr. Randall, the author of this (headless) rider, estimates that the *average* second-class rate as proposed will amount to 2½c. per lb. Here is a net increase of $17,225,000. Bearing in mind that the Post Office Department earned a surplus last year, compare this boost of 150 per cent. with the cut of 50 per cent. made by the statesmen of 1885. Either we must be getting too much intelligence, or certain politicians [illegible] having too little of it!

If the Congressmen of the United States really desire to institute postal reform, let them begin at home. There is a golden opportunity for reform in the franking privilege under which grand pianos and household furniture have been sent *by mail*, and through which every voter in the country is prior to election deluged with personal propaganda concerning the merits and achievements of the representative from his district. "To him who hath shall be given" is biblical, and true; but why should the fellow who is lucky enough to be in office avoid the postage incidental to reëlection, while his more unfortunate rival who is looking for the job is forced to attach a 2c. stamp to every letter that he sends in search of votes?

The Post Office Department seems to be the most obliging department of the Government. It is not enough that the Agricultural Department sees fit to distribute free seeds through Congressmen to Tom, Dick and Harry—but our post office must also carry the seeds gratis. Possibly if the recipients wanted them badly enough to pay postage, there would not be so many of these gifts thrown away, to say nothing of the increased postal revenue that would result. The idea, of course, is to improve the agricultural art—no one will find fault with this ambition, even with potatoes at $2 a bushel and a Ford on every farm. But why, since we are a mechanical and manufacturing as well as an agricultural people, make the machine-shop man and the readers of other instructive periodicals pay the postage on Farmer Jones' seeds?

That this rider is not a sincere effort justly to apportion expense is undeniably manifested in that it specifies the retention of the free-in-county distribution of periodicals. In other words, the Government will undertake to distribute free of charge through its postal system the circulation of any newspaper unimportant enough not to go outside of the county in which it is published. And this distribution is in large part through the most expensive branch of the postal service—the rural free delivery. A goodly portion of that $5 annual tax that Tom Jones will be asked to pay in extra postage on his *American Machinist* will go toward carrying, free of charge, the *Bugville Bugle* to Farmer Perkins, who lives 10 mi. from town on a free-delivery route! What with the free postage on seeds and the free postage on county newspapers, it looks as if we industrilists should be able to learn something about scientific management from the agriculturists.

Legislation that is rushed through a committee in two days cannot be discriminating, and discrimination is essential to just enactments. It would be idle to say that there are no abuses of the second-class mail rate, but it would be unjust if educational periodicals are compelled to suffer for the sins of others. We recognize the justice of taxing theatrical property and exempting school property—why not distinguish similarly between periodicals which instruct and those which amuse? Why place obstacles in the way of the circulation of reputable technical, trade and religious periodicals because certain unscrupulous publications parade their self-advertising at second-class rates under the cloak of a nominal subscription price?

It is argued that trade publications should suffer this unjust discrimination because of the advertising that they carry. You cannot separate the advertising from the editorial pages of a trade or technical publication and say: "These pages are educational because editorial; and these pages are not, because they are advertising." Advertising pages in a technical paper are informative. They do not correspond to the unrelated advertisements in the popular magazines, which have nothing in common with their editorial contents. Advertisements in technical papers are localized news items, invaluable to the man in the profession. All new developments in the mechanical line, when developed and proved successful, are considered to be fit for description in the editorial columns *once*. After that, they go into the advertising section. But to the man who has not had the issue in which they were described editorially, they are bona fide items of news and information, no matter in what part of the paper they are published.

And do not forget that the second-class mail matter is the inspiration that calls into existence a large part of the first-class mail. Ten thousand inquiries have been known to originate from a single page of advertising matter—inquiries that took ten thousand 2c. stamps to send to their destinations, and ten thousand more for the first reply.

We are not stating these facts because we are publishers of technical papers; but because, being publishers of technical papers, we see perhaps more clearly than others would see it the gross injustice that this proposed rider attempts to perpetrate upon the reading public who must ultimately pay the bill.

We object to the narrow-minded class legislation that would penalize the man who must get his education largely through reading.

We object to the unjust sectionalism that divides this country into a ring of zones, each ring imposing an additional handicap on the spread of information.

We object to the distinction that makes the mechanic pay the farmer's bill for postage.

We object to the step backward that we shall take as a nation if we discourage intelligence.

And you, Mr. Randall—do you, as the father of this proposal to tax intelligence, realize its consequences to the people of your own state? Do you realize that you are doubling the cost of nine-tenths of the reading matter that goes to the citizens of California—that you are placing a serious obstacle in the path of the mechanics in California's shops, the civil engineers who build California's bridges, the mining engineers who develop California's mineral resources?

You, and the *county weekly that you own* and that the Government circulates to your subscribers free of charge, will not be hurt by this bill, Mr. Randall; but the men in your state who are interested in things that occur outside of *your* county will be hurt, and we venture to say that they outnumber you a million to one.

And you, Mr. Reader, make it a point, as a patriotic citizen, to write your Congressman that you heartily disapprove of the Randall tax on intelligence.

Rights of Mine Locator

By A. L. H. Street*

The Nevada Supreme Court has adjudged to be void a contract by the locator of mining claims on public lands to abandon them, on condition that the other party pay him $100 monthly until sale of 160 acres of the land, apply for withdrawal of the lands under the Carey Act, and share the proceeds of their disposal. (Miller vs. Thompson, 160 Pacific Reporter, 775.) The court holds that such a contract is impossible of performance because the Carey Act does not permit sale of lands withdrawn under it, by the person withdrawing, but merely authorizes development of an irrigation system and sale of water therefrom to settlers making entry under purchases from the state.

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*Attorney at law, 829 Security Building, Minneapolis, Minn.

Details of Practical Mining

The Old Horn Spoon

There are a few old prospectors who still swear by the horn spoon shown in the illustration. Although a description of the manner of its use is almost superfluous, it is doubtful if many mining engineers have such a tool as this in their kits, while it is probable that a large percentage of mining men have never had the opportunity to see one.

A spoon of this size is a handy adjunct in placer work, in preliminary concentration tests, etc. It also has a wide range of general utility, being a convenient drinking cup which can be carried on one's saddle without danger of breaking and available for such use without dismounting; serving as a food container in an emergency; and, though less frequently, as a protective shield for the body in knife duels.

THE SPANISH-AMERICAN HORN SPOON

The particular specimen shown here has had an interesting history, being a relic of the old days of patio amalgamation in Mexico, with possibly an earlier history in Peru, and during the last decade having passed through many hands of greaser and gringo by theft, purchase and fiduciary custodianship.

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Hints for Operators of Small Mines

Many small mines in Rhodesia are worked by men who have had no training in either mining, mechanics or metallurgy, and these few notes have been presented in the *South African Mining Journal*, in the hope that they may be of assistance to such individuals in the economical working of their properties. To assist in gaining access to or egress from stopes, timbers are often fixed between hanging and foot walls or short jumpers fixed in either wall. In many cases these are placed at inconvenient distances apart, making it awkward to climb out. A result of this is that a miner, when blasting in such a stope, has to use extremely long fuses to insure his safety, whereas if a few extra timbers were put in to facilitate his movements, considerable economy might be effected in the amount of fuse used.

Where there is machinery running regularly on the surface the installation of a small electric-lighting plant to effect a saving in candles is well worth considering. Usually, a convenient countershaft can be found, from which a small electric generator can be driven. A generator of 2 kw. capacity will run about a hundred 16-c.p. lamps, and the running costs of such lights per 24 hr. should not exceed 10s. In few cases, however, would all lights be on full time, and therefore the daily cost would be considerably less. Even where no countershaft is available, a small self-contained oil engine and generator installed will often be profitable. Truck tramming is in most cases done with two boys per truck. This is necessitated by sharp rail curves or bad grading of track. If a track is laid off with easy curves and with a grade in favor of the loaded truck of about ½%, one native can easily handle a 10 cu.ft. truck. Incidentally, with the track graded in favor of the load, there is natural drainage for water to the station.

In a number of small mines it has been found economical to make each drill boy responsible for his own drill steel. The method usually followed is to issue to each boy sufficient drills to enable him to drill the requisite footage per shift. He carries his own steel to the face and returns it to the drill sharpener for dressing, and is responsible for recovering the same steel again from the drill sharpener. As the drills wear out, the short worn end has to be returned before a new one is issued. This system where tried has been found to be satisfactory and economical, few, if any, drills being ever left behind in the mine.

A large number of picks are purchased annually by small workers, and this number could be considerably decreased if, instead of discarding picks as points get short, new steel be welded on each end. This work can be most profitably done by collecting short picks, so that a number can be done in one job. Drill hammers the faces of which are out of shape should also be collected, as a blacksmith can face them up and retemper them.

Steel wire ropes, whether used on hoisting engines or on windlasses, should be regularly greased, as the life of the rope is thus materially increased.

Pumping Economies and the Use of Warm Feed Water in the Power Plant

Pumping water from underground by steam pumps is responsible for a large consumption of fuel, on account of the heavy condensation of steam in pipes and the large consumption of steam per horsepower with the usual positive-motion pump. In many cases this method of pumping cannot be avoided. In all pumping schemes, particularly from permanent stations, full consideration should be given, however, to the economies which can be effected by the installation of electric or other methods of pumping. Boilers and steam pipes should in all cases be carefully lagged with nonconducting covering, as the initial outlay will be quickly recovered by the saving in fuel consumption and general wear and tear of plant. Scale in boilers causes increased fuel consumption, and heavy scale endangers the life of the boiler. Surface waters are, as a rule, free from incrustation solids, but most underground water requires treatment before use as boiler feed. In all cases a sample of the water should be sent to an analyst, who will give a certificate of analysis with notes as to correct treatment. The quantity required for an analysis is about a quart. The cost of analysis is small, and the large majority of waters can be easily and cheaply treated, and the results achieved by such treatment fully justify the small expenditure involved.

Unless absolutely unavoidable, cold feed water should not be introduced into boilers. The exhaust steam from engine, pumps, etc., should be utilized for heating the feed water. Economizers for this purpose can be purchased, but in many cases an apparatus can be constructed on the mine. An advantage in heating the feed water to about the temperature of exhaust steam is that magnesia or carbonate of lime in the water is thrown down before the water enters the boiler. If exhaust steam is introduced directly into the feed-water tank, precaution should be taken to eliminate oil before the water enters the boiler. Ashpits under fire grates of boilers should be made deep, and in no case should accumulations of hot ashes be allowed to remain in them. A large number of new fire bars are annually used, and the majority of these are required because the old ones get bent and destroyed by hot ashes in ashpits. It is more economical to run two boilers, each with an easy load, than to force one boiler, overloaded, to do the same work.

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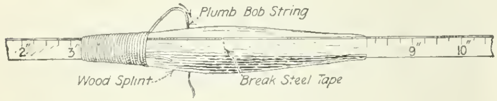
Field Mend for Steel Tape

By Hale H. Hunner*

Although there are several quick-repair menders for steel tapes on the market, it usually happens that they are in the office when the tape breaks. I was taught this simple mend by a practical surveyor several years ago, and have used it a good many times since and never had the least bit of trouble in making it hold as long as I cared to leave it on. I have worked for a week in the woods with two of them on the tape without having to be touched except for an occasional soaking.

When the tape breaks, cut a straight piece from a green alder or willow about 3 in. long. When the stick is split down the center and peeled, it should just cover the tape laid lengthwise. Smooth up the split faces and shave down the outside from the center of each half to a thin edge. About 3 ft. of plumb-bob string or stout cord will serve to wrap the splints. The cord should be wrapped as tight as possible each time and care taken to see that the binding does not have a chance to slacken up. When the splint is nearly half wound, place the broken ends together right side up and finish winding until the splint is entirely covered. A minute's soaking in water will remove any possibility of slipping. If it should slip at all, it will pull entirely out, thus there is very little chance of getting wrong chainage. It slides through the brush and around rocks with very little hindrance and while it puts a stiff place in the tape the advantage of a quick field repair overbalances the disadvantage.



MENDING A TAPE WITH WOOD AND STRING

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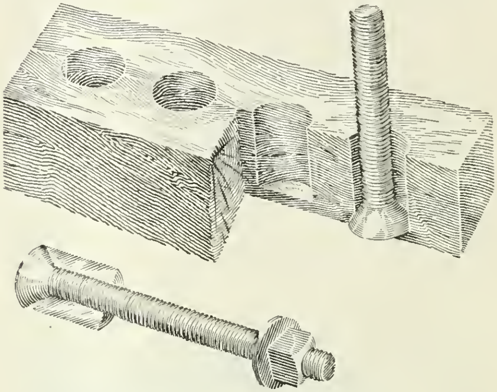
*920 Third Ave., Hibbing, Minn.

Making an Expansion Bolt

Making an expansion bolt that is satisfactory, especially for light work, is an easy matter when done as illustrated, according to F. F. Sengstock in *Power* for Dec. 19, 1916. Make a mold by clamping together two blocks of wood and boring a hole (half in each block) the size of the hole into which the expansion part of the bolt is to go and the depth required. Into this mold place a stove bolt (any other kind will do) threaded well down toward the head as shown, and pour molten lead around it. When the bolt is placed in position and the locknut is tightened down hard, the lead will swage out and hold the bolt securely. A countersunk head will help the bolt to expand the lead sleeve.



MOLD TO CAST LEAD SLEEVE AROUND A BOLT

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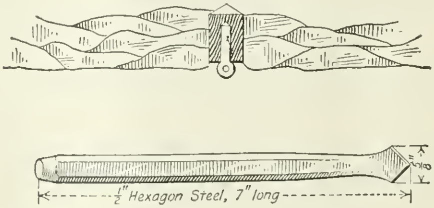
A Light Spad Drill

The instrument and method described by W. S. Herbert in *Coal Age* recently are possibly not new, but they may be of interest to many engineers who do underground surveying in mines with wall rocks not too hard.

A hand drill for drilling spad holes is apt to be heavy and cumbersome, and carrying it about through the mine requires much time and energy. A ⅝-in jumper drill, similar to the one shown herewith, and a hammer accomplish every purpose. By their use a hole may be quickly drilled into which a ¾-in. wooden spad plug may be driven. The drill is light and can readily be slipped into the pocket, so that but little effort is exerted in carrying it about and it beats chasing around to find a Cousin Jack who can be taken away from his work to drill the small hole needed.



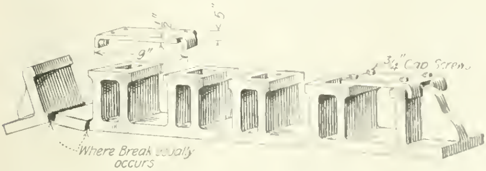
THE DRILL AND A SPAD HOLE

Details of Milling and Smelting

Stamp-Guide Reinforcement

By Arthur C. Daman*

The 1,550-lb. stamps at the Aurora Consolidated Mines Co.'s mill produce excessive vibration, and the guide frames break frequently. To strengthen the frame, a 9x5-in. plate ½ in. thick is bolted on at both ends of it. The ends are the weakest points, all breaks occurring there. Since using the reinforcement plates, no frames have been cracked or broken.



STRENGTHENING STAMP GUIDES

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Use of Diaphragm Pumps

In a paper to be read at the New York meeting of the American Institute of Mining Engineers, in February, 1917, and published in the *Bulletin* for December, 1916, Luther B. Eames, of Timmins, Ont., discusses "Counter-Current Decantation" and incidentally describes the pulp transfer plant at the Hollinger. This plant consists at present of five rows of 40-ft. tanks, four tanks to a row, forming a plant of five units. The tanks are arranged with a difference in elevation of 2 ft. 6 in. between steps with the final tanks of the series the highest, so that all solutions gravitate through and out of the plant to precipitation. The roof is supported on flat trusses, the lower chords of which pass just above the tank rims. These trusses also serve to support the thickener mechanisms and the walks between the tanks.

The diaphragm pumps used were designed by the company's staff. They are all three-throw or triplex pumps, so that in spite of the large tonnage handled the duty on each diaphragm is light. It is not uncommon for diaphragms to last 300 days, while the life of the present type of valves and seats has yet to be determined.

The pumps are used not only for pulp transfer, but also for the final discharge. This makes regulation of the final discharge for moisture much easier and more reliable, keeps the work of the operator all on the upper floor and allows the tailings to be discharged at a considerably greater elevation than would otherwise be the case.

The practice in most plants in the Porcupine district now is to use cone pulleys for the regulation of capacity, although some of the operators favor regulation by varying the length of stroke.

The valves should be of the floating type, as any hinge device will catch the wood chips that are present in the best-screened pulp. The chips lodged in the hinge of the valve start leaks which, though small in amount at first, cause cutting of the seat and consequently permanent leakage. With the floating valve there is no place for chips to lodge and the whole circumference of the seat is washed by pulp at every stroke. This type of valve also has the advantage that the lower valve may be placed directly below the upper one and may be made small enough to be lifted out through the upper-valve seat when the upper valve has been removed.

The best results have been obtained when the working surfaces of both the valve and seat were of high-grade rubber. Belting was used at first, but it was found that minute leaks were almost sure to start, owing to the fact that belting is not yielding enough to close over any chip that may lodge on the valve seat and that a leak once started would ruin both valve and seat in the course of a few days. On the other hand, valves of rubber seating on rubber have operated six months without the slightest decrease in efficiency and with scarcely perceptible wear.

Diaphragm pumps have been operated at speeds varying from 15 to 100, the higher speeds usually in conjunction with a short stroke.

The practice at the Hollinger mill has been to use a low speed and a stroke as long as the diaphragm could safely stand. Measurements taken on the Hollinger pumps equipped with standard No. 4 Gould diaphragm at 3-in. stroke gave results as shown in the following table:

Number of Strokes	Volume per Stroke, Cu Ft	Specific Gravity	% Solids
14.5	0.139	1.54	54.5
23.0	0.148	1.48	50.5

Tons Solids Pumped per Day	% Increase in Speed	% Increase in Volume per Stroke	% Increase in Tonnage
76.3			
114.5	58.5	6.5	50

From these figures, which are typical of numbers of tests made, it may be inferred that the volume pumped is roughly proportional to the speed of the pump, but that leakage is slightly greater on the lower speeds.

The low speeds and the placing of the discharge lips high enough above the discharge valve to leave three or four inches of pulp over the valve at the end of the upstroke have rendered the pumps of the Porcupine district practically free from the splash and drip that have been one of the chief objections to diaphragm pumps in the past.

Where tanks have a settling capacity of over 125 tons of solids per day, it may be found advisable to use the diaphragms in parallel, making a duplex [illegible] a triplex pump. This arrangement has several advantages, with the lowered speed, strains of the pump are lessened and distributed, and repairs can be made on one [illegible] without complete stoppage of the tank discharge. Diaphragm life appears to be roughly proportional to the number of diaphragms employed, while a corresponding increase in the strokes per diaphragm does not result in an increased cost for diaphragms.

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*2678 Eudora St., Denver, Colo.

As a safeguard against waste and other foreign matter it is advisable to screen the pulp before it goes to the decantation tanks, and where small wood chips are to be expected a fairly fine screen, usually of punched plate, will be of great service in protecting the thickeners as well as the pumps.

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Stamp-Mill Reports

By S. H. Brockunier*

One of the difficulties of preparing blank forms for mill, mine or other labor reports is the composing of something easily understood, which the workmen can readily and honestly fill in from the data encountered in his daily routine. Any blank form that will bring before his eyes the work he has performed during the day will be more likely to interest him and secure his coöperation than one so intricately planned or worded that he has to guess at the answer.

After trying various types of stamp-mill reports, with more or less success, the one reproduced herewith was composed. The idea incorporated in it was conceived while watching a dentist mark his chart indicating the treatment of a patient's teeth, hence the application of the idea is believed to be original.

The chart represents a 30-stamp mill as one stands in front of the stamps. Each battery has a number, and the chart column representing it is divided into five spaces, each representing a stamp. The usual repairs, changes or renewals are printed at the left, blank places being left for reporting unusual conditions, which should be written in when they occur. It is a simple matter for the millman to put a × in the column representing a certain battery or stamp, opposite the given repair, change or renewal. Spaces at the bottom of the report show the amount of "quick" fed, amalgam removed, and requisitions desired or filled, and another space is provided for reporting labor employed in the mill.

When these reports reach the office and are properly filed, it is an easy task for the clerk or superintendent to scan them quickly and catch the × showing any renewal or repair in question. One knows to the exact stamp and date just the information wanted without having to laboriously read a lot of matter foreign to the question. These charts are found a fine supplement to a tabulation. One cannot peruse them without getting near to the millman and his real need. They keep one informed better than a mere tabulation of figures from which all human feeling has been obliterated. In the use of this report the millman will not leave the manager in ignorance of his wants, for he is sure to stick some note on the margin, telling something perhaps previously unknown and many times giving the clue to the trouble the manager has been looking for.

This graphic report is easily tabulated for monthly reports, and may be worked out in many different ways. The report reproduced herewith indicates rather more than the usual ills of one shift in a mill, but is so given to more clearly illustrate the method. The chart shows that batteries Nos. 3 and 5 ran the regular time without trouble, only stopping to brush up the plates. Batteries Nos. 1 and 2 lost four hours each because of shortage of ore. Battery No. 4 had trouble with the shoe and die of the feed stem and the adjoining shoe on the second stem, and took advantage of the hang-up to change the screen. If new shoes or dies had been put in, the word "new" would have been put before the word shoes or dies. Battery No. 6 had a broken feed stem and lost an hour fixing it. The rest of the report is obvious.

Pennsylvania Gold Mining Co. Form No. 1

MILL REPORT

Nov. 25, 1916.

BATTERY NO.	6					5					4					3					2					1					REMARKS
Time run (hours)			7					7	¾				6					7	¾				4					4			
Hung Up (hours)			1						¼				2						¼				4					4			
Reason hung up																															
Brushing			×					×					×					×					×					×			
New Screens												×	×	×																	
Shoes												×	×																		
Dies													×																		
Ore Short																							×					×			
Fixed broken stem			×																												

Quicksilver fed battery 18 Oz.

Quicksilver on plates 3 Oz.

Amalgam from plates 66 Oz.

Requisitions *broom, belt* 16″x48′—5 *ply.*

Supplies received 50 *ft. hose* 481 *oz. quick.*

Labor *J. Jenks, rockbreaker* 8, *Jackson, repair* 2.

J Boyd Millman

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*Mining engineer, Nevada City, Calif.

The Assayer and Chemist

Assaying Gold in Copper Matte

By Roger E. Chase, Jr.*

The method described is the result of a number of years' experience in assaying copper matte running from 10 to 50 oz. Au, 20 to 200 oz. Ag and 30 to 50% Cu. During this period we averaged several carload lots per week and the sample of every lot was submitted to a certain well-known umpire. The method in all essential details has been in use for three years, and we have had no difficulty in winning our share of the umpires.

At first we attempted to assay this material by the ordinary crucible method with an excess litharge charge. This is universal practice in copper smelteries for the determination of gold and silver in matte. It calls for a 20-gram crucible (which has a capacity of about 175 c.c.) charged as follows: Sodium carbonate, 12 grams; litharge, 80 grams; silica, 6 grams; niter, 5 grams; matte to be assayed, ¼ a. t. This is stirred and the following cover is added: Litharge, 40 grams; borax glass, 15 grams; sodium carbonate, 12 grams. The muffle should be hot enough to insure a quiet fusion in 20 min. This method is quite satisfactory for low-grade mattes, but for the rich material in question the slag losses and cupel absorption were too high and the method was found entirely too erratic and unreliable.

Several scorification methods were tried. One called for several (five or ten) portions of $^1/_{20}$ a. t. each scorified in 2½-in. Bartlett scorifiers, the buttons to be cupelled separately and the beads combined in one parting cup. We abandoned this method for several reasons, the principal one being that it offers excellent opportunities for the multiplication of weighing errors at the pulp balance.

In another standard method, ¼ a. t. portions are scorified in 3-in. Bartlett scorifiers with about 85 grams of test lead. The matte is mixed with one-half the lead, after which the rest of the lead and a little borax glass are added for a cover. The assays are run in pairs, and the buttons from the first scorification are combined, made up to 65 grams with test lead, fluxed with 1 gram of silica and rescorified. The buttons still contain too much copper for cupellation and must be rescorified a second time. The results obtained by this method are certainly above criticism, but unfortunately, results are not always obtained. The temperature required for the first scorification is over 1,100° C., and I have been unable to find furnaces, muffles or scorifiers that would stand this heat for continued use. A slight drop in temperature at the start causes some constituent of the charge to separate out and float, effectively covering the lead and spoiling the assay. The muffles rapidly collapse, and the loss of scorifiers is extremely high. Nothing can be more discouraging than to nurse along an assay under such conditions and to have it leak out through a crack in a scorifier in the third scorification. It entails a serious loss of time and material, the former particularly annoying.

To overcome these various difficulties we finally adopted a scheme of our own, which is carried out in the following manner: Place 35 grams of test lead and 2 grams of silica in each of four 3-in. Bartlett scorifiers. Weigh out ¼ a. t. of the matte to be assayed and, by tapping the edge of the scale pan with the spatula, drop approximately one-half into each of two scorifiers. Repeat this operation with the other two scorifiers. (At first we made ⅛ a. t. weights by filing the bottoms of some 5-gram weights, but we found the method of splitting quarters to be faster and more accurate.) Stir and add 35 grams test lead and 2 grams borax glass as a cover. Open and scorify hot. Combine the buttons two and two and make up to 65 grams with test lead. Add 2 grams of silica and rescorify as before. The buttons will weigh about 20 grams and will cupel with feathers.

Flatten the beads on an anvil, combine them two and two in porcelain annealing cups and heat for 20 min. in dilute (1-5) nitric acid. Pour off the acid and heat 10 or 15 min. with nitric acid of 1.30 sp.gr. We use electric stoves wound so as to give a heat just sufficient to boil acid in these cups. Wash the beads first in hot dilute ammonia and then in distilled water. Dry and anneal. Each cup now contains, ready for weighing, gold from ¼ a. t. This method has been found to be accurate, rapid, economical and easily worked.

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Determination of Fluorine

A new method of determining fluorine is given by E. Pisan in *Comptes rendus* 1916, p. 791; abstr. *Journ. Soc. Chem. Ind.*, June 30, 1916, p. 709. The procedure depends on the fact that thorium nitrate gives with fluorine in alkaline solutions, made slightly acid with acetic or nitric acid, a gelatinous, voluminous precipitate of thorium fluoride ($ThF_4 + 4H_2O$), which settles rapidly. A large excess of the reagent is necessary to obtain complete precipitation, and it is best to pour off the supernatant liquid before testing whether all has been precipitated. The precipitate should be washed by decantation as far as possible, using hot water. It loses one molecule of water on drying at 100° C. and may be weighed after drying. It is better, however, to burn the filter paper and to convert the precipitate into thorium dioxide by strong ignition. [illegible] water may be decomposed by fusing [illegible] with five parts by weight of sodium carbonate, and after extracting the melt with water [illegible] with acetic acid. [illegible] fuse with 2½ parts of silica and 6 parts of sodium carbonate. The quantity of mineral required for the test [illegible] 0.2 to 0.3 gram when the amount of fluorine present is between 5 and 8%.

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Filter Paper. J. Grossfeld in "Zeit. f. angew. Chem.," 1916, [illegible]

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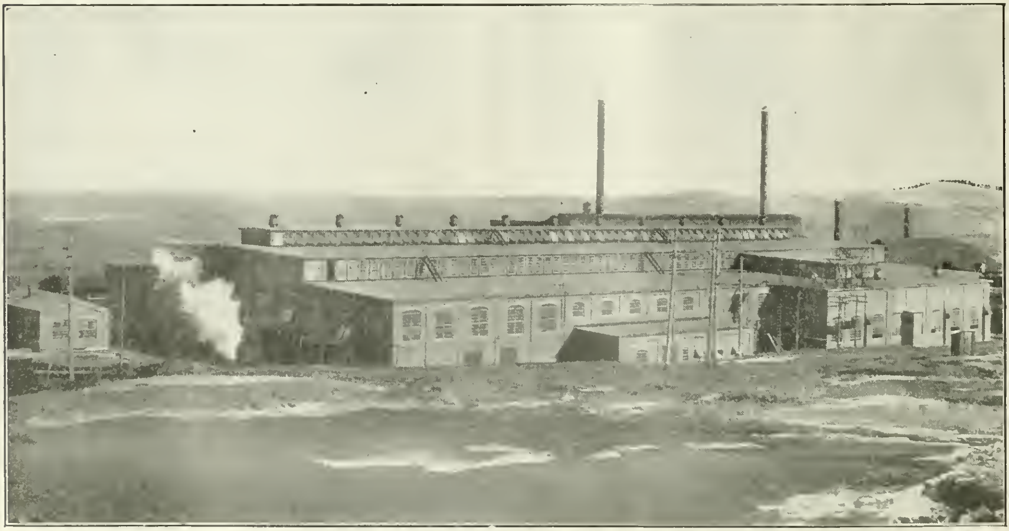
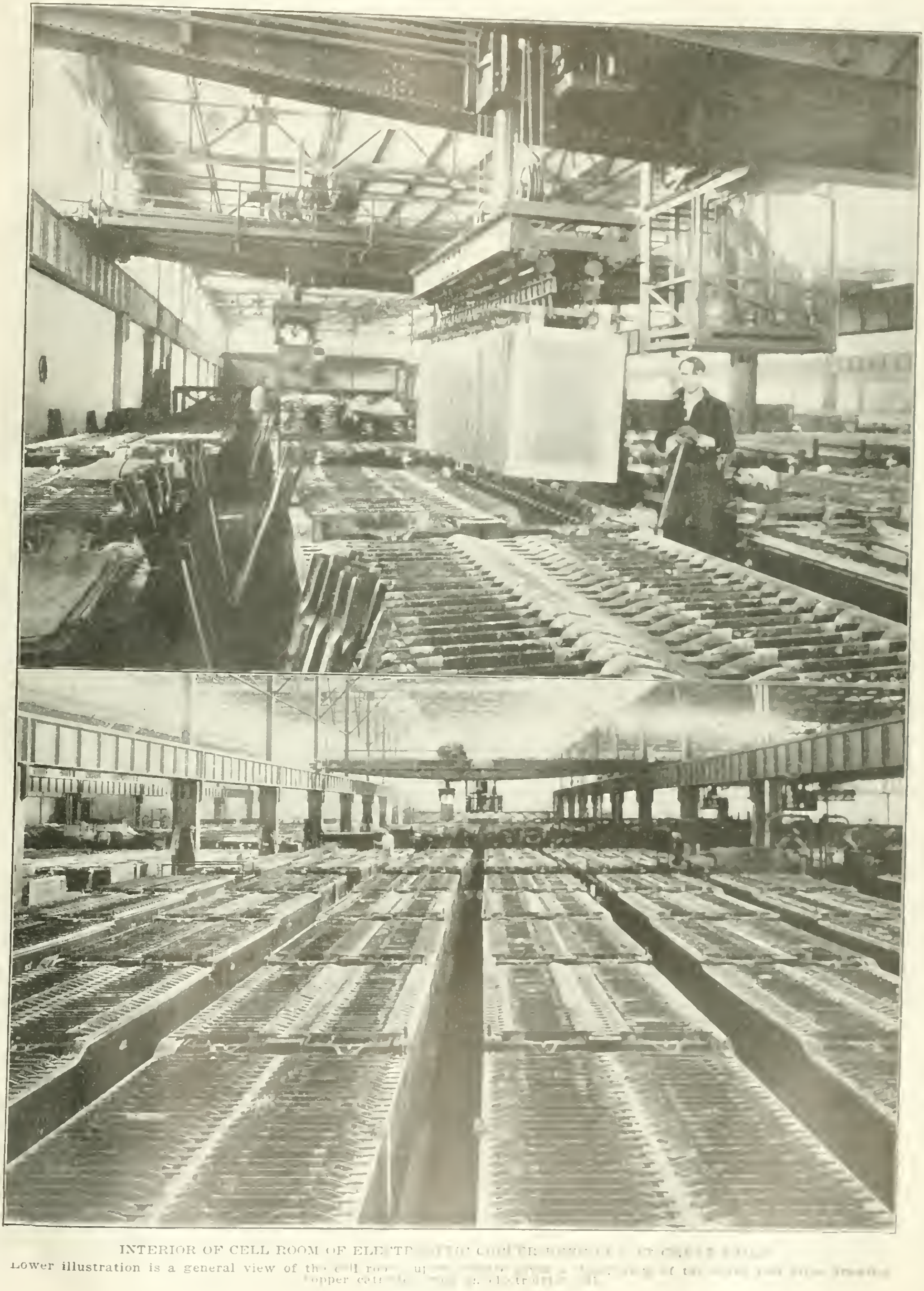
*3005 North Proctor St., Tacoma, Wash.

Photographs from the Field

GENERAL VIEW OF GREAT FALLS REDUCTION WORKS OF THE ANACONDA COMPANY



TANK HOUSE OF ANACONDA'S NEW ELECTROLYTIC COPPER REFINERY AT GREAT FALLS, MONTANA



INTERIOR OF CELL ROOM OF ELECTROLYTIC COPPER REFINERY AT GREAT FALLS

Lower illustration is a general view of the cell room; upper [illegible] of the [illegible] lifting copper cathodes [illegible] electrolytic cell

Correspondence and Discussion

Minerals Separation vs. Miami

In the editorial in the *Journal* of Dec. 16 there is a statement as to the Miami Copper Co. which, while technically correct, gives, if one has not in mind the circumstances and the patent condition at the time, an incorrect impression as to the attitude of the Miami company. It says, "The Miami Copper Co. also defied the patents."

The circumstances were that some months previous to the time that the Inspiration company entered into negotiations with the Minerals Separation, I had incidentally spoken to one of the officers of the General Development Co. of some very remarkable results I had obtained upon Teziutlan ores in working upon one of the earlier stages of what has developed into the Towne-Flynn process. It was at the time proposed that, at the first opportunity, I go to Miami to carry out some experiments, which I afterward did. In the meantime Minerals Separation had carried out its original small test-plant experiments at the Inspiration.

The Miami management, basing its calculations upon the results of these original Inspiration tests and assuming certain figures as to cost, etc., had concluded that, "commercially," flotation did not compare favorably with the results of a gravity slime-concentrating scheme upon which they had been experimenting.

Just at this time the Appellate Court, at San Francisco, had declared the Minerals Separation patent No. 835,120 invalid. The Miami company was therefore not in a position to sign a contract with Minerals Separation—the first clause of which affirmed the validity of this patent.

It was necessary, however, to determine more definitely just what commercial advantages, if any, flotation presented. For that purpose a small agitation type of machine was built. Upon this purely experimental operation, the machine, although receiving its feed from the mill, was not a part of Miami mill operations, upon which the first infringement suit, afterward withdrawn, was brought. The infringement was the merest technicality, but served the purpose of getting the patent before the Delaware court.

The process actually used at Miami, as well as the one that I had originally considered using, is so entirely different in action from the Minerals Separation process that the officials of the General Development Co. very honestly believed that there was absolutely no similarity in the process, nor had their process or their first consideration of the subject of flotation any connection whatever with Minerals Separation.

A representative of Minerals Separation had called upon one of the officers of the General Development Co., but would not disclose what his process was, simply urging that some ore be sent him for test. It was only from the London address given and the description of the gentleman who had called that I recognized what the process was that he had represented.

Once brought into the court upon such a mere technicality—for the purpose of obtaining the legal status of the patents in question—the Miami Copper Co. is doing what any defendant is obliged to do, without any intention of defying any patent or any other law.

I am in no way connected with either the General Development Co. or the Miami Copper Co., having merely been called in for consultation, yet, I feel constrained to protest against any interpretation of the matter that might reflect upon the attitude of these people. R. C. Canby.

Wallingford, Conn., Dec. 18, 1916.

Lead-Plating Sheet Metal

In the *Journal* of Dec. 9, page 1,017, it is stated that it has not been possible hitherto to lead-plate metal so that the deposit will not readily peel off. This is entirely incorrect, as no difficulty is experienced in lead-plating, sheet iron, for instance, with a soft, dense and adherent coating.

Realizing the great value of lead-plated sheet iron for many structural and other uses, I have experimented considerably along these lines. The only difficulty has been that the minute particles of slag in the metal would not take the coating and pinholes would be left which developed rust spots on exposure. If it had not been for this difficulty, lead-plated iron would have been on the market a long time ago. At the present time it is hoped to perfect a method of treatment based on playing a gas flame over the surface part of the deposit deep enough to close the pinholes, but not long enough to heat the lead through to the iron and cause it to melt off.

Patents on the deposition of solid lead coatings and on the solid lead deposit as a product are owned by me.

Asheville, N. C., Dec. 12, 1916. Anson G. Betts.

The Big Pine Cyanide Mill

In regard to my article on the Big Pine Consolidated mill, in the *Journal* of Dec. 16, 1916, where I brought up the matter of the theoretical possibility of a continuous counter-current flow without pumps, it has occurred to me that I made one mistake.

I said that the thick pulp would discharge from the bottom of tank No. 1 into the top of tank No. 2 by its static head until it had reached the level of tank No. 1. This is not true, since the specific gravity of the pulp in the pipe is much higher than in the discharging tank. However, if we discharge from the bottom of tank No. 1 to the bottom of tank No. 2 and immediately dilute with fresh solution to the specific gravity of tank No. 1, the pulp in tank No. 2 would rise by its static pressure to the level of tank No. 1 and the results I claimed would be obtained. In the article I believe I have called the tank No. 2 above, "agitator No. 1."

Charles H. Dunning.

Prescott, Ariz., Dec. 22, 1916

Belgian Kiddies, Ltd.

The following authentic story of a heart-breaking experience by H. C. Hoover, was told in the New York *Times* of Dec. 21, by his friend George Barr Baker, a member of the relief commission recently returned from abroad. This alone gives a correct idea of what the Belgian Kiddies are suffering. It is one of the most appalling things of this whole terrible war:

"Mr. Hoover, accompanied by Dr. W. R. Kellogg, went to Belgium during the last few weeks and saw 1,200 of these children standing in line in a district near Brussels waiting for their food to be doled out to them. They were all school children, none of them being much over 14 years. All of them were happy—the poor little things had their food tickets in their hands and were facing the pleasant prospect of getting something to eat. Their mothers and others of the women relatives were standing by watching them.

"Suddenly Mr. Hoover saw one of the Belgian women who are working with the commission step over to the line and drag a child out of it. The child screamed and fought to get back into line, but the woman kindly but firmly forced it to one side. This was followed by other women doing the same thing, which was always accompanied by the screaming protests of the child.

"Puzzled by these extraordinary incidents, Mr. Hoover went to one of the women workers and asked why the children were taken from the line.

"'They are of normal weight,' she said, 'and cannot have a meal today. They must wait until their weight is reduced before they may have food—this may be one or, perhaps, two or three days. Only those who are under weight and are facing starvation may have food. There is so little food that only those who need it most may have it.'

"Mr. Hoover was astonished and overcome, and asked the woman if it was possible that the children must be really starving before they could be allowed to have a meal.

"'Yes, that is so,' she said, sadly. 'We cannot feed so many little mouths with so little. If we had the food we would give it to them—but what can we do? If America would only send it to us we would see that all these little children had at least enough to keep them at normal weight. As it is now, we are powerless, and those who do not show signs of starvation must stand aside for the less fortunate ones.'"

Some of the letters accompanying subscriptions for Belgian Kiddies, Ltd.,[1] stock are very interesting, and some are touching. Here are some samples:

Your solicitation for subscriptions in stock permits no argument, and I find the first dividend already declared as I write my check for ——. I am not very fond of Belgian hares, but a kid is a kid the world over, whether he may be white, black, yellow or Belgian, and a hungry kid is too awful to think about.

The last ladder that all we mining engineers will climb is the one leading to Eternity, and I am sure when that day comes, we will all look back on our Belgian and similar investments with the utmost satisfaction. May every mining engineer so live and conduct himself that when he makes the last climb on the ladder, it will be up the shaft and leading to the sunshine and not a winze leading to gloomy stopes.

———

It gives me pleasure to be able to respond to your appeal for the Belgian Kiddies, and I thank God that I can help a little to right a monstrous wrong.

The Belgian Relief Committee has, heretofore, not been asking enough from Americans. Urge them to *make sacrifices* and to give to the Belgians instead of giving each other Christmas presents.

I congratulate you on having made yourself so wondrously useful to these poor abused people.

———

Enclosed please find my check for —— to cover subscription price on —— shares of stock, to be issued as indicated on subscription slip and sent to me at above address. I expect to put these certificates in my kiddies' Christmas stockings.

Will you also kindly send me a half dozen subscription blanks with literature, that I may turn promoter. Several of my friends can get better returns on their money in Belgian Kiddies, Ltd., than are likely to accrue from some of the wildcat mining schemes they are playing with.

———

Reading in the *Evening Post* today of the Belgian Kiddies, Ltd., and your connection with it, I consider myself privileged to become a stockholder and enclose my check for —— to pay for —— shares.

———

Enclosed please find check for —— in payment of —— shares Preferred Stock in your corporation, these shares to be in the name of —— and —— both kiddies who know the worth of a square meal, at least judged from the general uproar if it is five minutes late.

———

Notice your announcement in *Engineering and Mining Journal* and as your stock is so highly recommended, I would be pleased to subscribe for —— share and enclose my check for —— in payment. Only regret that I am unable to invest more heavily.

———

I enclose herewith check for —— for which the —— kiddies would like to subscribe for —— shares of preferred stock in the Belgian Kiddies, Ltd.

The —— kiddies have read the statements contained in the prospectus of this corporation given in the last issue of the *Engineering and Mining Journal* and they believe this to be a first-class investment, and are confident that they will receive dividends of 100% yearly on this investment.

———

For papa's check enclosed please enter my subscription for —— shares of —— stock.

December 15th—the day of the [illegible] Festival at Carnegie Hall.

———

No New Year presents. Investment in [illegible] will bring such joy as money [illegible] this project. Therefore subscribe!

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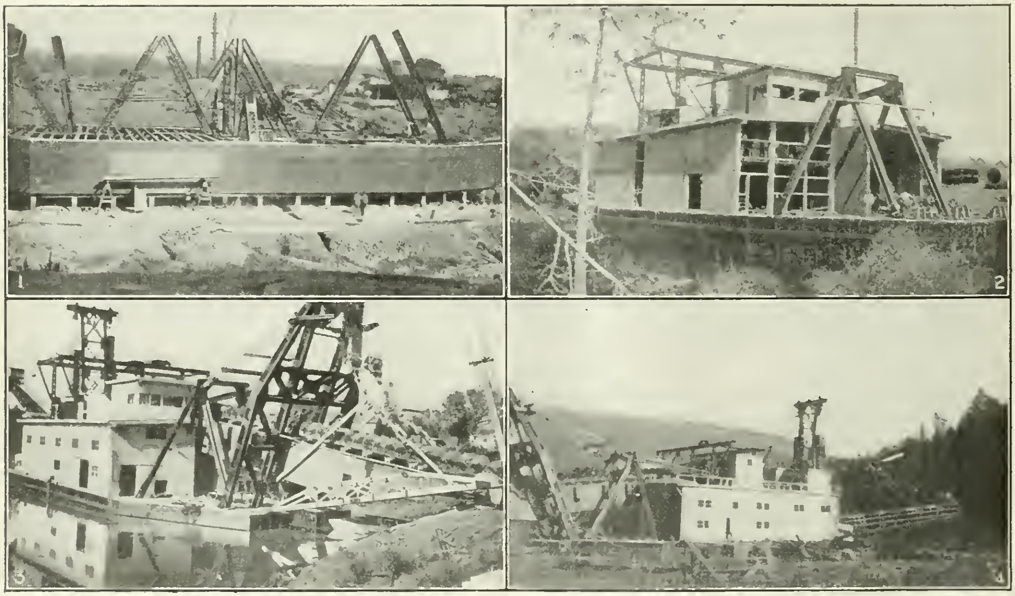
[1] Belgian Kiddies, Ltd., Room 2124, 120 Broadway, New York City.

Steel Dredge Construction by Pacific Dredging Co.

The Yukon Gold Co. has installed, in record time, two all-steel gold-placer dredges, built by the Marion Steam Shovel Co., Marion, Ohio, in accordance with plans furnished by the Yukon company. One of the dredges was installed on the north side of Yuba River, 17 mi. northeast of Marysville in Yuba County, California, and the other on Coffee Creek, a tributary of Trinity River above Carrville in Trinity County.

The construction work on both dredges was handled by the regular employees of the Yukon Gold Co. and carried on in the name of the Pacific Gold Dredging Co., which is the operating company for the Yukon in California. H. C. Perring was superintendent of construction of the dredge on the Yuba River, with John Myers as foreman. H. C. McNaught superintended the Coffee Creek construction, with Oscar Wicks as foreman. O. C. Perry is resident manager at Oroville of the Pacific Gold Dredging Co.



CONSTRUCTION VIEWS OF YUBA AND TRINITY DREDGES OF YUKON GOLD CO.

First photograph shows the dredge after 42 days of work. The second shows the housing completed after an additional 40 days of work. The third view is of the completed dredge, 4 months and 10 days after starting work on it. The last view is of the Trinity dredge, completed in 4 months 18 days

The dredges were built from the same plans and are alike except that the digging ladder of the Yuba dredge is longer than that of the Trinity. The Yuba was designed to dig 70 ft. and the Trinity to dig 60 ft. below the surface. Both have steel hulls and buckets of 9½-cu.ft. capacity. They are of very heavy construction, patterned after the dredges operated in the Folsom district by the Natomas Co. of California. The total weight of each is approximately 1,900 tons. The Yuba dredge was erected in 4 months, 11 days; riveting the bottom plates began June 19 and the dredge began digging Oct. 30. The Trinity dredge was erected in 4 months, 18 days; riveting bottom plates began June 25 and the dredge began digging Nov. 13.

The time which elapsed between the placing of the orders for the hulls and machinery with the Marion company and completion of the dredges (amounting to 9 months and 20 days for the Yuba dredge and 9 months and 27 days for the Coffee Creek dredge) was probably the shortest on record for steel-hull dredges.

All materials for the Yuba dredge were hauled 14 mi. from a spur of the Southern Pacific R.R. near Marysville, while those for the Coffee Creek dredge were hauled from Redding over the Trinity Mountains, a distance of 58 mi. The contract for the hauling of materials for both dredges was given to Henry J. Brandt, of Bakersfield, and was completed in less than four months. He had as many as 260 mules in harness on the Trinity Mountain road at one time. The hull sections were reduced in weight as much as possible, and the spuds, digging ladder and tails-conveyor frame were all hauled over the mountains before being assembled and were set up and riveted on the ground at the construction camp. Over 94,000 rivets were driven on the Coffee Creek construction, and 70,000 on the Yuba construction.

The hulls of these dredges are 135 ft. long, 60 ft. wide and 11 ft. deep. The well-holes are 77 ft. long by 7 ft. 4 in. wide. The digging ladder is 124 ft. 4 in. long, 9 ft. 4 in. deep by 4 ft. 5 in. wide, of plate-girder type of construction, as clearly shown in Fig. 3. Each dredge is equipped with two spuds exactly alike, of the box type, 70 ft. long 34x54 in. The upper tumblers are of nickel-chrome steel, shrunk on the shaft, which is of 18-in. diameter. The lower tumblers are of manganese steel of the round type, pressed on the nickel-steel shaft.

The buckets, are of two-piece manganese steel, made by the American Manganese Steel Co. of Chicago Heights, Illinois. The bucket pins are of $6\frac{3}{4}$ in. diameter, and 2 ft. 7½ in. long. The pitch of the buckets is 2 ft. 11 in., the weight of each bucket, without pin, is 3,000 lb.

The tails-conveyor frames are 155 ft. long, 7 ft. deep and 4 ft. 10 in. wide, of lattice-girder type. The conveyor belts are 36 in. wide and 318 ft. long

The screens are of the revolving type, and the gold-saving tables are arranged double-banked. The pumps were built by the Yuba Construction Co., each dredge having two 12-in. pumps, and a 6-in. two-stage pump. The electric apparatus is all of the General Electric type, the motors operating at 2,200 volts. Each dredge has motors of 645-hp. capacity. The main-drive motor for the digging end of the dredge is rated at 300 hp.

The rated capacity of each dredge is 200,000 cu.yd. per month.

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Molybdenite-Tungsten-Bismuth Developments of Queensland

By M. Vingoe*

The prices obtained by miners for molybdenum and tungsten ores since early in 1912 is a reflection of the demand for special steel alloys in which these metals are incorporated. The price of molybdenite, which was £2 per unit f.o.b. Cairns, or about £200 per ton for 96% ore in March, 1912, rose progressively to £550 previous to July, 1914.

Since there were but few known deposits of value, the high prices obtained for the product stimulated prospecting, and many places hitherto regarded as of negligable value have received attention with results most promising for the future production of molybdenite.

Records of mineral won and prospecting work done, regularly published in the *Queensland Government Mining Journal,* conclusively show that production increased by over 50% in 1915 compared with the preceding year. The annual production of North Queensland approximates, and may this year exceed, 150 tons.

The mining district known as the Chillagoe gold and mineral field produced the greater portion of Australian molybdenite output. Wolfram township is associated with early exports of tungsten ores, and the surface deposits are believed by many to be payable at considerable depths, the tungsten being associated with molybdenite and metallic bismuth.

The characteristics of the wolfram district, which is only a small portion of the Chillagoe field, are well known. The metals are not found to any extent in defined lodes or fissures, but appear to have been intruded through faults in the granite country. The pipes or shoots are often erratic in their course and present faults and pinches in a manner most exasperating to the miner. Often when a pipe enlarges, the ore becomes leaner and unpayable. Mining proper, as practiced on well-defined lodes, is unknown here. The miner follows the quartz pipes, which are tortuous in direction and uncertain in extent and continuation.

The richest portion of the district contains a few leases of value. One or two of the shafts bottom at 300 to 400 ft., and at present the ore is not very promising at that depth. On one lease a shaft has been sunk through a diorite overlay passing through granite and porphyry at 300 to 400 ft., and fortunately intercepting at less than 500 ft. one or more quartz pipes. The latter are apparently rising toward the surface on adjoining claims already being worked at higher levels. The general opinion of geologists who have visited this center is that the pipes, or shoots, may tend to become larger with depth, but the metal content will become more sparsely distributed. Indications in some of the hitherto best-paying mines at present confirm this opinion. One of these mines, a large and consistent producer of the three rare metals for several years has ceased operations in the main shaft in consequence.

Efforts have been made from time to time to consolidate the field by a large capital issue, buying out the present owners and mining according to uptodate methods. A mining company holding large interests in the field has in late years found direct control unprofitable and except in one or two places has abandoned regular mining and encouraged leasing.

In view of recent developments it would appear that the position formerly held among producing centers by Wolfram Camp is seriously challenged. The characteristics of the lodes from a mining point of view, the high values placed on their holdings by present mine owners, and the onerous labor situation, yearly becoming more acute, all combine to present a serious problem to the capitalist who would endeavor to create a unified holding.

The more recent developments already referred to consist chiefly of the discovery of various bodies of quartz in the Chillagoe and Etheridge districts, which on prospecting, have proved to be real fissure lodes containing payable and in some cases high-grade molybdenite, often associated with wolfram and bismuth ores. One property especially is receiving considerable advertising locally, and on paper apparently presents good prospects for a stock company. Many claims and leases have been taken up on adjoining land, and in the event of a successful flotation of the main property the holders of these claims would probable be able to liquidate at very advantageous terms. Be this as it may, the *Queensland Government Mining Journal* reported in the June issue a probable production of ore from the first 100 ft. on the lode in question of one claim alone, valued at present prices at over £26,000.

There are other fissure lodes in this and adjoining fields which promise equally good mining speculations. One of these, reported upon favorably in August (1915) number of the *Queensland Government Mining Journal,* extends over a mile in length and is considered to be a fissure lode of great constancy. Throughout its length there are deposits of molybdenite, wolfram and bismuth in the quartz body, from the surface down, and one prospecting shaft sunk 100 ft. has been driven through payable ore without encountering a single barren spot.

In North Queensland the future of mining these particular metals depends largely on ruling prices. If prices fall to the 1912 level, it will mean the closing of many mines unable to support the high mining costs which ever tend to increase. A large company could not successfully compete with the small producer over such a scattered producing area. A leaser or independent "fossicker" in the limitless back country will be content to burrow and mine for months, obtaining a subsistence of 20 to 30 shillings weekly, in the hopes, often realized, of making a "strike." The same man, discouraged by lack of success, may take to day labor in a payable mine and obtain a remuneration of from £4 to £6 weekly for an actual working week of 41½ hours, thanks to the strong Australian Workers Union. Such are some of the encouragements offered to capital to develop properties which otherwise will be only scratched by the independent miner and abandoned when the shaft begins to deepen and costs increase.

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*Manager, Twisp Syndicate, Wolfram, North Queensland.

It is expected that the newly formed Australian Metal Exchange will take hold of these and other metals when the Imperial Requisition is lifted and a regular quotation will then replace the present competitive bidding.

Some accounts and samples of molybdenite ore from the Western States of America have been received on this field, and an American enterprise which had intended operating in North Queensland has diverted its interest to the new fields nearer home, where it is stated labor is more efficient and a fair day's work is still obtained for a fair day's pay. The delay and difficulty attending successful treatment is said to be retarding actual production in those parts, but the deposits are evidently to be reckoned with in the near future of the molybdenite market.

The successful treatment of molybdenite involves an oil-flotation process, and although efforts have recently been made along progressive lines, much remains to be done before good recovery can be commercially made. It is believed, however, that a little careful experimenting will completely solve the problem.

The British Copper Restrictions

The following order [Serial C, 3011] was issued by the Ministry of Munitions of War, dated Dec. 8:

The Minister of Munitions in exercise of the powers conferred upon him by the Defence of the Realm (Consolidation) Act, 1914, the Defence of the Realm (Amendment) No 2 Act, 1915, the Defence of the Realm (Consolidation) Regulations, 1914, the Munitions of War Acts, 1915 and 1916, and all other powers thereunto enabling him hereby orders as follows:

(1) No person shall as from the date hereof buy, sell or, except for the purpose of carrying out a contract in writing existing prior to such date, enter into any transaction or negotiation in relation to the sale or purchase of copper of any class whether wrought or unwrought situated outside the United Kingdom unless such person is authorized by a special permit from the Minister of Munitions to purchase or sell the same. All applications for Special Permits shall be made to the Director of Materials, Armament Buildings, Whitehall Place, London, S. W., and marked "Copper Permit" and all persons to whom such permits are granted shall observe and perform all the conditions subject to which such permits may be granted.

(2) All persons shall, except as below mentioned, not later than the 16th day of December, 1916, send in to the Director of Materials, Armament Buildings, Whitehall Place, London, S. W., returns of: (*a*) All unwrought copper at the date hereof held by them in stock or otherwise under their control; (*b*) All unwrought copper due at the date hereof for future delivery to them; (*c*) All contracts existing at the date hereof for the sale to or purchase by them of unwrought copper.

Notwithstanding the above no return is required from (1) any manufacturer or smelter of stock in hand or due for future delivery for the sole purpose of manufacture or smelting at his works; (2) any person whose total stock in hand and due for future delivery does not exceed two tons.

By a further Order of the same date [Serial C, 3012] the Minister of Munitions gives notice: (1) That in exercise of the powers conferred upon him by the Defence of the Realm (Consolidation) Act, 1914, the Defence of the Realm (Amendment) No. 2 Act, 1915, the Defence of the Realm (Consolidation) Regulations, 1914, and all other powers thereunto enabling him he hereby prohibits as from the date of this Order the use of copper whether wrought or unwrought in any kind of manufacture except for the purposes of a contract or order for the time being in existence certified to be within Classes "A" or "B" of circular L. 33 as to control of output issued by the Minister of Munitions on March, 31, 1916. (2) That the Order of the Minister of Munitions on November 6, 1916, relating to the manufacture of copper wire and cable containing copper is hereby cancelled.

All applications in reference to this Order should be addressed to: The Ministry of Munitions of War, Priority Branch, 1 Caxton Street, Westminster, London, S. W.

The Ministry of Munitions announced that they had appointed Cecil Budd, of Vivian Younger & Co., London, and R. M. Rucker, of Henry Rodgers, Sons & Co., London, as a committee to advise the Ministry on the purchase and distribution of copper. Mr. Budd is chairman of directors of the London Metal Exchange, and Mr. Rucker is chairman of the Metal Exchange. Mr. Stroud, of Charles Tennant & Co., will act as secretary to the committee.

Minerals of French Indo-China

A recent review of French Indo-China, by Lawrence P. Briggs, United States Counsul at Saigon, published as a supplement to *Commerce Reports,* of the Department of Commerce, at Washington, points out how much the zinc industry has profited by the war. After the dullness of the last few months of 1914, the price of zinc rose to several times its former figures, and the industry developed as fast as possible under the limitations of lack of machinery and of European supervisors. Shipments of zinc last year totaled 33,335 tons, of which 17,903 tons went to France, 7,825 tons to Baltimore and Galveston and 7,602 tons to Japan. In 1914 the exports amounted to only 19,562 tons. In the first half of 1916 zinc exports from Haifong amounted to 19,699 tons.

Tonkin also exports tin, tungsten and antimony. Shipments of tin and tungsten ore or wolfram, amounted to 397 tons in 1915, against 216 tons in 1914. The customs figures show that 161 tons of ore were exported during the first seven months of 1916, but it is doubtful if these figures are exact. The ores are sent only to France.

Exports of antimony ore, which also goes to France, amounted to 833 tons in 1914, 630 tons in 1915 and 198 tons during the first seven months of 1916. A plant for the reduction of antimony ore is in course of construction near Haifong.

Editorials

The Position of the Metals

The change that occurred in the position of the metal markets in December was pronounced and without doubt indicates the turn of a tide, just as did the change last May. Indeed there was a good deal of similarity in the events. The momentous news of Dec. 12 was simply contributory to hastening what was already developing.

Thus, in spelter we had the first great advance in 1915 when the price rose to about 25c. followed by a decline to about 10c. Late in the year began a secondary advance which in the spring of 1916 culminated at about 18c., followed by a decline to about 8c. In the fall of 1916 began the third advance, which culminated at about 13c. Each of these major upward movements was less powerful than the one preceding.

The third advance attained its climax at the end of November. On Dec. 1 speculators attempting to liquidate found that there were few buyers, and they began immediately to offer at concessions in order to sell, small producers joining in the movement. The big producers stood aloof; not being sure that it was anything but a temporary recession that had started and recognizing that any aggressive offerings on their part would simply precipitate the decline. The latter was well under way and important interests had become definitely bearish before the German peace proposal came. The disturbance produced by the latter simply carried on in spelter what had already begun.

In lead the situation was different. The position of this metal had become quite tight. Producers in general had booked their expected supplies up to February. The market had passed largely into the hands of speculators, who were promoting the advance on small transactions, the principal producer resisting as best it could, adhering to its declared policy of keeping the price for lead within bounds, out of regard for the broader interests. Thus, we had the A. S. & R. Co. quoting 7½c. while the outside market was much higher. This was a repetition of the experience of last March, but it turned out to be briefer and less pronounced. Lead momentarily touched 8c. in the outside market just before Dec. 12. It is uncertain whether the wavering preceded or coincided with that date. Anyway, the unsettlement that developed then put an immediate end to the speculation in lead, and the premium in the outside market vanished almost overnight. Prompt lead which previously had been so scarce turned out to be available and the whole situation became easier. However, the steadying influence of the principal producer exhibited itself in this juncture, just as it had in retarding an extravagant advance.

As for copper, the boom culminated distinctly on Nov. 18, which date marked the end of the enormous buying. After that the transactions were relatively small—indeed, very small—but the situation was such that even they produced a further advance in price, while as for prompt copper it was apparently so scarce that anybody who could supply a little of it could get about anything he was pleased to ask of somebody who had to have it. Yet, this situation differed from that of last May only in that the producers were sold further ahead and the level of prices was a little higher. The same sequences were bound to occur. Even in November there were strong suspicions that some consumers had overbought.

With the news of Dec. 12 and the immediate collapse in the stock market, the copper market was stunned and experienced a sort of paralysis, but after a few days some people were minded to sell copper. It was curious how the pronounced scarcity of prompt and early copper immediately disappeared. Dealers who had nothing to offer acquired millions of pounds almost overnight. Whence did it come? Why, from consumers who made up their minds that they were not going to need all for which they had contracted—perhaps at 27 or 28c.—and deemed it wise to take a profit while the going was good. Of course, the premiums practically vanished then and the whole market declined.

There had been, however, some consumers who had not covered their first-quarter requirements and when the price reached 33@34c. decided wisely to wait and take their chances. Their opportunity came soon after the middle of December and some of them bought, although others continued to wait. This uncovered interest proved to be of great value in checking a decline, which might have been disorderly if there had been no buyers. In this respect also the December situation was different from that of May-July.

We are manifestly going to have a perplexing condition in the copper market for months to come. The producers have sold their expected production to the middle of 1917 and their contracts are good, i.e., their copper is going to stay sold. On the advance their sales were diminishing, as is always the case, and the average of their sales for the first half of 1917 is nothing like the figure to which the market advanced. Something like 26½@27c. is probably what they are going to get. But having thus contracted their copper they are not going to be in the market for a long time to come, except for the relatively small extent to which they may turn out to have been oversold, i.e. to which their production will prove to be larger than expected. If we are on the threshold of a contraction in consumption, manufacturers who have contracted copper will doubtless sooner or later request producers to postpone deliveries, which will put [illegible] in possession of supplies. For the present, however, the market is likely to be made by [illegible] who are willing to resell and consumers [illegible] will [illegible] a situation [illegible].

What will happen after that, who pretends to say with assurance? The one thing that can be pronounced with certainty seems to be that in copper, as well as in the other metals, the period of wild speculation and inflation is over. This will be a blessing to [illegible] consumers [illegible] to be a good [illegible].

Belgian Kiddies

The stories that Mr. Hoover and his associates tell of the condition of the children of Belgium are heart-rending. Hoover has given up two years of his time—and as we all know his is very valuable time—to the amelioration of their suffering. What pains Hoover a good deal is manifestly that his countrymen have not backed him up as they should have done. It is not too late for them to make good.

We appeal to mining engineers and to mining men generally to come forward and lead the way. It is up to them especially, for Hoover is a mining engineer—a California mining engineer—whose achievements have glorified the profession. They have got to make good. Never mind formalities, subscription blanks, etc. Simply send a check to Herbert C. Hoover, 120 Broadway, New York, with a note that it is for the Belgian children.

The mining industry has profited from the war as much as any other, probably more than most, for the steel, copper, zinc and lead mining companies have notoriously paid large dividends. Mining engineers have participated in them. Let them now be generous.

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The Development of the Small Mine

A correspondent, evidently the developer of a small mine, writes us as follows:

> There is a stage in the mining industry and a necessary one; namely, after the discovery of mineral-bearing ground, the getting it in shape to be worth while to bring to the attention of capitalists. People like us would like to know what to do to put our properties in shape for engineering examination.

This letter might be answered in several ways and if referred to half a dozen authorities would probably bring forth as many different replies, several of which might contain suggestions of value to the writer of the letter. Not knowing the worldly circumstances of "people like us," not knowing the character of the deposit the writer had in mind and not knowing exactly what he would propose to do with the "attention of capitalists" when obtained, the reply must assume certain premises.

Presuming that "people like us" are prospectors with plenty of vitality but with little capital, with plenty of good common sense but with few strong financial friends; presuming that the deposit is a vein or an outcrop of low-grade precious or base metal, and presuming that the capitalist is to be asked to become the financial partner or sole owner of the property, an answer may be attempted, but even with these comparatively simple conditions it will be unsatisfactory; for there are no two prospects that are just alike, there are no fixed rules or methods of procedure to be adopted, and circumstances will often point to the most logical course to pursue.

The prospector who finds a cropping containing ore sufficiently rich and of such size as to warrant shipping from grass roots needs to look for neither friends nor capitalists. Such a fortunate individual might more appropriately ask how to protect himself against friends and capitalists, for under such circumstnaces they will be more likely to search for him than to be searched for.

There are several ways of securing money on the supposition that it is to be spent in the making of a mine; some of the ways are as crooked as a worm fence. There are as many ways of selling a hole in the ground—ways that will not stand close inspection, notwithstanding the fact that they are often used and often succeed; but the capitalist of today whom our friend wishes to interest is one who must be shown before he makes an investment. We presume that our correspondent is neither the lucky one who has found a cropping of ore that may be shipped to the reduction works just as broken nor the dishonest one trying to sell a hole in the ground, but a legitimate searcher for ore who has found that which he believes will lead to something of importance.

Our first suggestion to one who has found such a deposit is to let it alone unless he has the courage of his convictions, unless he is willing to put in his own time on it and is willing to sweat blood in demonstrating that it is worth development. Unless he is willing to do this, and does do it, he had better not waste time setting his stakes, for the prospector of today is up against it unless he has something of real interest to show. In earlier days, when rich finds were more frequent, neighboring claims with small exposures and little work done could often be sold or financed upon the strength of adjoining property; but conditions have changed, and the finds of the prospector of today are often far from any rich neighbor, where they must stand entirely upon their own merits, and without some commercial ore in sight or excellent indications of finding it, they will not be eagerly taken up.

Having found something that is worth good hard work, our suggestion is to start that work at once at the most promising point where conditions permit and stick at it until it is impossible to go farther with the means at hand. Do not attempt to stake the whole country or cover the whole district, if a new one, with your claims. If you have been the first on the ground and have taken the best, leave some for the other fellow; let him have something to work on. If he strikes pay he won't hurt you, and his finding ore under a less favorably disposed surface may even help you. A large number of claims, if honestly held, means scattered and ineffective work, while a small number well located permits of the assessment work being concentrated at one or two points and the effective accomplishment of results.

If your circumstances permit, do not stop when the annual assessment work is done, but keep digging as long as you can and then put in another round just for luck; don't stop until you have ore in the bottom or ore in face. No matter how hopeful you may be, no matter how much interest you are ready to give up, a barren or hungry face will attract little attention. Scattered work over a large number of prospects makes a bad impression. It appears as though you had looked about everywhere for an oreshoot and had failed to find it. One shaft with something in the bottom is worth a dozen holes in leached vein matter.

If you find something on the surface or underground, stick to it no matter where it leads or how crooked a hole it makes; follow the high-grade streak wherever it leads. Remember that you are prospecting—not mining. Your business is not to open the ground for economical mining, but to make the most extensive opening possible upon ore.

Let your capitalist sink the vertical working shaft or run the long crosscut to reach your ore at greater depth. Many a good prospect lies idle today, not for lack of work done, but because the work was wasted on excavations that never reached the oreshoot.

Having done good honest work, all that you could afford to do, and having found nothing but perhaps a still deeper belief in the merits of your find, we are at a loss for a method of securing capital. On the other hand, if you have found commercial ore and continue to find it as you sink or drive, the chances are that you will not have to seek capital; a real find advertises itself, and sooner or later one or more scouts from the many substantial mining organizations operating all over the United States will reach you.

Should the scout not appear, because of your isolation, he or his employees may be reached by means of the addresses published in the professional directory in the *Engineering and Mining Journal*. Write a plain straightforward letter telling what you have found. Do not exaggerate; stick to facts, and let theories alone. If the first one turns you down, try again. If you have something that is worth while and you are able to tell what you have, you will find someone who will be interested.

BY THE WAY

Cananea is probably the most prosperous camp in Mexico today. There are more people in this community than ever before, and many who have jobs are supporting others who have found no other means of keeping from starving. The Cananea Consolidated Copper Co. is running full blast and is employing more Mexicans than ever in its history. Instead of paying them in paper currency worth about 1c. on the dollar, this company is paying its employees in coin, and there is more satisfaction and prosperity for Mexicans in this Americo-Mexican community than in any other part of their country. Many other places would be sharing in this unbounded prosperity if Mexico's house were in order. There is much talk of late that the foreigner will no longer be permitted to exploit Mexico's resources. If the foreigner does not supply the money required for developing these enterprises, who will? Mexico has been sucked dry by its bandits, politicians and generals, and such capital for the most part dares not return. The rank and file of the Mexicans will yet learn that the Gringo is their best friend, and before long they will be courting him to come back and bring his regular paydays and good times.

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After standing trial twice for using the mails to defraud, Albert W. Freeman, promoter of the Hawthorne silver- and iron-mining ventures, pleaded guilty before Federal Judge Augustus N. Hand on Dec. 20 and was fined $3,000. Freeman was first convicted in March, 1912, with Julian Hawthorne and Dr. William G. Morton, for using the mails in the sale of the mining stock. Hawthorne and Morton served a year in the Atlanta prison, but Freeman, who was sentenced to five years, took an appeal and won it. "I only impose this sentence," said Judge Hand, "because the Government has consented to it and because after years have passed and two trials have been held, a jury was loath to convict. I do not, however, consider this sentence adequate punishment, Mr. Freeman, for what you have done. In these indictments there is clear proof that representations were made to the public which purchased those stocks that the money would go into the properties and no commissions would be paid, as would have been necessary if the propositions had been underwritten in Wall Street. As a matter of fact, you had an underwriting agreement which provided on its face that you would be paid a large part of the money received as commissions. I think that under the circumstances it was a very aggravated case, and I cannot understand why the jury did not convict." Freeman seemed not to be affected by the judge's words and stepping forward briskly, peeled the amount of the fines from a roll of thousand-dollar bills and handed the money to Court Clerk Westervelt.

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A new member of the Toronto Standard Stock Exchange was recently subjected to the ceremony of initiation, which, as administered by that body, not only furnishes a source of innocent merriment to the sportively inclined, but imparts to the neophyte a highly useful lesson. The victim received a telephone call from "Dr. Drinkwater" instructing him to sell 1,000 shares of "Continental Porcupine," a purely fictitious stock, at 15c. The sale was speedily effected, and other transactions in the stock followed during which the price steadily rose. Then came another call from Dr. Drinkwater, asking the broker if he had bought the shares according to instructions. The broker insisted that the order was a selling one, the supposed client growing exceedingly indignant and insisting on having the stock, which in the meantime had been bid up to 40c. After the new man had been sufficiently impressed with the seriousness of the situation and the fact that he was up against a loss of several hundred dollars, all transactions in Continental were called off, the stock removed from the list and the victim informed that he was a duly initiated member and cautioned about doing business with unknown parties over the 'phone.

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J. Parke Channing is one of our great mine operators who is intensely interested in the welfare of the men that work under his direction and who does for them with his right hand a lot of things that his left hand does not know. When Mr. Channing was a young man, engaged in iron mining in Michigan, a town in northern Michigan was named for him, an honor in which he has always felt a proper and pardonable pride, and naturally a great interest in the town. He has lately signalized this by giving to the railroad men of Channing a clubhouse. Speaking of this, the *Daily Mining Gazette*, of Houghton, Mich., makes the following graceful remarks: "Channing, a junction point, needs just such a building to serve just such a purpose as Mr. Channing plans. We call attention to this act by Mr. Channing because he is today a man of prominence and a man of wealth. He came here to the Copper Country from college and in his youth worked in our copper mines and in our iron mines. His great successes came afterward. Now he is looking about to do good things for his fellow men. And he remembers the towns of upper Michigan. Naturally he remembers the little town that was named in his honor. And, naturally, for him, he decided that a sensible practicable proposition like a good clubhouse would be more fitting than a monument done in bronze or iron or copper. Mr. Channing's act is all the more to be commended because of the fact that the Copper Country has graduated any god's number of millionaires, most of whom promptly forget their old Copper Country and few of whom ever once think of remembering the old town of their origin or the beginning of their wealth."

Personals

Will L. Clark was in New York for a short visit.

J. T. Young has removed to Stoddard Ariz., from Metcalf.

John Gross is at Georgetown, Colo., on professional business.

E. W. Westervelt has changed his address from Ludwig, Nev., to 1545 St. Paul St., Rochester, N. Y.

F. C. Schrader, of the Geological Survey, has returned from geological work in Nevada and New Mexico.

Arthur P. Watt, metallurgist for the St. Louis Smelting and Refining Co., at Saint Francois, Mo., is in New York.

E. W. McMurray has been retained as general superintendent of the Rambler property, at New Albany, Wyoming.

Dorchester Mapes has been appointed general manager for the Rambler Copper and Platinum Co., New Albany, Wyoming.

J. L. Mauch formerly with Repath & Mac Gregor, Douglas, Ariz., as chief draftsman, has been in New York recently.

E. J. Wallis will become manager of the Pacific Coast district of the Western Electric Co., with headquarters at San Francisco.

William Spence Black has been placed in charge of the Ajax mine, Victor, Colo., which has been taken over by the Carolina Co.

Julius Thielman, president of the Rambler Copper and Platinum Co., has retired from the active management of the company.

C. A. Filteau has resigned as manager of the St. Lawrence Talc Co. to take the management of the National Mines, Ltd., Cobalt, Ont.

Dr. H. M. Payne has returned from a business trip to the Pacific Coast and expects to be in New York until the middle of January.

R. W. Pack, of the Geological Survey, has returned to Washington after an extensive study of the geology of the oil fields of California.

A. T. Drysdale has been appointed superintendent of the Birmingham, Ala., plant of the United States Cast-Iron Pipe and Foundry Co.

A. E. Wells, who was in New York before the holidays, has returned to Salt Lake City, where he will take charge of the Bureau of Mines Station.

D. M. Liddell, consulting engineer for Merrill Lynch & Co., of Wall St., will leave for the middle west New Year's day on a short professional trip.

James H. Spencer, of Spencer & Waters, Santiago, Chile, is in New York for a stay of about two months. His address will be in care of Remington-U. M. C. Co., Woolworth Building.

George B. Butterworth sailed on Wednesday, Dec. 27, from New York for Venezuela, where he will undertake the management of the South American Copper Syndicate, operating at Aroa.

Howland Bancroft has returned to the United States after an extended absence in Bolivia and Chile. He will be at the Engineers' Club, New York, during January, after which he will return to Denver.

George F. Kunz addressed a meeting of the American Association for the Advancement of Science, at New York, Dec. 26, at the School of Mines, Columbia University, on the subject of "Preparedness."

E. H. Webb has resigned as superintendent for the Pittsburgh Crucible Steel Co., and undertook his new duties as superintendent of the Virginia Iron, Coal and Coke Co.'s blast furnaces, at Roanoke, Va., on Dec. 15.

Dr. George H. Ashley, a geologist in the service of the U. S. Geological Survey, has been granted a leave of absence to occupy the chair of geology in Vanderbilt University at Nashville, Tenn., during the absence of Prof. L. C. Glenn. Professor Glenn is engaged in private work but has not resigned his position at Vanderbilt, which he may resume next year.

Obituary

Williard Gray, M. P. for London since 1915, when he was elected by acclamation following the death of Major Beattie, died at London, Ont., Dec. 12, 1916, following a long illness from Bright's disease. He was 54 years of age. He was born in Newcastle, Ont. He had held many offices of trust in the conservative party in London, and had a reputation as a most successful worker. He leaves a wife and one son. Mr. Gray was president of the Dominion Oil Co., president of the Maple Leaf Oil Co., of Coalinga, Calif., and was connected with a number of other concerns.

John Roberts Mitchell, a mining engineer well known and highly respected throughout the West, was attacked by heart disease while examining mining property in Arizona, and just lived to reach his home in Denver, where he expired on Dec. 16, 1916. Mr. Mitchell was born in Cornwall, England, in 1856, had considerable experience in diamond mining in South Africa but has been in America for the last 35 years. His most notable positions were: Superintendent of the Dolores mine, Chihuahua, Mexico, and superintendent of "Alaska Gold," then known as the Alaska Perseverence. The latter mine was developed by Mr. Mitchell, who erected the Perseverence mill and profitably treated the ores for several years. Mr. Mitchell is survived by a wife and son, a brother in Rhodesia and by two sisters.

Societies

Northwest Mining Association will hold its convention in Spokane, Wash., on Feb. 19 to 25, 1917. This will be an important event for the mining men of the Northwest, many coming from the Northwestern States and from British Columbia and Alaska.

The Faraday Society—At the 80th meeting of the Faraday Society held in London on Nov. 8, 1916, the general subject of refractory materials was considered. Dr. J. W. Mellor spoke on the subject of "The Texture of Firebricks." Prof. W. G. Fearnsides on "The Application of Petrographic Methods to the Study of Refractory Materials." Dr. P. G. H. Boswell read a paper on "Refractory Sands." Several other papers relative to the subject were read also.

The Colorado Metal Mining Association will hold its annual meeting at Denver, Jan. 9, 10, 11 and 12, 1917. At that time a meeting of the tungsten producers of the United States will be called for the purpose of formulating a definite plan for concerted action in all matters affecting the industry, and particularly to unite in an effort to secure as early as possible favorable action on the part of the proposed tariff commission in behalf of a duty on tungsten ores and its products.

American Institute of Mining Engineers, Utah Section, held their annual meeting at the Utah Hotel, Salt Lake City. The officers elected for the ensuing year were: Chairman, C. W. Whitley; vice-chairman, William Wraith, and secretary-treasurer, Ernest Gayford. Papers by J. M. Callow, entitled "Notes on Flotation, 1916," and by Irwin Wilke, entitled "The Manufacture and Use of Sulphuric Acid" were presented. An address was also made by Major Westly King on "Military Conditions on the Mexican Border." Attendance at the meeting reached about 100 members and guests.

University of Illinois—The senior mining engineering students, under the direction of Professors H. H. Stoek and E. A. Holbrook, have completed their annual inspection trip. This year the trip included an inspection of the State Mine Rescue Station at Springfield, Ill., the lead smeltery at Collinsville, Ill., and the Laclede byproduct coking plant at St. Louis Mo. From here the party established headquarters in Flat River, Mo., and spent several days visiting the lead mines and mills in the district. A side trip was made to the old "Mine La Motte," which is being rejuvenated by modern methods. Afterward several of the large coal mines in southern Illinois were inspected.

Geological Society of America—At the Albany meeting of this society George Otis Smith, Director of the U. S. Geological Survey, said that geologists who accept professional work involving appearances before courts in favor of a litigant are in danger of lowering the scientific standard of their profession. Dr. Smith predicted that the day is not far distant when the court will summon its own expert witnesses and compensate them for telling the whole truth and not that part of the truth which favors one party to a suit. Dr. Smith's subject was "Geology and Public Service." He appealed to geologists as a professional class, not only to make their science more human but to humanize themselves. He declared it to be his belief that the geologist is well qualified by special training to serve society, not only as a professional adviser, but to take a larger part as a citizen.

American Association for the Advancement of Science held two joint meetings at New York during Christmas week with the American Electrochemical Society, one on Dec. 27, and another on Dec. 28. The first meeting was for the consideration of a symposium on "The Structure of Matter," at which several well-known authorities explained their views. At the meeting of the second day various subjects were discussed. On Friday evening, Dec. 29, the engineering section of the society held a meeting by invitation of the American Society of Civil Engineers, American Institute of Mining Engineers, American Society of Mechanical Engineers, and the American Institute of Electrical Engineers at the United Engineering Societies Building. The subject discussed was the relation now existing and that which should exist between men of pure science and their brothers of the engineering professions.

Michigan College of Mines—Manager E. W. Walker, of the Mass Consolidated Mining Co., president of the Alumni Association of the Michigan College of Mines, yesterday gave out the list of nominees reported to him recently by the nominating committee of the association. These nominees probably will be elected at the coming annual meeting. They are: President, W. H. Schacht, assistant to the general manager, Copper Range Co., Painesdale, Mich.; vice-president, John Knox, general superintendent, Calumet & Hecla companies, Calumet; treasurer, H. T. Mercer, chief engineer Champion Copper Co., Painesdale; secretary, James Fisher, professor of mathematics, Michigan College of Mines, Houghton. Members of the board of managers, John L. Harris, general manager, Hancock Consolidated Co., Hancock; A. H. Floeter, chief engineer, Mohawk and Wolverine companies, Kearsarge; W. B. Pattison, general superintendent Breitung-Kaufman mines, Negaunee; S. Russell Smith, superintendent, Ahmeek mine, Ahmeek.

Industrial News

Venegas F. Aguiles, School of Engineering, Lima, Peru, requests catalogs of mining and milling machinery. These should be addressed to him as above.

The Layne & Bowler Corporation, of Los Angeles, recently supplied an electrically driven sinking pump, on a hurry order, for the Tom Reed Gold Mines Co., at Oatman, Ariz.

Wood Drill Works, of Paterson, N. J., has just placed a new self-rotating hammer drill on the market. The drill automatically cleans the hole. If by chance the air going through the steel is not enough to clean the hole by pressing down on the button at the top of the chest the full pressure of air is directed to the drill point, cleaning the hole of all cuttings at once. By releasing the button, the drill starts automatically. One of the advantages claimed for this drill is the absence of piston breakage, and another is, that no collars are required on the steels, eliminating a great deal of the blacksmith trouble and expense. The steel only requires to be cut off squarely and tempered and pushed up against the anvil block of the drill.

Trade Catalogs

Portable Electric Drills, Reamers, Grinders. The Van Dorn Electric Tool Co., Cleveland, Ohio. Catalog. Pp. 50; 3½x8½ in.; illustrated.

Storage Battery Trucks. The Jeffrey Mfg. Co., 974 N. Fourth St., Columbus, Ohio. Bulletin No. 200. Pp. 8; 6x9 in.; illustrated.

Giant Fuel Oil Engines. Chicago Pneumatic Tool Co., Fisher Building, Chicago, Ill. Bulletin 34-W. Pp. 28; 6x9 in.; illustrated.

Jeffrey Arcmaster and Solenoid Switch. The Jeffrey Mfg. Co., 974 N. Fourth St., Columbus, Ohio. Bulletin No. 204. Pp. 4; 6x9 in.; illustrated. Describes new devices designed to eliminate the burning of contact fingers and arc deflectors of the controller.

Boyer Railway Speed Recorder. Chicago Pneumatic Tool Co., Fisher Building, Chicago, Ill. Bulletin No. 263. Pp. 28; 6x9 in.; illustrated.

Assessments

Company	Delinq.	Sale	Amt.
Alta T. & Trans., Utah	Jan. 6	Jan. 25	$0.01
Atlantic, Ida	Dec. 9	Jan. 9	0.001
Blue Point M. & M., Utah	Jan. 2	Jan. 15	0.0025
Bullion, Nev	Jan. 8	Jan. 30	0.02
Caledonia, Nev	Jan. 9	Feb. 3	0.05
Carbonate Keystone, Utah	Dec. 14	Jan. 2	0.01
Century Gold, Utah	Dec. 10	Jan. 10	0.01
Eagle Mtn., Ida	Dec. 22	....	0.001
East Hercules Ext., Ida	Jan. 2	Feb. 2	0.0005
Ely-Gibraltar, Nev.	Dec. 15	Jan. 10	0.0025
Emerald, Utah	Dec. 15	Jan. 13	0.00½
Eureka, Ida	Dec. 9	Jan. 9	0.001
Four Timbers, Ida	Dec. 2	Jan. 2	0.002
Hector, Ida	Dec. 22	Jan. 16	0.005
Idaho & Los Angeles, Ida	Jan. 12	Feb. 9	0.005
Imlay, Nev	Dec. 19	Jan. 9	0.01
Independent, Ida	Jan. 13	Feb. 13	0.01
Iron King, Ida	Dec. 9	Jan. 9	0.001
Mayflower, Ida	Dec. 23	Jan. 25	0.005
Nevada Stewart, Ida	Jan. 8	Feb. 8	0.003
New Hope, Ida	Dec. 11	Jan. 11	0.002
North Franklin, Ida	Dec. 30	Jan. 22	0.005
O.K. Extension, Utah	Dec. 21	Jan. 10	0.0025
Old Veteran, Ida	Jan. 6	Jan. 27	0.002
Ophir, Nev	Jan. 9	Jan. 30	0.05
Potosi, Nev	Jan. 8	Jan. 31	0.02
Rarus M. & S., Utah	Dec. 16	Jan. 4	0.00075
Reindeer Queen, Ida	Dec. 16	Jan. 22	0.005
Savage, Nev	Jan. 5	Jan. 29	0.02
Secret M. & M., Utah	Dec. 21	Jan. 10	0.0075
Sierra Nevada, Nev	Jan. 4	Jan. 25	0.10
Silver Dollar, Utah	Dec. 31	Jan. 15	0.0005
Silver Pick, Nev	Dec. 2	Jan. 8	0.02
Slavonian, Ida	Dec. 30	Jan. 20	0.001
Southwestern Miami, Ariz.	Jan. 11	..	0.50
Tarbox, Mont	Dec. 22	Jan. 13	0.005
Tiberius, Ida	Dec. 21	Jan. 12	0.00075
Utah Bellevue, Utah	Dec. 15	Jan. 6	0.001
Uvada, Nev	Jan. 6	Jan. 22	0.02
Wallace M., M. & R., Ida.	Dec. 8	Jan. 8	0.0025
West Dip, Nev	Dec. 24	Feb. 13	0.005

The publication of this table will be discontinued after Dec. 30, 1916.

Editorial Correspondence

SAN FRANCISCO—Dec. 22

Transportation for the Darwin District may be improved. The Darwin Development Co. has made a preliminary survey between Darwin and Keeler. It was found that the distance of about 26 mi. by wagon road must be increased in order to secure a 5% maximum grade over which an industrial railroad may be economically operated. It is believed that such grade can be secured in a distance of 32 mi. The entire district has developed rapidly in the past year and a number of mines would be enabled to make much more advancement toward profitable commercial production with the advantage of shipping facilities that could be provided by a small railroad system. But the Darwin Development Co. is the only operator and owner having a production warranting an interest in such an undertaking. Many of the silver-lead and copper ores of the district could be shipped with economic transportation rates. It would thus be profitable to mine on a small scale and give to the small owner and leaser a chance for development looking to larger production. The Darwin Development Co. has not announced intention of undertaking the railroad construction, but has been gathering data on this subject through its consulting engineer, F. W. Weekes and C. L. Ray, chief engineer of the company.

Ventilation in Metal Mines is discussed in Bulletin 3, issued by the State Industrial Accident Commission. Suggestions are offered regarding the prevention or overcoming of difficulties that are often encountered. Results of poor ventilation coming under the notice of the U. S. Bureau of Mines are discussed, and one case is cited of a mine that produced approximately 1,000 tons of ore per day at a cost of $1,000. The labor cost was about $750. On account of poor air and heat in one part of the mine it was estimated that miners put in only one-half of their time in effective work, producing 300 tons, where 600 tons could have been extracted had conditions been normal, or increasing the total to 1,300 tons per day, and reducing the labor cost from 75c. to 57.7c. per ton. Numerous cases were noted where muckers were overcome by powder gases from the muck pile. In several large mines it was noted that in opening new levels, drifts were run as far as 1,000 ft. before raising to the level above. The causes of vitiation and pollution of mine air, effect of impure air on men, and heat and humidity are also discussed. Natural and mechanical ventilation of dead ends are also presented briefly and suggestions offered as to best method of ventilation. The bulletin may be secured without cost by application to the commission at 525 Market St., San Francisco.

Coöperative Mine-Safety Work of the State Industrial Accident Commission and the U. S. Bureau of Mines will continue under the direction of H. M. Wolflin, who will act as mining engineer for the Bureau of Mines and as chief mine inspector for the Industrial Accident Commission. The arrangement being practically the same as that under which Mr. Wolflin's predecessor, Edwin Higgins, had been working, with the exception that it is understood that more time is to be spent on investigative work than has been possible in the past. The mine-safety work in California has grown to large proportions and at the close of 1916 it appears to be doubtful if the work of inspection can be adequately carried on by the present force. It is not improbable that the services of an additional inspector may be required next year. The appointments are made from the eligible list of state civil-service men who passed the examination of two years ago. At that time it evidently was not foreseen that should a vacancy occur in the position of chief inspector, such vacancy might not be easily filled from the eligible list of metal-mining engineers. This condition arose upon the resignation of Mr. Higgins at the end of October and had not Mr. Wolflin been desirous of returning to California, there could have been no satisfactory appointment under the rule which governed at the initial organization of the coöperative work. The complete and satisfactory organization of the mine-safety work of the Industrial Accident Commission in coöperation with the Bureau of Mines, will not be accomplished until there is provided a system of examination that will make mining engineers, who successfully pass the examination for the position of inspector, eligible to the position of chief mine inspector. The state civil-service examination now reaches only to the point of capability for the position of inspector in the field. It would be an easy matter and an effective plan to make two grades. The position of inspector in the field and an advanced grade which places the man who stands highest in the active list of inspectors employed, eligible to the position of chief mine inspector. If some such method as this be carried out, it will not only satisfy the mine owners that they will not be subject to unsatisfactory changes in the personnel of the department, but will give the field men an incentive to more ambitious effort. And it will take the method of appointment entirely out of any possible contact with, or submission to, political influence.

DENVER—Dec. 21

Rockfall at Independence Mine about midnight on Dec. 12 was for some time thought to be an earthquake but Victor residents learned the next day that it was only a heavy rockfall in one of the oldest workings of the Independence. Nobody was injured.

Tungsten Reduction Works have been under consideration for some time by the independent milling companies, such as the Rare Metals Ore Co., operating at Rollinsville, and the Boulder Tungsten Production Co., at Stevens. These concerns hope to have reduction departments in commission before long and to produce commercial forms of tungsten and its compounds. The camps of Nederland, Lakewood and Stevens are active, although they have dropped the feverish activity of a year ago.

Labor Strike at Leadville is believed to be indefinitely postponed by recent action of the principal mine operators who have granted the following wages, effective Dec. 1: Men heretofore receiving $3.30 will now receive $3.50; those formerly paid $3.85 will now earn $4; while men who have been paid $4.40 will now receive $4.50. This is not a uniform advance but it is really a raise of 50c. over the wages that prevailed prior to last April when a uniform advance of 10% was made owing to the high price of spelter.

Smuggler Mine at Aspen which produced fabulously rich ore in the nineties—ranking in fame with its neighbor, the Mollie Gibson—has been afire for years. Orebodies of the district are in a carbonaceous, shaly limestone that fires spontaneously. All efforts to suppress this fire have failed and for years past operations in the mine have been conducted at great handicap. The heat in the workings has been intense. Two weeks ago miners on the 1,800 level unwittingly tapped a strong water course that quickly flooded the workings, the men barely escaping with their lives. The electric mine pumps were promptly drowned. Manager Anderson of the company that leases the mine looks upon the accident as a disguised blessing and is content to permit the workings to remain flooded long enough to completely extinguish the fire before he attempts unwatering.

"Dividends" is the glad word among mine owners this holiday season. Disbursements that have been declared by Colorado companies are too numerous to give a complete list but among the important ones were the Portland at Victor and the Yak at Leadville. Beside the regular 3% quarterly disbursements by the Portland company, there was recently issued an extra dividend of 2%. The year's profits to stockholders amounted to $420,000 and all of this was paid out of earnings that accrued prior to March, 1915. The Yak Mining, Milling and Tunnel Co.—of which some of the principal stockholders are Walter W. Davis, Harry C. James, John C. Mitchell, Myron T. Herrick and the estate of James B. Grant—has, in addition to its regular quaterly dividends of 7%, declared a Christmas present to its owners of a round 50%. The company being capitalized at $1,000,000, the year's distribution amounts to $780,000. The bulk of this extra dividend was made possible by the action of Manager Davis in withholding his silver bullion from the market until the price reached the recent high points.

Radium Is Being Produced in Denver by the Schlesinger Radium Co., using a [illegible] process that is said to be superior to that developed by officials of the U. S. Bureau of Mines and publicly announced last winter. Several former attachés of the Federal bureau are connected with the new company which has [illegible] laboratory at 2001 East Colfax Av., [illegible] the Capitol Hill residence section; the works are at 191 Tejon St. on the west side [illegible] road trackage. The laboratory site was [illegible] with the object of securing [illegible] possible from vibration [illegible] influences that prevail [illegible] of the city. The bu[illegible] with a particular [illegible] pany is not fully [illegible] production of radium average[illegible] per day. The U. S. [illegible] owning 560 mg. of [illegible] manufactured in [illegible] to the Pittsburgh [illegible] has deposited its [illegible] of Mines in Golden, the [illegible] branch of the bureau.

BUTTE—Dec. 22

Tuolumne's Discovery in its Main Range property continues to be the mining sensation in Butte. Total width of vein formation is given at 132 ft. and about [illegible]0 tons per day is being taken out in the development work on the 700 level.

Natural Gas Fuel for Anaconda Smelteries is in prospect. According to report Anaconda has acquired control of the Montana Canadian Oil Co., owning a large producing well near the international boundary and will pipe this gas to Great Falls and Anaconda for use in its reduction plants, as well as for domestic purposes. The gas, it is stated, will first be piped to Great Falls, about 75 mi., and is expected to make an important saving in fuel expense for that plant. Several hundred miles of piping will be required if the project to carry the pipe lines to Anaconda and Butte is carried out.

Fourth Section of Zinc Refinery at Great Falls will not be started until about Jan. 1 and the fifth section about two weeks later; this change of dates in starting was caused by delay in the receipt of electrical equipment for the substation. The three sections that are now in operation are doing better work than was anticipated. Last Saturday, Dec. 16, 95 tons of zinc were made in the three sections, a record breaking day so far. This 190,000 lb. of the superior electrolytic brand is bringing a good premium over the regular price of ordinary spelter. When the plant was planned, it was anticipated that its capacity would not exceed with all five sections running, 6,000,000 lb. of zinc per month or 72,000,000 lb. per year. Saturday's output was at the rate of over 100,000,000 lb. per year.

Mineral Output of Montana was valued, in the annual report of State Mine Inspector W. B. Orem at $111,000,000 for this year, an increase of $51,852,862 over 1915. "Without the slightest desire to belittle any other industry," says the report, "it is of interest to note that mining tops any other two industries combined in Montana. Figures show that the value of the mineral output for 1916 exceeds that of farming and stock-raising combined by $30,000,000. The Butte district alone, with its less than four square miles, produces more in mineral value than all the farm lands of the huge state combined, produce. The mines, mills and smelteries of Montana, not including the coal mines, give direct employment to 28,000 persons, the highest paid laborers in the world. Two-thirds of the state's output comes from the Butte district." Commenting on the old prejudice that existed in former years in the rural district against Butte and the mining industry, the report says: "It used to be argued by the residents of the cow counties that the big mining companies dug out the metals, sold them and sent all the proceeds East to enrich wealthy stockholders. Such is a long way from the truth. The facts are that for every three dollars taken from the ground in Montana in the form of mineral wealth two dollars remain in the state and from $50,000,000 to $100,000,000 are paid out by the mining companies of Montana each year for labor and supplies. The mining centers of Montana are the greatest consuming districts. The City of Butte alone with its [illegible] inhabitants consumes as much as other cities of double that size. Hay, grain, fruits, meats, dairy products pour into Butte in wholesale quantities from the Montana farms and valleys." The report states that 18,500 men work in and around the mines of the Butte district and of this number 11,500 work underground and [illegible] in the mills and on the surface. The [illegible] for the year averaged over $2,0[illegible] per month for the men employed [illegible]. This does not include the [illegible] at the reduction works in Anaconda and Great Falls.

Growth of the Zinc Industry in Montana [illegible] Mr. [illegible] "The [illegible] of the zinc industry in Montana [illegible] [illegible] will [illegible] the [illegible] B[illegible] M[illegible] Ore [illegible]

During the first nine months of the year 1916, only 50% of the zinc ore hoisted was treated at the small plant at Anaconda. The remainder was stacked up on the surface at the mines. The shipment of these stock piles was started in October when the zinc concentrator at Anaconda and the electrolytic zinc plant at Great Falls were put into commission. At present there are 725 men employed by the Anaconda Copper Mining Co. in the mining and development of zinc ore. This number will be greatly increased during the coming year. Ground was broken for the Great Falls electrolytic zinc plant in December, 1915. The first unit was put into operation early in September. The zinc produced is extremely pure and assays 99.95% zinc. The plant when operating at capacity will use 35,000 hp."

SALT LAKE CITY—Dec. 22

Enlargement of Garfield Smeltery—practically doubling the capacity—will, it is expected, be completed during the autumn of 1917. The capacity is to be 6,000 tons of ore daily, as compared to an original capacity of 2,500 tons, already somewhat increased. Power line facilities needed for the operation of the enlarged plant are being added to. For the use of its working force—numbering approximately 1,500—the company is building a large central bath house, with lockers, etc., provided free of charge. A community refrigerating plant for employees also is to be built.

Utah Leasing Co., which is meeting the problem of the treatment of the low-grade dumps of the old Cactus mine at Newhouse in Beaver County, expects to have the capacity of its mill increased to 850 tons daily by the middle of February. The plant began operation a little over a year ago and has been treating 600 tons a day. There are about 1,000,000 tons of ore on the Cactus dumps and at the rate of 850 tons daily, this ore will furnish material for the mill over a period of at least four years. The dumps carry about 0.7% copper. The saving so far made is stated to have been satisfactory to the company, and it is thought the new equipment and added capacity will make possible a better extraction and larger profit. Flotation is used.

Starting of Pacific Mill in American Fork Cañon—instrumental in bringing better power facilities to the district—marks important progress for the mines in the cañon. The Utah Power and Light Co. has extended a power line from its Snake Creek power plant over the divide to the Pacific and Dutchman mines. As well as furnishing power for the new mill, the new line will provide electricity for driving compressors at various other properties in the district. The Pacific mill itself—built by the Fissures Exploration Co., lessees—with a rated capacity of 50 tons daily, which can be easily raised to 75 tons, will materially increase shipments from the cañon. The Pacific mine is the largest shipper there, and recently marketed two cars of ore running well in copper and silver, from operations carried on by the Fissures Exploration Co. A short time ago an initial dividend of $8,000 was paid by the Pacific mine from royalties.

Dividends from Utah Mines in 1916, amounting to $24,404,430, show an increase of almost $14,000,000 over 1915, which with $10,025,000 held the record in a period of fifty years. Twenty-one names helped to make up the total in 1916. There are five new names in the list of mines beginning payments this year and the last. The Cardiff operating in Big Cottonwood Cañon paid an initial dividend of $125,000 last year, and this year, $375,000. The Lakeview Mining, beginning work last year on Promontory Point, not far from Ogden, paid $59,000 in 1915, and $65,000 this year, chiefly from zinc ore, and some lead. The South Hecla at Alta in Little Cottonwood Cañon made its first payment this year, amounting to $39,525. The Pacific Gold a short time ago paid $8,000, its first payment. The Utah Metal and Tunnel at Bingham, opening a large new body of ore and consolidating with the Bingham-New Haven—a familiar name on the list—in August of 1916 paid $342,470. The entire list comprises the Cardiff, Centennial-Eureka, Chief Consolidated, Eagle & Blue Bell, Eureka Hill, Gemini, Grand Central, Iron Blossom, Horn Silver, Judge, Lakeview, May Day, Mammoth, Pacific Gold, Silver King Coalition, Silver King Consolidated, South Hecla, Utah Consolidated, Utah Apex, Utah Metal and Tunnel, and Utah Copper.

WALLACE, IDAHO—Dec. 21

Tungsten Resources of the Coeur d'Alene have been studied for certain interests for about a year and a half by Chester T. Kennan, a mining engineer of Colorado, who took up his residence in Murray about the time the tungsten excitement was at its height and manifested much interest in that metal, which is found as scheelite in conjunction with the gold ores of the North Side. There is probably not a gold prospect within a radius of 10 mi. of Murray that he has not visited and thoroughly inspected. His investigations have been followed by the purchase of a large group of claims on both sides of Trail Creek and a considerable number of men are now employed in preliminary work upon them. Mr. Kennan is still negotiating for additional property, and for that reason declines to outline his ultimate plans. The property he has acquired has been held for years for its gold content, but it is believed that Mr. Kennan has also found the tungsten content interesting. Associated with Mr. Kennan are E. J. Roberts, of Spokane, and mining men of Salt Lake City and Denver.

GOODSPRINGS, NEV.—Dec. 20

Important Zinc Discoveries have been made this year in the Yellow Pine district in the Root and the Sultan mines, and at the north end of the property of the Yellow Pine Mining Co., a new zone was opened disclosing important orebodies. The Bullion mine in this camp was sold to a Salt Lake syndicate for $50,000 by Yount & Fayle. Among other new companies now operating in the district are the Yellow Pine Extension, Dawn Mining Co., Bill Nye Mining Co., etc. In the copper-gold-platinum section, the Boss mine opened new and larger orebodies, and the Oro Amigo has discovered ore similar to that of the Boss mine.

HOUGHTON, MICH.—Dec. 23

Franklin's Increased Production is expected to reach its high mark by about Mar. 1, when the company's output is planned to be 1,300 or 1,400 tons of rock per day from the Allouez conglomerate. This will be an increase of approximately one-third, as the mine now is averaging nearly 1,000 tons daily. Franklin's increase in rock output will result in a corresponding decrease in cost per ton because of greater efficiency underground. The management has established two economies that other mines are likely to copy. One is the scheme of running as many as eight machine drills in a row, all supervised by one expert. Another is a method of handling foot-wall rock first and "caving" the hanging. The latter is not new, except as applied to Franklin, but it works out admirably as regards this peculiar formation—the Allouez conglomerate. Another feature of the rock handling is a system of tramming haulage which uses an endless rope. The bunching of machine drills pleases the miners, who like company in their work and it saves on supplies.

ISHPEMING, MICH.—Dec. 23

Shaft Accident caused by crosshead freezing to the guides at the Holmes mine near Ishpeming. Three men were instantly killed and three others seriously injured on Dec. 14, when one of the buckets in the shaft dropped. The six men were going to their work of shaft sinking and stopped at the first level to turn off the air that had been used to blow out powder and gas fumes. When they rang to be lowered again the bucket and crossheads did not move. The upper crosshead had become fast to the runners because of heavy frost. The rope coiled on top until the weight caused the crosshead to become loosened. The bucket then dropped 108 ft. to the bottom of the shaft. The shaft is about completed. Only a few feet remained to be sunk. Drifting is to start soon. It was hoped the work would be finished without an accident, many precautions having been taken to make the work safe. A second crosshead was added two weeks ago, to insure greater safety.

Lake Shipping Season Ended on Dec. 13. From figures already been compiled, the total shipments are indicated to have been 65,116,288 tons—over 15,000,000 tons in excess of the record year of 1913. Few vesselmen, men or mine operators believed that the lake fleet would be able to transport as much as 65,000,000 tons in a single year, but there were some who were optimistic from the outset and believed that that figure could be reached under favorable conditions. The all-rail shipments amounted to about 1,000,000 tons; in 1915 it was 960,000 tons. The shipments by ports for 1916 were as follows: Duluth, 21,837,849; Superior, 12,787,086; Two Harbors, 10,735,852; Ashland, 8,057,813; Marquette, 3,858,092; Escanaba, 7,849,596; total, 65,116,288 tons. Of the total amount moved, about 30,000,000 tons came from the mines of the Oliver Iron Mining Co., the ore subsidiary of the United States Steel Corporation. There is no doubt but that the 1917 shipments will be in excess of this year's movement, as plans are already being made to beat all records next year. The railroads will have more cars; there will be more boats operating; and there will be more ore in stock at the mines. Many new underground and openpit mines are being developed, the advance in the price of iron ore causing a big stimulus. Never before did the outlook for the industry appear more promising.

HIBBING, MINN.—Dec. 21

At Chisholm, orders have been received at the headquarters of the Oliver Iron Mining Co. to proceed with the stripping of the Glen mine and the Burt and Bliss properties (the Hartley mine). The appropriation, which has been allowed by the Steel Corporation, calls for the removal of 1,500,000 cu.yd. of overburden at the Hartley mine and 1,000,000 cu.yd. at the Glen mine. It is the intention to push the work at both these mines so that they will be on the producing list in the spring.

In the Hibbing district, another big stripping job has been started near Carson Lake. This property is known as the Smith mine and it is the intention to be ready to ship ore next season. Another mine that started shipments this year is the Kerr. To haul the ore from this pit it was necessary for the Duluth, Missabe and Northern R.R. to build a trestle over a mile long.

Some sales of iron ore for shipment in 1917 have been made at an advance of $1.30 a ton. This would make the price of Mesabi bessemer $5.50 a ton and Mesabi nonbessemer $4.85 a ton. The companies, which sell their ore, however, will not reap the benefit of the entire increase as the lake rates for transporting ore have been increased about 50c. a ton and other advances must be deducted from the net increase in the price of the ore. A sale of ore amounting to 185,000 tons is reported to have been made at an advance of $1.50 per ton. The advance will be welcomed by the companies some of which have been operating at a loss or nearly so during the lean years they have just passed through, and it will compensate them for the increase of wages they will have to contend with in addition to the increased cost of their supplies and other mining expenses.

Important Change in Lease, pratically amounting to a sale on the installment plan, is being considered by the Higgins estate and the Oliver Iron Mining Co. The Higgins property, which is owned by the heirs of ex-Governor Higgins and his sister, Mrs. Frank Sullivan Smith, is one of the largest estates on the range. It comprises about 770 acres, of which 450 acres are situated between Elba and Biwabik, 120 acres east of Embarrass and 200 acres between Gilbert and Virginia. The Oliver Iron Mining Co. has been drilling this property for about two years preparatory to the readjustment of the lease and it is estimated they have shown up about 70,000,000 tons. The new lease which is about concluded provides for the payment of the lease in installments covering a period of 30 years. There is a rumor that the Steel Corporation intends taking over the Hill iron-ore leases; this has been denied by Corporation officials. The Hill lands are said to contain about 300,000,000 tons of ore.

Opening of Iron Mines, that had been closed for a considerable time, was a feature of the Mesabi operations during the season just closed. The St. James mine, of Aurora, owned by the Corrigan-McKinney interest, was opened the first of the year after an idleness of several years. The Bray mine at Keewatin, originally an open-pit property and later opened underground, is now being pumped out preparatory to work this winter. The Inland Steel Co. which took over the old Bessemer No. 3 and Bessemer No. 4 properties, erected a new plant on the latter and are sinking a shaft which is expected to be finished this winter. Another property which is expected to open up this winter is the Gilbert mine at Gilbert. This Oliver property was stripped about seven years ago and then developed further by underground operations. It was closed in 1913 and partly dismantled. It is now proposed to strip an additional 500,000 cu. yd. this winter. The Fayal mine at Eveleth broke its previous high records, this year, its shipments running over 2,000,000 tons. This winter they will remove a large tonnage of lean material to release ore for next summer. The Adams mine also intends to do considerable stripping during the winter. At Biwabik a large additional tonnage of ore is reported part of which lies under the Biwabik dump. At Nashwauk, the Hawkins mine is uncovering considerable ore and the York mine which has been recently opened is doing considerable test-pitting and making other preparations for shipping in the spring.

BRAINERD, MINN.—Dec. 22

Cuyuna Range has had the busiest season in its history. Its oft-spurned manganiferous ores were in strong demand this year, owing to restricted importations. Ever since the opening of the range, there has been much speculation and discussion as to the value of these ores. It was the general consensus of opinion for a long time that they had but little market value. So large a tonnage had too great a percentage of silica and phosphorous, and much, according to the opinions of the investigators, was too low in manganese to make it available for the manufacture of ferromanganese or speigeleisen. On the other hand the manganese content was usually considered a detriment as it spoiled the ore for foundry purposes. The fourth biennial report of the Minnesota State Tax Commission printed several opinions and published the conclusion that most of this ore was not merchantable and of little or no value. However, in the course of the last two years there has been a great change. The war prevented the importation of manganese ores from Europe and at the same time created a demand for iron and steel which had considerable of this element. The price of ferromanganese rose to as high as $200 a ton. The great demand for manganiferous ores and the high price paid have lead to the exploitation of such properties as were available and several stock propositions which were then organized on the range received considerable encouragement. The Cuyuna-Sultana is now active and is preparing to ship 50,000 tons to Chicago by an all-rail route. This property has not been opened up for big production heretofore and slicing is just commencing. The Cuyuna Mille Lacs is also anticipating activity and the Mangan No. 1 in the same vicinity, is working at a good rate and is preparing to stockpile its product. A shaft is being sunk at the Joan mine. Several of the larger properties have had a satisfactory season. The largest producing properties on the north range have been the Rowe, Thompson, Armour, Croft and Mahnomen. The Croft is the only known mine containing a deposit of bessemer ore on the range. The Rowe mine at Riverton is the largest pit, mining a large deposit of siliceous ore which is treated at its concentrating plant. The Mahnomen mine has been stripped during the last two years and considerable water trouble has delayed operation as the pit is in a low spot. At present two shovels are removing ore. A drainage shaft is being sunk at the Rowe.

JOPLIN—Dec. 23

November Shipments from the Arkansas Field, the statistics of which have just been made available, broke all previous records, with a total of 93 cars aggregating 3,000 tons, estimated valuation $200,000. The Edith mine at Rush and the Big Hurricane at Pindall were the largest individual shippers ,each having 10 cars to its credit. The apportionment to the various camps was as follows: Rush, 18; Buffalo, 12; Zinc, 25; St. Joe, 11; Gilbert, 5; Pyatt, 2; Pindall and miscellaneous, 23 cars.

Cold Weather Curtailed Production decidedly in the Joplin district during the last week. Gas pressure was low, and ore froze in bins and elevators. Water froze in the tailing piles and its failure to run back into ponds left many plants short of water for milling purposes. Continued shortage of electric power, preventing mills from being operated straight through the day, increased number of "freeze-ups." A number of plants are substituting steam engines for motors, among these being the Athletic at Duenweg, and the Big Run at Webb City.

Mine Owners Will Operate a Hospital in this district. At meeting of the Southwest Missouri Mine Safety and Sanitation Association on Dec. 21, the members voted to take over the management of the Jane Chinn hospital in Webb City for the coming year. Many operators have been contributors to the upkeep of the institution but in the past it has been managed by a board of trustees. The hospital is a gift to the city by the late Mr. Chinn as a memorial to his wife. Ownership will remain as provided by the will, but the management will be entirely in the hands of the Safety and Sanitation Association.

WASHINGTON, D. C.—Dec. 23

Placer-Mining Statistics may be no longer collected by the U. S. Geological Survey, owing to indifference on the part of the operators. There are 3,200 names on the Survey's placer mine list. To the first request for statistical information there were replies from only 19[illegible]. Subsequently 1,306 second requests were sent out from which replies were received from 30[illegible]. Since the two inquiries received so little attention, it is regarded at the Survey offices as indicating that the placer-mine operators are not interested in data regarding their industry. This is a decided contrast with the conditions among other mining operators. To obtain the data necessary for carrying out the plan of complete placer-mine statistics, it would be necessary for the Survey to go to large expense and take up much of the time of men urgently needed on other work. To get the data by personal visits to the properties from which no returns were made would entail undue expense.

TORONTO—Dec. 23

Flagrant Manipulation of Ontario mining stocks is being practised by certain Canadian houses. One practically worthless property has been boomed to a stock-market value of nearly $1,500,000 on false reports of the grade and amount of ore developed. This state of affairs will work harm to the industry and when the inevitable [illegible] will make it much harder to interest the small investor in [illegible]. Several of the promoters of these new speculative issues [illegible] the wide distribution of flamboyant advertising, and no doubt by their own efforts in protecting the market, have succeeded in running the stocks up to much higher levels than they would [illegible] and [illegible] some extent [illegible]. [illegible] has resulted in the [illegible] of a number of other companies and the same tactics are being employed to boost the prices of these stocks. This kind of stock should be viewed with suspicion as the operators are [illegible] interested in making money out of the public than out of the ground. It is unfortunate that laws cannot be devised that will prevent people from losing their money in foolish speculation, but in the present case they have been drawn into a carefully [illegible] net of "publicity."

The Nickel Problem has entered upon a new phase and has latterly become almost entirely a party issue. Conservatives, who had formerly been outspoken in favor of drastic measures to control the export of nickel, generally profess themselves satisfied with the explanations of the government. Constituents of W. F. Maclean, M. P. for South York, one of the strongest assailants of the government policy, at a representative meeting of the Conservative party passed a resolution endorsing the nickel policy of the Canadian and Ontario governments and expressing disapproval of Maclean's stand on the question. The attack, however, is maintained vigorously by the Liberal press and speakers and a strong point is made of the alleged undertaxation of the Canadian Copper Co., the subsidiary of the International Nickel Co., the profits of which it is contended should be calculated differently. This is all political claptrap, as the International is working in perfect harmony with the British Government.

The Mining News

ARIZONA

Cochise County

PEABODY CONSOLIDATED (Johnson)—Second carload of machinery has arrived and new compressor plant is being set up at No. 2 shaft which is being sunk to extract the sulphide ore. Property opened many years ago but up to present has shipped only oxidized ores.

COPPER QUEEN EXTENSION MINING CO. (Bisbee)—This company has succeeded the Bisbee West. Incorporated by James Letson, of Bisbee, Thomas Higgins and D. F. McGary, of Los Angeles. Controls 440 acres west and southwest of Don Luis. On the ground are two old shafts, 750 and 500 ft. in depth, both in barren ground. May prospect property at greater depth.

Coconino County

POWER OF MOONEY FALLS on Cataract Creek may be utilized for working nearby mines of Northern Arizona Lead and Zinc Co. which has even considered establishing electrolytic reduction plant. A dozen years ago a company spent several hundred thousand dollars trying to utilize the power of Mooney Falls, 250 ft. high, and Bridal Veil Falls, 144 ft., with about 10,000 miners inches of flow, but failed. The Northern Arizona company plans tramway from mines in Cataract Cañon to the cañon rim.

NAVAJO COPPER CO. (Flagstaff)—New camp of this company, 105 mi. northeast of Flagstaff, is to be named Bobsburg, after Robert Mitchell, the leading spirit of the enterprise. Carbonate ore from surface is being hauled to Flagstaff on motor trucks for shipment to El Paso smeltery. New buildings being erected for store and office uses, and for housing force of 200 men. May treat carbonate ore by leaching. Eugene de Sabla, 120 Broadway, New York, is interested.

Gila County

NEW DOMINION MINES (Globe)—Working 30 men and mining surface carbonate ores for shipment. Shaft retimbered to bottom, 250 ft.

WRIGHT & BUCKINGHAM (Copper Hill)—These lessees of group near the Iron Cap have shipped 13 carloads of manganese ore to Chicago and now have contract for steady supply to Illinois Steel Co. May install washing plant.

Pima County

GUNSIGHT DISTRICT again active, with a number of mines producing silver-lead ore. High-grade ore reported on Griffin-Johnston claims. Thirty years ago, district was considered one of the richest in Arizona, but it declined with the fall in the price of silver.

AJO CONSOLIDATED (Ajo)—Fourteen claims adjoining the New Cornelia and this company's properties have been added to the latter's holdings. The sellers were W. M. Gillard, of Ajo and Fred Z. Steele, of Tempe; consideration of $10,000 cash and some stock. Company has put down more than 50 drill holes.

NEW CORNELIA COPPER (Ajo)—The labor strike failing. Troops now at Ajo to assist in maintaining order and about 700 men are back at work. The most important feature of the week of Dec. 23 was the starting of the first steam shovel. Date of starting production will be delayed by the strike.

MILE WIDE COPPER (Tucson)—This company is installing a Sullivan W. J. 3 angle-type compressor and 100-hp. Fairbanks-Morse oil engine. Contemplate 6,000-ft. crosscut tunnel connecting Alta and Santa Cruz valleys and reducing railroad distance to Copper King shaft from 18 to 5 mi. Tunnel will pass through Orient group of claims. W. J. Bloch, of Bisbee, has been appointed assistant superintendent and will make geologic map of that portion of Tucson mountains embracing the company's property.

Yavapai County

UNITED VERDE EXTENSION (Jerome)—Erection of a smelting plant at an expense of $1,500,000 in the Jerome district is being definitely considered by the directors who may take final action at the coming meeting of the board. Much of the ore is now going to the Consolidated Arizona smeltery at Humboldt. Ore reserves between 1,300 and 1,400 levels have more than been maintained in the last half year and the grade is expected to be slightly better than previously estimated.

COLORADD

Boulder County

CARIBOU MINES AND MILLS CO. (Caribou)—The 100-ton mill closed for the winter on Dec. 20. Mill operations began last July. The mine had been idle for 30 years; it was once one of the most famous silver properties in Colorado. Main shaft now down 1,000 ft., and company will immediately sink another 100 ft. Mill operations will be resumed about Apr. 1. William C. Russell, general manager.

Clear Creek County

SEATON (Idaho Springs)—High-grade lead ore opened in Newhouse tunnel level; raise has been made 18 ft. above the level in ore; an [illegible] trial shipment returned $50 a ton. Present development is 2,000 ft. below outcrop. Cincinnati men interested. E. H. M[illegible]h[illegible]l, of Idaho Springs, is manager.

Summit County

JUNE BUG (Breckenridge)—High-grade [illegible] silver ore, 4 to 6 in. wide, opened in [illegible] of tunnel by lessees.

NEW YORK (Breckenridge)—Lead ore opened in lower tunnel, 450 ft. from portal. R[illegible] ore now under way. Shoot [illegible]. Mill [illegible] be built next spring, meantime, ore will be treated in Old Union mill.

MICHIGAN (Kokomo)—Fifty tons iron sulphide ore assaying well in gold and silver shipped daily to Globe smeltery, Denver; lead ore shipped to Leadville. No. 1[illegible] Imperial type Ingersoll-Rand compressor and several Jackhamers installed. Main tunnel now in 750 ft.

WASHINGTON (Breckenridge)—Considerable work being done by lessees. Main lessee, P. M. Tyler, has developed considerable ore, and will do more extensive work next spring. Good-grade lead ore opened in incline by lessee Ben Benton. Other lessees will work placer ground of company next spring; pipe line now being laid from [illegible] Gulch.

PIONEER CONSOLIDATED (Breckenridge)—Mill now treating ore from Extension vein, brought out through Jumbo workings. Construction of new boarding house, one of largest in district, now under way. Old Jumbo drift to [illegible]wood workings, where bodies of good-grade ore known to exist, being opened. Contractors driving main tunnel.

GOLDEN QUEEN MINING CO. (Kokomo)—Porphyry vein 15 to 20 ft. wide with streaks of high-grade silver ore opened. Shaft sunk 40 ft. and 40 ft. of drifting done. Tunnel, now in over 375 ft., being driven to cut vein at depth of 200 ft. Several cars ore, assaying $60 to $1[illegible] per ton, [illegible] reported shipped recently. Bonded indebtedness of company paid off. [illegible] of 18 men employed.

MICHIGAN

Copper

MOHAWK (Mohawk)—Contracted with General Electric Co. for [illegible] steam turbine for the mill at Traverse City.

NEW BALTIC (H[illegible])—[illegible] from drilling brought in [illegible] of good character.

CHEROKEE (H[illegible])—[illegible] was encountered [illegible] ft. level [illegible] work has [illegible] ft.

CALUMET & HECLA [illegible] is expected to be [illegible] branches of [illegible].

NEW ARCADIAN (H[illegible])—[illegible] completed; [illegible] of shaft [illegible] running, rockhouse [illegible].

COPPER RANGE (P[illegible])—[illegible] work and roofing of new [illegible] completed. Work on the c[illegible] foundations is [illegible]. Ext[illegible] be used for [illegible] ngs. M[illegible] about 3,500 t[illegible] d[illegible].

MICHIGAN (Rockland)—Development of Ogimah lode temporarily checked by fault which throws present face of the drift into trap; the course of the mineral is now being worked out. In the Evergreen lode about 30 ft. of mass copper has been encountered. Mass copper also found on the east side at fifth level.

Iron

AMASA-PORTER (Amasa)—New hoist purchased. Operations to be rushed.

DOBER (Iron River)—Water is being bailed and pumped from workings again. Mine was flooded to put out fire in the black slates. Unwatered few weeks ago, but fire rekindled.

FORTUNE LAKE (Crystal Falls)—Shaft now down over 100 ft. Will be sunk to 300 ft. before first level is started. Ore lies close to surface and will be well developed by time navigation opens again.

ISABELLA (Palmer)—Shipments from this mine in Sec. 29, 47-26, Marquette County, were nearly triple those of last year. In 1916, total shipments to Escanaba docks were 98,683 tons of which 72,117 tons were nonbessemer ore. Mine owned by Cascade Mining Co. of Hibbing, Minn., Oscar B. Warren, general manager.

MINNESOTA

Mesabi Range

SUSQUEHANNA (Hibbing)—Operations for season closed; 764,190 tons shipped this year by Rogers, Brown Iron Co.

BENNETT (Keewatin)—Shipments from this mine of the Keewatin Mining Co. in 1916 were: Bessemer ore, 171,251 tons; nonbessemer, 501,676; total for season, 672,927 tons—shipped to Great Northern ore docks. Oscar B. Warren, of Hibbing, general manager.

OLIVER IRON MINING (Eveleth)—Company has started one of largest stripping jobs in history of range at the Spruce, Adams and Cloquet properties. Several shovels now working. Removal of overburden will continue for several years. Spruce and Adams pits will be joined in few years.

PICKANDS, MATHER & CO. (Marble)—Sullivan & Hale Exploration Co. has disposed of its property between Marble and Calumet to Pickands, Mather & Co. Stripping is to be started immediately. Ore developed six years ago by diamond drills. Butler Bros. have stripping contract. About 400,000 cu.yd. to be moved before ore can be mined. Mine is near Hill Annex mine, now being stripped.

HIBBING PIT MINES have stopped shipping for the season. Shovels working at some mines where stripping is to be continued throughout the winter. All underground properties are active. There will be a great deal of ore in stock by spring. Some ore going to new plant of Minnesota Steel plant near Duluth, which has used 590,000 tons of Mesabi ore this season. It is believed that about 750,000 tons will be sent there in 1917.

MISSOURI

Joplin District

WORLEY & CO. (Commerce, Okla.)—Will reopen ground at Big Chief mine, where they have been operating mill on tailings for several months.

GOLDEN ROD (Tar River, Okla.)—Encountered lead ore in cutting pump station at 196 ft. Installing Pomona pump to make possible working of lower level.

ARROW (Aurora)—At a cost of about $25,000, this company is moving mill from Joplin camp to lease near Red Wasp mine at Aurora. Good orebody proved by drilling.

CORNFIELD (Tar River, Okla.)—Name of mine changed to Lucky Bill. Company which now has property is erecting second mill, to be known as Lucky Junction.

JAMES LUKE (Carthage)—With associates is prospecting on Ravenswood lease at Reeds, abandoned by U. S. Smelting Co. last summer. Good holes reported and new mill likely.

SYMMES (Joplin)—Rich strike in drill hole in new portion of Dixie lease at Prosperity. Thirteen feet of cuttings contained 66.45% blende, one of the best holes ever recorded in district. Sinking of new shaft southeast of mill probable.

McCONNELL (Tar River, Okla.)—These zinc mines near Picher, Okla., have been taken over by B. J. Cantwell, of St. Louis, representing Boston interests. First openings in Picher-Century-Cardin district and have been good producers. New owners sinking new shaft and later will erect second mill.

MONTANA

Jefferson County

BOSTON & MONTANA DEVELOPMENT (Elkhorn)—While running crosscut to the Idanaha vein, encountered 4 ft. of milling ore containing copper sulphides.

Silver Bow County

BUTTE & LONDON (Butte)—In north crosscut encountered a 25-ft. vein, 18 ft. of which is said to assay 1.2% copper, 8% zinc and some silver.

PILOT-BUTTE MINING CO. (Butte)—On Dec. 15, petition was filed in district court by company asking dissolution of corporation, all property having been sold to Anaconda company.

ANACONDA (Butte)—October record of accidents in company's mines was not so good as in September. All told, there were 30 accidents in a total of 344,523 shifts, or an average of 0.87 to every 10,000 shifts. In 10 out of the 27 mines there was not an accident.

GREAT BUTTE COPPER CO. (Butte)—Has just installed a station pump on 500-ft. level of Calumet shaft and retimbering to the 1,000-ft. level will now be rushed. The cave-in, encountered above the 500 has all been cleared up and below timbers seem to be in good shape. Shaft was caved from the 385-ft. point to the 500.

DAVIS-DALY (Butte)—The Opbir 150-ton mill has started treating zinc ore of this company. As soon as capacity of mill is increased, zinc output will be augmented to 200 and later to 500 tons per day. Copper ore now being blocked on 1,200, 1,400, 1,500, 2,400 and 2,500 levels of company's Colorado mine; within two weeks it is expected new hoisting engine will be in commission, when it will be possible to increase tonnage of copper ore now being shipped to Washoe smeltery.

BUTTE-DULUTH (Butte)—Shipment of precipitates to the Washoe smeltery has been made by the Mines Operating Co., which has this property under lease. Shipment consisted of 60 tons and the precipitates are said to run about 90% copper. Company was compelled to shut down the plant last week for the lack of acid; shipments on way from Denver but severe weather interfered with the delivery. Machinery needed to increase capacity from 200 to 500 tons per day has been ordered.

NEVADA

CONSOLIDATED COPPERMINES CO. (Kimberly)—New directors of this company include Albert E. Humphreys, of Charleston, W. Va., and Denver; Albert E. Humphreys, Jr., of Denver; Thomas A Merritt, of Duluth; and I. W. Bernbeim, of Louisville. Thomas F. Cole has retired from the directorate.

OHIO

VALLEY SMELTING CO. (1320 Citizens Bldg., Cleveland)—Cleveland and Detroit men will build plant in Cuyaboga Valley for smelting and refining nonferrous metal wastes. Officers of new company are Joseph Sillman, president; Charles O. Patch, vice-president and treasurer; H. D. Le Bel, general manager, and H. B. McGraw, secretary.

OREGON

QUICKSILVER properties in Jackson County have been active this year, and production is expected locally to reach 300 flasks. Operating properties are the Black Butte Quicksilver, Bonanza Mountain King and the Utah Quicksilver Co.

COPPER MINES in southern Oregon are developing favorably. Active mines in Josephine and Jackson Counties include the Alameda, Queen of Bronze, Copper Queen and the Waldo. The Iron Dyke, in Baker County in eastern Oregon, shipped 50 to 75 tons daily early in the year and lately completed its 150-ton flotation plant.

UTAH

Juab County

RIDGE & VALLEY (Eureka)—Car of ore from 1,700 level brought $2,000, net smelter returns.

SIOUX CONSOLIDATED (Eureka) — Shaft down to 800 level. Station to be cut. Further sinking as well as drifting to be done.

MAY DAY (Eureka)—Dividend of 2c. a share paid Dec. 23, making $56,000 for year. Shipments for 11 months about 3,500 tons; shipped in November in six cars.

CHIEF CONSOLIDATED (Eureka)—Plans to enlarge shaft, and make it double compartment all the way down, as it is below the 1,200. Expects to do this work without hampering production.

UNITED TINTIC (Eureka)—Gasoline hoist installed in north end of property. Shaft—now down 100 ft.—to be sunk further. Property not far from Tintic Standard. Ore opened in southern end in Minnie Moore lease.

MAMMOTH (Mammoth) — Double the usual quarterly dividend—$40,000 or 10c. a share—paid Dec. 20, bringing total for 1916 to $100,000. Dividends to date, $2,420,000. During 11 months of 1916, shipped 685 cars or about 30,000 tons.

Salt Lake County

ALTA SHIPMENTS have been irregular recently owing to the snowslides in Little Cottonwood Cañon, beginning unusually early. The week ended Dec. 18, however, five or six cars were brought to market, most of the ore coming from the South Hecla and the Michigan-Utah. The Sells shipped a car recently, and concentrates from the Albion are being prepared for the market.

SILVER SHIELD (Bingham)—Another car shipped from Back vein. Ore opened in new raise to Miracle stope.

OHIO COPPER (Bingham)—Expected that company will take over mine and mill Jan. 1, no extension being granted General Exploration Co. now working property under lease. Rumored that Alfred Frank—formerly manager of the Ohio Copper and at present directing leasing operations—will be manager for company. Mill treating 2,000 tons daily; flotation equipment may be added, and capacity brought up to 3,000 tons.

UTAH METAL AND TUNNEL (Bingham)—Fifth orebody in Utah Metal end of property officially reported. Followed about 25 ft., and four sets wide. Capacity of mill being brought up from 225 tons daily to 300 tons. Low-grade ore at present treated in coarse state, to be reground and treated by flotation. Earnings from mill expected to be increased $25,000 monthly. Company report for nine months' operation—ended Oct 1, 1916—of Utah Metal and Bingham-New Haven ground shows 69,364 tons of ore and concentrates wet weight to have been shipped, which sold for $1,262,752. Gross income, with $37,161 additional income added was $1,299,913, and total expense $732,176, leaving operating profit of $567,737. Development work amounting to 10,190 ft. was done, during which 4,481 tons of ore were taken out.

Summit County

ONTARIO (Park City)—Shaft being retimbered following recent cave.

BROADWATER MILLS (Park City)—Remodeling plant to treat tailings. To be ready about Feb. 1. Forty-eight men working.

JUDGE MINING AND SMELTING (Park City)—Weekly shipments of about 450 tons of crude ore and concentrates being made. November production was 1,733 tons, October 1,878 tons, and in September 2,700 tons. Dividend of 25c. a share paid Dec. 20, making $435,000 or $1 a share for 1916.

CANADA

Alberta

COYNE PETROLEUM CO. (Edmonton)—Will drill four wells in the Wabiscaw River area, south of Fort Vermilion, where geological survey was made last summer.

Ontario

ORE SHIPMENTS from Cobalt district in November, as reported by Arthur A. Cole, mining engineer for Temiskaming & Northern Ontario Ry., were: Cobalt proper: Buffalo 31.69 tons; Coniagas, 104.70; Cobalt Comet, 49.13; Crown Reserve, 72.70; Hudson Bay, 70.98; Kerr Lake, 74.67; La Rose, 87.32; Mining Corporation of Canada, 94.20; McKinley-Darragh, 166.64; Nipissing, 535.70; O'Brien, 33; Penn Canadian, 54.10; Temiskaming, 81.54; Trethewey, 41.67; from Elk Lake by the Miller Lake-O'Brien, 25.95; total silver ore shipments 1,523.99 tons. From Porquois Junction by the Alexo, 332.65 tons of nickel ore.

INSPIRATION (Porcupine)—Second drill has started.

GOLD REEFS (Porcupine)—High-grade ore opened on 50-ft. level.

ADANAC (Coablt)—Shaft down to 400 ft. level, where station is being cut.

McINTYRE (Schumacher)—Production in November, $142,000. This is the highest grade big mine in camp.

PLENAURUM (Porcupine)—Control being acquired by a Toronto syndicate to amalgamate with the McIntyre.

MAIDENS MACDONALD (Porcupine) — Resumed underground work—stopped while plant was being installed.

AURUM (Munro Township) — Another vein struck north of the Crœsus boundary. Has been stripped for 100 ft.; about 4 ft. wide showing visible gold.

VIPOND (Porcupine)—Proposed amalgamation with the North Thompson will be submitted to shareholders soon. Merger should result in decreased operating costs.

DOME (South Porcupine)—November production low, account closing down ball mill for shortage of liners. Important strike in horizontal drill hole at 700-ft. level, cutting 51 ft. averaging $14; same hole previously cut 10 ft. of $10 ore.

TRETHEWEY (Cobalt)—Financial statement shows cash in hand $78,594; value of silver unsold, $40,792; value of ore on hand, $21,000; total, $140,387.

HOLLINGER (Timmons)—New mill building under cover but complete installation of machinery will probably not be completed till next fall. Company offering 120,000 shares to shareholders at $6.50 to pay off debts and provide capital.

PORT ARTHUR COPPER CO. (Toronto)—This new company will operate in the Mine Center district and arrangements are being made with New York and Toronto men for erection of custom smelting plant at Port Arthur. J. F. Hewiston, of Port Arthur, interested.

DUTCH GUIANA

GOLD PRODUCTION for 10 months from various districts is estimated as follows: From Surinam River, by long toms and sluices, 234 kg.; from Saramacca River, 176 kg.; from Marowyne River, 17 kg.; from Lawa River, 210 kg. These results about 15% less than the yield in corresponding period of 1915.

The Market Report

Metal Markets

NEW YORK—Dec. 27, 1916

All of the metals were still unsettled and business in them was relatively light. Copper and spelter continued to be distinctly reactionary.

Copper, Tin, Lead and Zinc

Copper—The market was made especially by offers of copper for resale, considerable lots of such copper turning up in a variety of quarters. On the other hand, there was some resistance to pressure through uncovered consumers who stood ready to take copper. Some business was done for March-April delivery, buyers who were willing to contract so far ahead showing a continued confidence in the situation, but the bulk of the business reported was for near-by and first-quarter delivery. In the latter part of the week, January was quoted at 30¼@30½, February, at 29¾@30c., and March, 29¼@29½c., all regular terms. First-quarter delivery was offered at 30c., r.t.

Copper Sheets—Base price for copper sheets remains unchanged at 42c. for hot rolled and 43c. for cold rolled. Wire is quoted 37c. f.o.b. mill.

Tin—Very little business was done in this metal. At the beginning of the week spot was 40¼c. and futures, 40⅜c. At the close, spot was 40¼c. and futures, 40c.

Lead—The situation in this market is that producers have disposed of about all of their January supply and much of what they expect to produce in February. The near-by market is therefore in the control of second hands, who were able to realize the price that the principal producer continues to quote, there being a fair domestic demand. There has been talk of lead offered at lower prices, but buyers who would be willing to take it do not seem to be able to find it. There is, however, some bearish sentiment in lead and sellers could probably be found to contract to deliver lead in February and later at concessions from present prices. There was not much inquiry from abroad reported in the market this week, but China and Japan were still inquiring and were talking about taking February shipment, not being able to get January. The lead producers of Southeastern Missouri have become greatly troubled by transportation difficulties, which are preventing some of them from shipping lead and are making it hard for all of them to get in enough coal to keep the mines unwatered.

Spelter—The price continued to crumble away from day to day. On Dec. 23 producers offered at sharp concessions and succeeded in placing a fair tonnage for first-quarter delivery, some being taken by galvanizers. Brass special for prompt delivery was sold at 10c. Right through the week, second-quarter spelter was offered at low prices, producers being manifestly desirous of getting more orders on their books than at present. The spelter market is quite unsettled. Producers who are bearish avoid anything that might be regarded as aggressive selling, while on the other hand, many producers are standing aloof, expecting a contraction of production through gas troubles and a rally in the market.

Zinc Sheets—Base price of zinc sheets remains at $21 per 100 lb. f.o.b. Peru, Ill., less 8% discount.

Other Metals

Aluminum—The market is extremely quiet. Prices remain nominally at 63@65c. per lb. for No. 1 ingots, New York.

Nickel—There is no change in the market quotations for nickel. Price remains at 45@50c. per lb.; electrolytic commands an extra 5c. per lb.

Quicksilver—The market was quiet and steady at $80. San Francisco reports by telegraph $78, firm.

Antimony—Market steady, fair business, quotations unchanged at 14½@15c. January-February shipments from China are quoted at 13@13½c. c.i.f., New York, duty unpaid.

Gold, Silver and Platinum

NEW YORK—Dec. 27

Gold—According to advices from London under date of Dec. 7, the Bank of England reserve of gold against its note issues showed a decrease of £51,075 as compared to the previous week.

Silver—Owing to the holiday season there has been some recession in the price of silver. The market is quiet and dull but the undertone is good and after the middle of January unless some unexpected condition arises there is a fair chance of some improvement in the price.

In the "Journal" of Dec. 16, the price of silver at London on Dec. 8 was incorrectly quoted. It should have been 35[illegible] pence.

According to report of Samuel Montagu & Co., London, under date of Dec. 7, the steadiness at which the price of silver has been maintained round about 36d. is significant. The fluctuations have kept within ¼d. and the movement have tended upward. This has been the case notwithstanding that the China exchanges have receded from the high point recently touched and seems to suggest that a return of the China exchanges to a lower level may remove little more than the driving power which the upward movement has had upon the price of silver. So much silver has been withdrawn for export from the stock at Shanghai that unless, and until it is replenished from the interior, an operation which would of course take some time, fresh sales of silver on account of China are very doubtful. Meanwhile the Indian Bazaars are taking favorable views of the market, impelled no doubt by the fall during one week of 219 lacs in the holding of silver—coined and uncoined—by the Indian treasury. This reduction during one week is the largest since January, 1912, when a drop occurred of 240 lacs.

Zinc and Lead Ore Markets

Joplin, Mo., Dec. 23—Price quotations per 2,000 lb.: Blende, high, $92.40; 60% zinc, premium ore $90, medium, $85@75, low, $65; calamine per ton 40% zinc, $55@45; average selling price all grades of zinc, $83.31 per ton. Lead, high price $101.30; base, $100@96; average selling price, all grades of lead, $93.22 per ton.

Shipments of the week: Blende, 6,277 tons; calamine, 761 tons; lead, 1,284 tons. Value, all ore the week, $706,050; 51 weeks, $37,292,770.

The market was without support until near the end of the week, several large orders were received by buyers for next week's delivery. Freezing to zero weather has nearly eliminated calamine production, and greatly retarded blende production in isolated localities. The district is enveloped in a snow that fell Thursday, part of which was thawed today.

Platteville, Wis.—The report for last week, delayed in transit, says that quotations for the district were according to the following figures: Base price per 2,000 lb. ton for material assaying 60% zinc, $93 for premium ore down to $89 for medium grades. Base price per 2,000 lb. ton for material assaying 80% lead, $95. Shipments for the week ended Dec. 16, 1916, were 2,876 tons of zinc ore, 124 tons of lead ore, and 958 tons of sulphur ore. For the year to date the figures are 128,2893 tons of zinc ore, 4,195 tons of lead ore and 31,681 tons of sulphur ore. Shipped during the week to separating plans, 4,195 tons of zinc ore.

Other Ores

Tungsten Ore—The activity has continued in spite of the peace talk, and considerable business was done at $17.50. Several hundred tons were reported under option to foreign buyers at the same price. We quote the market at $17@17.50.

Molybdenum Ore—Continues very firm with very little ore offered. The tendency is regarded as advancing. Business in ferromolybdenum was done at $3.80 per lb.

Manganese Ore—The market for foreign manganese ore, 50%, is not very clearly defined according to "Iron Trade Review" for the reason that offerings are scant and there have been no known sales recently. A fair statement of the market would be 65 to 70c. per unit [illegible] ese at tidewater. Buyers have offered 60c. per unit, which sellers have declined to accept. Some sellers will not quote less than 70c. per unit. In speaking of 50% foreign ore reference is made especially to Brazilian and Indian [illegible].

Imports during the week at Baltimore included 8,300 tons of manganese ore from [illegible] and 367 tons from [illegible].

Other Minerals

(Quoted by [illegible] Philadelphia [illegible])

Barytes, 99% [illegible], per ton, $18.

Beryl, minimum [illegible] BeO, per lb. [illegible]

Chrome ore, [illegible] per [illegible]

Fluorspar, [illegible] per ton, $1[illegible]

Magnesite, raw, [illegible] $1[illegible]

Magnesite, calcined, [illegible] $[illegible]

Manganese ore, [illegible] and [illegible] per ton, $[illegible]

Manganese ore, standard Brazilian, per unit, 65@75c.

Tantalite, guaranteed 6[illegible] Ta₂O₅, per [illegible] $1[illegible]

Monazite sand, [illegible] ThO₂, per lb. of thorium oxide, $1[illegible]

Rutile, [illegible] concentrates, [illegible] TiO₂, per ton, $[illegible]

Ilmenite, [illegible] TiO₂, per ton, $[illegible]

[illegible] 2[illegible] per ton, $1[illegible]

Zircite, [illegible] grade, [illegible] ZrO₂, per ton, $120.

SILVER AND STERLING EXCHANGE

Dec.	Sterling Exchange	Silver New York, Cents	Silver London, Pence	Dec.	Sterling Exchange	Silver New York, Cents	Silver London, Pence
21	4.7544	76[illegible]	36[illegible]	25			
22	4.7544	75[illegible]	36[illegible]	26	4.7544	75[illegible]	
23	4.7544	75[illegible]		27	4.7544	75[illegible]	36[illegible]

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine.

DAILY PRICES OF METALS IN NEW YORK

Dec.	Copper Electrolytic	Tin Spot	Lead N. Y.	Lead St. L.	Zinc St. L.
21	30[illegible] @31[illegible]	41[illegible]	7[illegible] @7[illegible]	7.10 @7.40	9[illegible] @9[illegible]
22	30[illegible] @31[illegible]	40[illegible]	7[illegible] @7[illegible]	7.20 @7.40	9[illegible] @9[illegible]
23	29[illegible] @30[illegible]	40[illegible]	7[illegible]	7.30 @7.4[illegible]	[illegible] @9[illegible]
25					
26	29[illegible] @30[illegible]	40[illegible]	7[illegible]	7.3[illegible] @7.4[illegible]	[illegible] @9[illegible]
27	29[illegible] @30[illegible]	40[illegible]	7	7.3[illegible] @7.40	[illegible] @9[illegible]

The above quotations [illegible] average of the major markets [illegible] and reported by producers and agencies [illegible] sent to the best of our judgment the prevailing [illegible] of the metals for the [illegible] major markets reduced to basis of New York [illegible] except where St. Louis is the [illegible]

The quotations [illegible] ingots and wirebars. Electrolytic copper [illegible] sold on regular terms [illegible] buyer's works [illegible] The difference between the price [illegible] New York [illegible] The price of [illegible] 0.05 to 0.10c. below that of [illegible] Quotations of spelter are for [illegible] brands. We quote New York price at 17[illegible] St. Louis.

[illegible] freight rates [illegible] St. Louis-New York, 17[illegible] St. Louis [illegible] 6.3[illegible] St. Louis-Pittsburgh, 13.1[illegible]

LONDON

Dec.	Copper Standard Spot	Copper Standard 3 Mos.	Copper Electrolytic	Tin Spot	Tin 3 Mos.	Lead Spot	Zinc Spot
21	142[illegible]	136	155	17[illegible]	1[illegible]	[illegible]	[illegible]
22	14[illegible]	135[illegible]	154	177	17[illegible]	[illegible]	[illegible]
23							
25							
26							
27	140			17[illegible]	[illegible]	[illegible]	[illegible]

[illegible] Metal Exchange [illegible] per long ton of 2,240 lb. [illegible] per 2,240 lb. [illegible] 4.29 [illegible] £30 = 6.4[illegible] [illegible] 17.8[illegible] [illegible] £[illegible]

Iron Trade Review

NEW YORK—Dec. 27, 1916

The first effect of peace talk upon the steel trade was a halt in new orders, but that has passed and the market has picked up considerably. Here and there is a change of attitude as to placing orders for the far future, and calculations are based on indefinite continuance of the war. What has happened mainly is that peace is taking a definite place in calculations, whereas it had no place before or was thought of too far in the future to affect the present plans.

Domestic pig-iron inquiries have fallen off sharply and the export business is less. Italy has just taken 10,000 tons more of bessemer iron. Steel making pig iron in the Pittsburgh district is quiet.

Blast furnaces are facing much higher coke costs. They refused to contract at $4 for the first half, but $4.50 is now the producers' figure. But coke has sold in considerable quantities at $9.

The general use of 50% ferrosilicon in the steel works operations make important the reported limitation of Canadian electric power now employed at Niagara in the making of this product for the American market. The movement is causing concern to other American users of Canadian power.

PITTSBURGH—Dec. 26

Everything else marketwise is now subsidiary to the transportation situation. Prospects of better or poorer demand, price advances, whether the war is to end in six months or two years, is of less interest than how much material can be made and shipped. Car supplies are no better, which means that they are very poor. Possibilities of shipping materials are reduced because there are more embargoes. Some mills do not have cars enough in which to ship their product and have to pile it or reduce production, while some cars are loaded and cannot be shipped because there are embargoes as to the intended destinations.

To these conditions there is now added a fuel famine, particularly as regards coke. Coke labor is scarce, on account of the holidays, and cars are still scarcer. The Carnegie Steel Co. last week banked 14 of its operating furnaces, and had six out of blast, chiefly on account of coke scarcity, so that 20 of its 57 furnaces are not operating. It was hoped the banked furnaces would resume today but coke conditions are such that it is more likely additional furnaces will have to be banked. Other furnace interests are in as bad shape, some perhaps worse. The Carnegie Steel Co. has a large reserve of pig iron and scrap, chiefly the latter, but most steel interests have practically none, and thus a continuance of present conditions as to coke will reduce the output of finished steel.

The general prospect is that considerable steel production will be lost in the next two or three weeks, while the balance of probability is that production will be curtailed more or less for many weeks, until spring weather arrives.

On the afternoon of Dec. 20 the Carnegie Steel Co. announced advances of $2 a ton in bars, shapes and plates, making bars 3.00c., shapes 3.10c. and plates 3.60c. Some independents had already been quoting these prices and the advanced prices were then generally adopted. As the market had been very quiet for a week, and as all, or nearly all, the previous advances in this movement had occurred during very active buying, this last advance is generally interpreted in the trade as being one of the old-time advances, calculated to stiffen the market by making the recognized market prices higher than the price on any of the business already entered. Naturally it is surmised that the steel interests recognize that the buying movement is over and that the next thing to do is to proceed with the filling of the business on books, plus such business as always drifts in, even in a very quiet market. Barring serious accidents, the mills may be regarded as assured of full operations for a twelvemonth, subject to such curtailment as may occur through transportation facilities being insufficient.

Some reports have been published to the effect that the slowing down of activity following the German peace overture was temporary and has already yielded to greater activity, but no such condition is observed here, the market being rather still duller, as a combination of holiday dullness, the sobering effect of the peace proposal, and the fact that the feverish activity of November could not be maintained, some of the November business being seasonal, and not such as could be repeated month after month.

Pig Iron—The pig iron market is quieter, and is quite inactive as to late deliveries, while as to early deliveries the business is confined to small lots, delivery premiums being paid for foundry and malleable. The scarcity of coke is making prompt iron daily more scarce, by curtailing pig iron output. We quote: Bessemer, $35@36; basic, $30; foundry, $30@32; malleable, $30@33; forge, $29@30, f.o.b. valley furnaces, 95c. higher delivered Pittsburgh.

Steel—There have been a few transactions, in billets for export and in sheet bars for early deliveries, showing that the market for soft steel is quotable about $3 higher, and we now quote billets at $60@62 and sheet bars at $60@63, Pittsburgh. Rods are $5 higher at $75@80 while forging billets are stronger, at $80@85.

STOCK QUOTATIONS

N. Y. EXCH.†	Dec. 26
Alaska Gold M.	11¼
Alaska Juneau	7¾
Am. Sm. & Ref., com.	105
Am. Sm. & Ref., pf.	115
Am. Sm. Sec., pf. A	98
Am. Sm. Sec., pf. B.	94
Am. Zinc	38½
Am. Zinc, pf.	72
Anaconda	83¾
Batopilas Min.	1⅜
Bethlehem Steel	500
Bethlehem Steel, pf.	132
Butte & Superior	47½
Chile Cop.	25⅞
Chino	54½
Colo. Fuel & Iron.	46
Crucible Steel	62
Dome Mines	20
Federal M. & S.	12
Federal M. & S., pf.	39⅞
Great Nor., ore ctf.	36¼
Greene Cananea	44½
Homestake	128
Inspiration Con.	58
International Nickel	43
Kennecott	45⅝
Lackawanna Steel	84¼
Miami Copper	38¾
Nat'l Lead, com.	60¼
National Lead, pf.	111¼
Nev. Consol	24¼
Ontario Min.	6¼
Quicksilver	2¼
Quicksilver, pf.	2½
Ray Con.	26½
Republic I. & S., com.	78
Republic I. & S. pf.	105
Sloss-Sheffield	61⅛
Tennessee C. & M.	16⅝
U. S. Steel, com.	107¾
U. S. Steel, pf	119½
Utah Copper	103
Va. Iron C. & C.	48

N. Y. CURB†	Dec. 26
Buffalo Mines	1.15
Butte & N. Y	1⅜
Butte C. & Z	11½
Caledonia.	.49
Can. Cop. Corpo	1⅛
Cashboy.	.07
Cerro de Pasco	37½
Con. Ariz. Sm	1 11/16
Con. Coppermines	3⅝
Con. Nev.-Utah	.12½
Crystal Cop	.62½
First Nat. Cop.	3⅞
Florence	70
Goldfield Con	63
Goldfield Merger	.06
Granite	.40
Hecla Min.	7½
Howe Sound	7¼
Jerome Verde	1 7/16
Joplin Ore & Spel.	.35
Kerr Lake.	4⅝
Magma	40¾
Majestic.	.75
McKinley-Dar-Sa	.51
Mother Lode	.44
Nevada Hills	.22
N. Y. & Hond	15
Nipissing Mines	9½
Oro	‡ 03½
Ray Hercules	4½
Rochester Mines	.66
St. Joseph Lead	17⅞
Standard S. L.	1
Stewart	.21
Success	.41
Tonopah	6
Tonopah Ex.	4⅝
Tribullion	.25
Troy Arizona	.57
United Zinc.	4
White Knob, pf.	1¾
White Oaks	5
Yukon Gold	2¼

SAN FRAN.*	Dec. 26
Alta	04
Andes	15
Best & Belcher	.05
Bullion	.01
Caledonia	.25
Challenge Con	.05
Confidence	.10
Cons. Imperial	‡.01
Con. Virginia	.09
Gould & Curry	.03
Hale & Norcross	.08
Jacket-Cr. Pt	.03
Mexican	.15
Occidental.	.65
Ophir	.14
Overman	.04
Savage	.05
Seg Belcher	.02
Sierra Nevada.	.13
Union Con.	.49
Utah Con	.02
Belmont	4 70
Jim Butler	.83
MacNamara	.06
Midway	.20
Mont.-Tonopah	.18
North Star.	.13
Rescue Eula	.26
West End Con.	.68
Atlanta	.09
Booth	.09
C.O.D. Con	‡.02
Comb. Frac.	.05
D'field B.B.	.04
D'field Daisy	.04
Jumbo Extension	.28
Round Mountain	.39
Sandstorm Kendall.	‡.04
Silver Pick.	24
Argo	06
Ariz. Central	08
Big Jim	1.12½
Lazy Boy.	.07
Nellie	.30
Tom Reed	1 95
United Eastern	5.00
United Western	‡.04

BOSTON EXCH.*	Dec. 26
Adventure	3¾
Ahmeek	100
Algomah	1 3/16
Allouez	65
Ariz. Com., ctfs.	14¾
Bonanza	‡ 40
Butte-Ballaklava	2
Calumet & Ariz.	79½
Calumet & Hecla	550
Centennial	22
Copper Range	65⅝
Daly West	2½
East Butte	17
Franklin	8¾
Granby	91½
Hancock	17
Hedley	‡24
Helvetia	70
Indiana	3½
Island Cr'k, com.	59½
Isle Royale	35
Keweenaw	4¼
Lake	12
La Salle	‡4½
Mason Valley	5¾
Mass	14¼
Mayflower	2⅛
Michigan	3¼
Mohawk	96
New Arcadian	5¼
New Idria	15½
North Butte	23½
North Lake	2¼
Ojibway	1½
Old Colony	2
Old Dominion	65
Osceola	93
Quincy	89½
St. Mary's M. L.	89
Santa Fe	2
Shannon	9
Shattuck-Ariz.	27
So. Lake	4⅝
So. Utah	.30
Superior	13
Superior & Bost.	5½
Tamarack	47½
Trinity	6¼
Tuolumne	2 1/16
U. S. Smelting	63½
U. S. Smelt'g, pf	51½
Utah Apex	3¼
Utah Con	18
Utah Metal	6½
Victoria	6½
Winona	4⅞
Wolverine	49
Wyandot	2½

BOSTON CURB*	Dec. 26
Alaska Mines Corp.	1 03⅛
Bingham Mines.	8⅝
Boston Ely	.50
Boston & Mont	.67
Butte & Lon'n Dev	.45
Calaveras	4
Calumet-Corbin	.01½
Chief Con	2
Cortez	.30
Crown Reserve	.35
Davis-Daly	6
Eagle & Blue Bell	1¼
Houghton Copper.	1½
Iron Cap Cop., pf	17¾
Mexican Metals	.40
Mines of America	1⅛
Mojave Tungsten.	1⅛
Nat. Zinc & Lead	.55
Nevada-Douglas.	1⅞
New Baltic	2⅞
New Cornelia.	15
Ohio Copper.	1¼
Oneco	.80
Rex Cons.	.50
Rilla	.05
United Verde Ext.	37

SALT LAKE*	Dec. 26
Big Four	.90
Black Jack	05
Cardiff	7.25
Colorado Mining	.16½
Crown Point	05
Daly-Judge	8.00
Emma Cop.	‡1⅛
Empire Copper	1.50
Gold Chain	.17
Grand Central	59
Iron Blossom	1.37½
Lower Mammoth	06½
May Day	10½
Opohongo	‡ 01½
Prince Con.	1 32½
Seven Troughs	‡ 03
Silver-King Coal'n.	3 30
Silver King Con	4 25
Sioux Con	.12½
So. Hecla	1.30
Uncle Sam	.06
Wilbert	09
Yankee	.20

TORONTO*	Dec. 26
Bailey	.06½
Beaver Con	40
Chambers Ferland	15
Coniagas	4.75
La Rose.	.53
Peterson Lake	.15
Right of Way	.08
T. & Hudson Bay	72.00
Temiskaming	.60
Wettlaufer-Lor.	.10½
Dome Exten.	.23
Dome Lake	.65
Foley O'Brien	.70
Hollinger	6 85
Jupiter	.35
McIntyre	1.83
Newray	1.38
Porcu. Crown	65
Schumacher	.68
Vipond	.44
West Dome	.31½

STOCK QUOTATIONS—Continued

COLO. SPRINGS	Dec. 26
Cresson Con	7.44
Doctor Jack Pot.	.08¾
Elkton Con	.13
El Paso	.40
Findlay	.06
Gold Sovereign	.06¾
Golden Cycle	2.62
Granite	.50
Isabella	.20
Mary McKinney	.27
Portland	2.00
Vindicator	1.49

LONDON	Dec. 9		
Alaska Mexican	£0	12s	6d
Alaska Tre'dwell	2	15	0
Burma Corp.	3	12	6
Cam & Motor	0	10	6
Camp Bird	0	6	6
El Oro	0	7	0
Esperanza	0	9	9
Mexico Mines	3	10	0
Nechi, pfd	0	12	0
Oroville	0	15	9
Santa Ger t'dis	0	9	0
Tomboy	1	1	0

* Bid prices. † Closing prices. ‡ Last Quotations.

MONTHLY AVERAGE PRICES OF METALS

Silver	New York			London		
	1914	1915	1916	1914	1915	1916
January	56.572	48.855	56.775	26.553	22.731	26.960
February	57.506	48 477	56.755	26.573	22.753	26.975
March	58 067	50.241	57.935	26.788	23.708	27.597
April	58.519	50 250	64 415	26.958	23.709	30 662
May	58.175	49 915	74.269	26 704	23.570	35 477
June	56 471	49 034	65.024	25.948	23.267	31 060
July	54.678	47.519	62.940	25.219	22.597	30.000
August	54.344	47.163	66.083	25.979	22.780	31.498
September	53.290	48.680	68.515	24.260	23 591	32.584
October	50.654	49.385	67.855	23.199	23.925	32.361
November	49.082	51.714	71.604	22.703	25 094	34.192
Dec.	49.375	54.971	....	22.900	26 373	....
Year	54 811	49.684	...	25 314	23 675	....

New York quotations cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

Copper	New York		London			
	Electrolytic		Standard		Electrolytic	
	1915	1916	1915	1916	1915	1916
Jan	13.641	24 008	60.756	88 083	65.719	116.167
Feb	14.394	26 440	63.494	102.667	*	133.167
Mar.	14 787	26.310	66.152	107.714	*	136.000
April	16.811	27.895	75 096	124.319	*	137.389
May	18.506	28 625	77 600	135.457	*	152.522
June	19 477	26.601	82.574	112.432	95.333	137.455
July	18 796	23.865	76.011	95.119	91.409	125 500
Aug	16.941	26.120	68.673	110.283	82.333	126.304
Sept.	17 502	26.855	68.915	113.905	85.250	134.071
Oct.	17 686	27.193	72.601	122.750	88.000	142.523
Nov.	18 627	30.625	77.744	134.659	93.273	155.432
Dec.	20.133	......	80.773	....	100.430	....
Year	17.275	......	72.532	....	....	....

Tin	New York		London	
	1915	1916	1915	1916
January	34.260	41.825	156.550	175.548
February	37.415	42.717	176.925	181.107
March	48.426	50.741	180.141	193.609
April	47.884	51.230	166.225	199.736
May	38.790	49.125	162.675	196.511
June	40.288	42.231	167.636	179.466
July	37.423	38.510	167.080	168.357
August	34.389	38.565	151.440	169.870
September	33.125	38.830	152.625	171.345
October	33.080	41.241	151.554	179.307
November	39.224	44.109	167.670	186.932
December	38.779	....	167.000	....
Av. year	38.590	....	163.960	....

Lead	New York		St. Louis		London	
	1915	1916	1915	1916	1915	1916
January	3.729	5 921	3.548	5.826	18.606	31.167
February	3 827	6.246	3.718	6 164	19.122	31 988
March	4 053	7.136	3.997	7.375	21.883	34 440
April	4 221	7.630	4.142	7.655	21.094	34 368
May	4 274	7.463	4.182	7.332	20.347	32.967
June	5.932	6.936	5.836	6.749	25.170	31.011
July	5 659	6.352	5.531	6.185	24 611	28.137
August	4.656	6.244	4.520	6.088	21 946	29.734
September	4 610	6.810	4.490	6 699	23.151	30.786
October	4 600	7.000	4 499	6.898	23 994	30.716
November	5.155	7.042	5.078	6.945	26.278	30.500
December	5.355	......	5.266	......	28.807	......
Year	4 673	......	4 567	......	22.917	......

Spelter	New York		St. Louis		London	
	1915	1916	1915	1916	1915	1916
Jan.	6.386	16.915	6.211	16.745	30 844	89 810
Feb.	8 436	18 420	8.255	18.260	39.819	97.762
Mar.	8 541	16.846	8.360	16 676	44.141	95.048
April	10 012	16.695	9.837	16.525	49.888	99.056
May	14.781	14 276	14 610	14.106	68.100	94.217
June	21 208	11.752	21 038	11.582	100.614	68.591
July	19.026	8.925	18.856	8.755	97.250	50.750
Aug	12.781	8.730	12 611	8.560	67 786	51.587
Sept.	13 440	8.990	13.270	8.820	67 841	52.095
Oct.	12 800	9.829	12 596	9.659	66 536	54.159
Nov.	15.962	11.592	15.792	11.422	88.409	56.023
Dec.	15 391	......	15.221	......	89 400	....
Year	13 230	......	13 054	......	67.553	....

New York and St. Louis quotations, cents per pound, London, pounds sterling per long ton. * Not reported.

Pig Iron, Pitts.	Bessemer‡		Basic‡		No. 2 Foundry	
	1915	1916	1915	1916	1915	1916
January	$14.59	$21.60	$13.45	$18.78	$13.90	$19.70
February	14.55	21.16	13.45	18 93	13.90	19.51
March	14.55	21.81	13 45	19.20	13.95	19.45
April	14.55	21.65	13.45	18 95	13.95	19 45
May	14.61	21.78	13.60	19 11	13 83	19 58
June	14.70	21.95	13.67	18.95	13.77	19.34
July	14.94	21.95	13.91	18 95	13.68	19.20
August	16.01	21.95	15.31	18.95	14.75	19.25
September	16.86	22.88	15.95	19.58	15.70	19.53
October	16.95	24.61	15.96	21.26	15.80	21.51
Nuvemoer	17.57	29.12	16.47	27.23	17.20	25.60
December	19.97	......	18.44	......	18 95	....
Year	$15 82	......	$14 76	......	$14 95	...

‡ As reported by W. P. Snyder & Co.

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